

**Rare Plant Survey of Select Bureau of Land  
Management Lands in the Arkansas River Canyon,  
Chaffee and Fremont Counties, Colorado**



**Stephanie Neid, PhD.  
Colorado Natural Heritage Program  
Colorado State University  
8002 Campus Delivery  
Fort Collins, Colorado 80523-8002  
2007**



**Colorado  
State  
University**  
*Knowledge to Go Places*

**Rare Plant Survey of Select Bureau of Land Management Lands in the Arkansas River Canyon, Chaffee and Fremont Counties, Colorado**

*Prepared for:*

**Bureau of Land Management  
Royal Gorge Field Office  
3170 East Main Street  
Cañon City, CO 81212**

*Prepared by:*

**Stephanie Neid  
May 1, 2007**

**Colorado Natural Heritage Program  
Colorado State University  
College of Natural Resources  
8002 Campus Delivery  
Colorado State University  
Fort Collins, Colorado 80523-8002**

Copyright © 2007 by Colorado Natural Heritage Program



Cover photograph: Arkansas River corridor west of Parkdale; Arkansas Canyon stickleaf (*Mentzelia densa*) in foreground on railroad right-of-way.  
All photos taken by Stephanie Neid, unless otherwise noted.

## TABLE OF CONTENTS

INTRODUCTION .....	1
METHODS .....	9
RESULTS .....	11
DISCUSSION.....	18
Species Accounts .....	18
Fendler's false cloak-fern ( <i>Argyrochosma fendleri</i> ); Maidenhair Fern Family (Pteridaceae) .....	18
Brandegee wild buckwheat ( <i>Eriogonum brandegeei</i> ); Buckwheat Family (Polygonaceae).....	18
Rocky Mountain bladderpod ( <i>Lesquerella calcicola</i> ); Mustard Family (Brassicaceae) .....	19
Arkansas Canyon Stickleleaf ( <i>Mentzelia densa</i> ); Blazing Star Family (Loasaceae).....	19
Jeweled blazingstar ( <i>Mentzelia speciosa</i> ); Blazing Star Family (Loasaceae) .....	21
Rock-loving neoparrya ( <i>Neoparrya lithophila</i> ); Parsley Family (Apiaceae) .....	21
Wright's cliffbrake ( <i>Pellaea wrightiana</i> ); Maidenhair Fern Family (Pteridaceae) .....	22
Degener beardtongue ( <i>Penstemon degeneri</i> ); Figwort Family (Scrophulariaceae).....	22
Fendler's Townsend daisy ( <i>Townsendia fendleri</i> ); Sunflower Family (Asteraceae) .....	23
Recommendations:.....	23
ACKNOWLEDGEMENTS .....	24
REFERENCES .....	25
Appendix A. Natural Heritage Methodology and Ranking System .....	29
Appendix B. Plant Characterization Abstracts .....	29
Appendix C. Potential conservation areas (PCAs) in the Arkansas Canyon.....	61
Appendix D. Natural heritage elements in Over The River panels. ....	95

## LIST OF TABLES

Table 1. Select BLM parcels identified for rare plant survey in 2006.....	2
Table 2. Proposed Over The River project panel sections.....	2
Table 3. List of rare plant species found during the survey period.....	9
Table 4. Natural heritage features at BLM parcels. ....	11
Table 5. Natural heritage features at Over The River panels.....	12
Table 6. Numbers of Arkansas Canyon stickleaf individuals within OTR section areas. ....	12
Table 7. Biodiversity ranks (B-rank) of potential conservation areas. ....	12

## LIST OF FIGURES

Figure 1. BLM Survey Areas and Panel Locations .....	3
Figure 2. CNHP Potential Conservation Areas in the Arkansas Canyon .....	17

## LIST OF PHOTOS

Photo 1. Grape Creek survey site.....	5
Photo 2. Tenderfoot Hill survey site (photo taken from King Gulch to the south). ....	5
Photo 3. King Gulch survey site (photo taken from Tenderfoot Hill to the north).....	6
Photo 4. Castle Garden survey site. ....	6
Photo 5. Reese Gulch within the Texas Creek survey site. ....	7
Photo 6. Northern end of sandy wash drainage in Big Hole survey site. ....	7
Photo 7. Salida East survey area. ....	8
Photo 8. Five Points survey area.....	8
Photo 9. Arkansas Canyon stickleaf ( <i>Mentzelia densa</i> ).....	13
Photo 10. Rocky Mountain bladderpod ( <i>Lesquerella calcicola</i> ).....	13
Photo 11. Wright’s cliffbrake ( <i>Pellaea wrightiana</i> ).....	14
Photo 12. Fendler’s Townsend daisy ( <i>Townsendia fendleri</i> ).....	14
Photo 13. Rock-loving neoparrya ( <i>Neoparrya lithophila</i> ).....	15
Photo 14. Fendler’s false cloak-fern ( <i>Argyrochosma fendleri</i> ). ....	15
Photo 15. Brandegee wild buckwheat ( <i>Eriogonum brandegeei</i> ).....	16

## INTRODUCTION

The Royal Gorge Office of the Bureau of Land Management (BLM) initiated a rare plant survey on select areas in the Arkansas River Canyon in Chaffee and Fremont counties, Colorado. The areas selected were a compilation of those with known rare plant resources and areas with potential management concerns from various current and projected land uses. There are eight parcels (Table 1) and eight sections along the Arkansas River identified in the proposed Over the River (OTR) project (Table 2). The selected survey areas are diverse in geologic origin, vegetation patterns, geomorphology, and land use. All roughly occur in the Arkansas River valley between Salida and Canon City (Figure 1). The Arkansas River valley has a high concentration of rare plant species; there are 48 species of concern (Spackman Panjabi 2004), several of which are endemic within the region.

The predominant natural feature along the sixty road miles between Salida and Canon City is the Arkansas River. The Arkansas River is among the most popular recreation areas in the United States for river-rafting, fishing, wildlife viewing, and rock hounding, in part due to its accessibility. A major highway and a railroad parallel the river between Salida and Canon City. In this reach, the Arkansas River and its tributaries impose a natural disturbance regime through ice build up and scouring within their channels. It flows through different bedrock types, which has led to varied geomorphology that includes broader valleys as well as steep-sided canyons (Cooley et al. 2001).

The OTR project is a proposed display of fabric panels suspended horizontally above the Arkansas River for approximately seven discontinuous miles within the forty mile stretch between Canon City and Salida. There are 962 proposed fabric panels suspended by cables anchored by various methods that will involve drilling into riverside rock outcrops and unconsolidated rock or sinking cement caissons into the riverbanks (Christo and Jeanne-Claude 2007). If the project proceeds, the area will face an influx of recreational users, and significant increases in hiking, sightseeing, and camping are anticipated.

Average annual precipitation in the study region ranges from approximately 10 inches (25cm) in Salida to 13 inches (33cm) in Canon City (Western Regional Climate Center 2006). Eighty percent of this precipitation falls between April and September. Thunderstorms are common in the mid- to late summer as wind patterns often shift to more southerly directions providing monsoonal moisture to convection storms (Doesken et al. 2003). Average annual minimum and maximum temperature differ as well, with a minimum and maximum of 29.1 °F to 62.8 °F in Salida and 29.5 °F to 67.9 °F in Canon City. The river valley is cooler because of cold air drainage. Summers are hot with July tending to be the hottest month. Lowest average temperatures occur in January. The mountain ranges and hills in the study region affect general air movements, which can affect local climatic conditions (Doesken et al. 2003). Westerlies comprise the predominate wind pattern in the region, which in proximity to mountain ranges sets the stage for periodic, severe Chinook winds that moderate the climate of the foothills. In fact, below Royal Gorge, winds persist to such a degree as to moderate localized climate near Canon City, making the winter climate milder than anywhere else in Colorado

(Doesken et al. 2003). The growing season is approximately 130 days in Canon City, whereas it is 81 days in Salida just west of the Fremont-Chaffee county line (Wheeler et al. 1995).

Table 1. Select BLM parcels identified for rare plant survey in 2006.

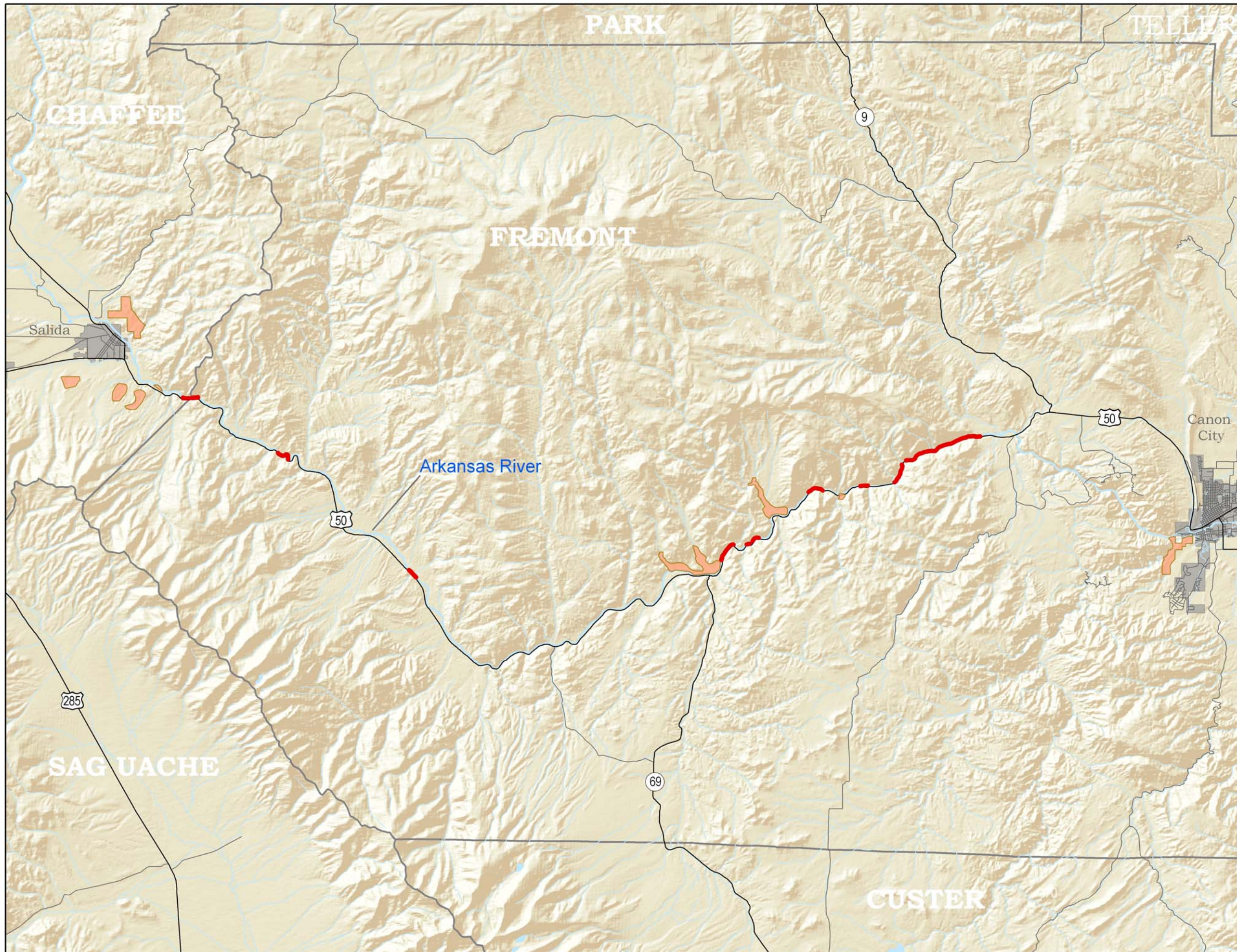
Parcel Name	Total Acres (ha)	Previously Known Elements
Big Hole	312.1 (126.3)	none
Castle Garden	329.7 (133.4)	<i>Eriogonum brandegeei</i>
Five Points	27.5 (11.1)	<i>Penstemon degeneri</i>
Grape Creek	339.8 (137.5)	none
Kings Gulch	145.4 (58.8)	<i>Neoparrya lithophila</i>
Tenderfoot Hill Area	514.5 (208.2)	none
Salida East AHRA	16.1 (6.5)	none
Texas Creek area	512.0 (207.2)	<i>Mentzelia densa, Mentzelia speciosa</i>

Table 2. Proposed Over The River project panel sections.

Panel Section	# of panels	Total Acres (ha)	Linear Distance (km)
County Line Section	6	57.0 (23.1)	0.95
Tunnel Section	4	56.3 (22.8)	0.97
Vallie Bridge Section	4	46.9 (19.0)	0.64
Texas Creek Section	8	82.7 (33.5)	1.3
Maytag Section	4	33.2 (13.4)	0.95
Three Rocks Section	6	41.5 (16.8)	0.98
Spike Buck Section	12	82.1 (33.2)	3.2=1.2 + 0.4 (with 1.6km gap)
Parkdale Section	32	224.0 (90.7)	4.9

Pinyon-juniper (*Pinus edulis-Juniperus monosperma-Juniperus scopulorum*) woodlands are the most prevalent vegetation in the study areas as they tend to occur on dry slopes at lower elevations. Associated shrubs in the understory include Gambel oak (*Quercus gambelii*) and/or mountain mahogany (*Cercocarpus montanus*) on the dry, shallow soils of hill slopes with frankenia (*Frankenia jamesii*) and Bigelow's sage (*Artemisia bigelovii*) on the Niobrara shale hogbacks near Canon City. Grasslands occupy valleys and are scattered in areas of deeper soils throughout the montane and foothill areas.

At the eastern end of the study region is the Grape Creek area south of Canon City (Photo 1). The Grape Creek area is at the edge of a land feature known as the Canon City Embayment, a deposition zone of eroded materials from the orogenies as well as the edge of the inland seaways that covered the interior of the continent in times past. It sits between the Wet Mountains and the southern end of the Front Range. Thick layers of limestones and shales were deposited, some of which were tilted up by the adjacent mountain building to form hogbacks and ridges (Beach 1982, Scott 1977, Gerhard 1967, Wynne 1962). In the vicinity of Canon City, the exposed limestones and shales of the Niobrara Formation form barren hogbacks. These barrens are rare and unique



Colorado Natural Heritage Program  
 Colorado State University  
 254 General Services Building  
 8002 Campus Delivery  
 Fort Collins, CO 80523-8002

Ph (970) 491-1309  
 Fax (970) 491-3349  
 www.cnhp.colostate.edu

Map Date: 04/11/2007

### Legend

- Panel Locations
- BLM Survey Areas

### Colorado Base Data

- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

Digital Elevation Model Produced by the USGS

### Location in Colorado

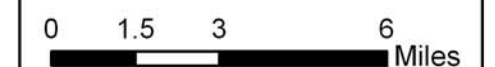


Figure 1. BLM Survey Areas and Panel Locations

geomorphic features that occur in a high concentration between Canon City and Pueblo. They harbor unique assemblages of plant species, including several endemics such as Arkansas River feverfew (*Bolophyta tetraeuris*), Rocky Mountain bladderpod (*Lesquerella calcicola*), golden blazing star (*Mentzelia chrysantha*), Pueblo golden weed (*Oonopsis puebloensis*), round-leaf four-o'clock (*Mirabilis rotundifolius*), and to some degree Arkansas Valley evening primrose (*Oenothera harringtonii*). The barrens in the Arkansas River Valley have been identified as one of the sixteen highest priority areas for immediate conservation action by The Nature Conservancy because of the wealth of biodiversity resources in a region experiencing high development pressure (Kelso et al. 2003, The Nature Conservancy 2001).

At the western end of the study region are three areas clustered in the hills around Salida: Tenderfoot Hill, King Gulch, and Castle Garden. The Tenderfoot Hill area sits in the craggy, volcanic hills north of Salida (Photo 2). The origin of these hills began thirty-five million years ago when a major period of volcanic activity erupted in the immediate vicinity of the study region. The Thirtynine Mile and Cripple Creek volcanic centers near Guffey and the Mt. Princeton area in the Sawatch Range just northwest of Salida violently erupted, dramatically changing the surrounding landscape (Henry et al. 2004, Wobus et al. 1979, Epis et al. 1979, Wobus et al. 1977). Ash and debris were strewn across the area, much of it collecting in valleys (Wallace et al. 1999, Wallace and Lawson 1998). Andesitic lava flows and ash debris from this time period are the basis for the bedrock types in much of the area around Salida, extending east to the center of the Fremont County and beyond (Taylor et al. 1975). The Cripple Creek volcanism led to mineralization and creation of gold-bearing ores that would dramatically impact land use and human settlement in the region during the late 1800's. King Gulch (Photo 3) and Castle Garden (Photo 4) comprise exposures of fine-textured soils derived from the Dry Union Formation. This bedrock has elements of sediment deposition during the Tertiary that filled what is now the Upper Arkansas Valley (which extends northward from Salida). It is a mix of gravel, sand, mud, and volcanic ash deposits (Van Alstine 1969). The King Gulch and Castle Garden areas are embedded within pinyon-juniper woodland, but contain highly erodable badlands that generally support relatively sparse vegetation.

The rest of the study sites are associated with the Arkansas River between Salida and Canon City. Following the volcanic episodes, continual uplift increased the erosive capacity of rivers as their gradients steepened. The Arkansas River became a predominant force, carving majestic canyons through hard, granitic Precambrian bedrock in what is now Fremont County (Colorado Geological Survey 2003). The river canyons near Cotopaxi and in the Royal Gorge are examples of this force. Modern tributaries of the Arkansas River have formed narrow, V-shaped canyons before flowing into the wider river valley running west to east. The Texas Creek (Photo 5) and Big Hole (Photo 6) areas are centered around dry, sand wash tributaries on the north side of the Arkansas River. Salida East (Photo 7) and Five Points (Photo 8) are two of the Arkansas Headwaters Recreation Area (AHRA) river-access areas that are managed jointly by the BLM and the Colorado Division of Parks and Outdoor Recreation (Colorado State Parks 2006). The OTR panel sections are proposed locations for fabric panels to span the river in the plans for the OTR project.





Photo 1. Grape Creek survey site.

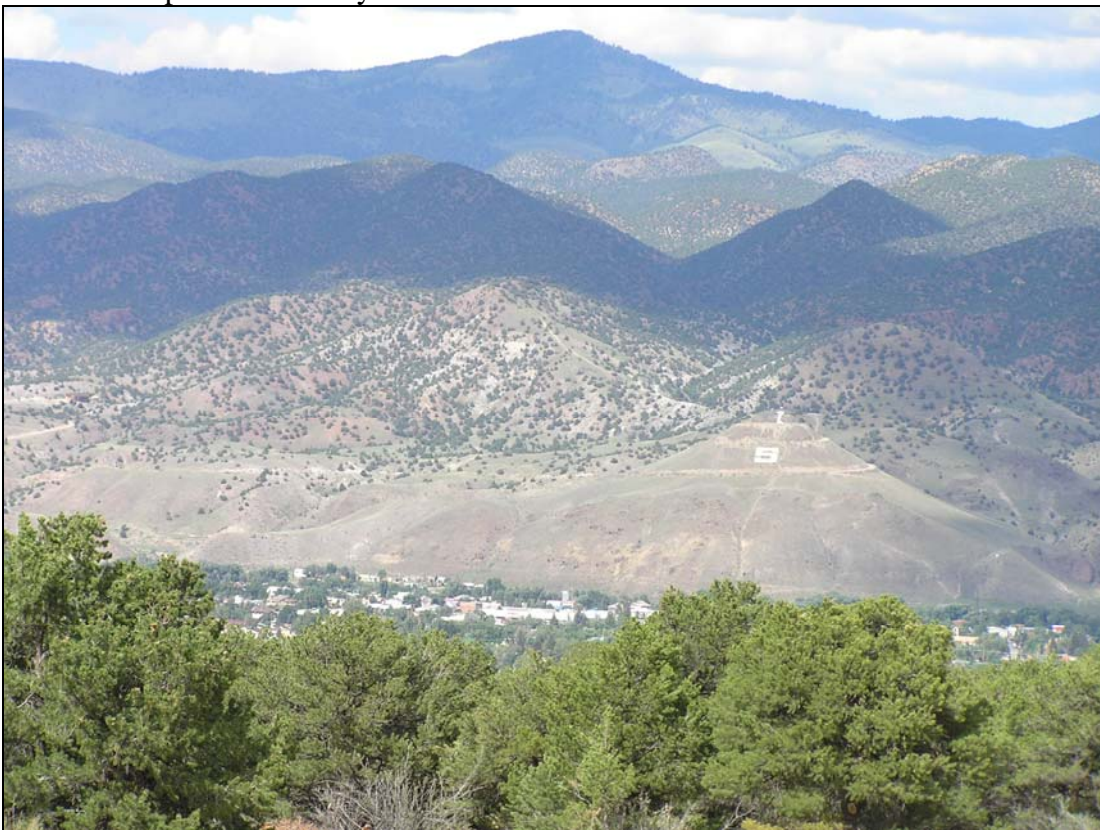


Photo 2. Tenderfoot Hill survey site (photo taken from King Gulch to the south).



Photo 3. King Gulch survey site (photo taken from Tenderfoot Hill to the north).



Photo 4. Castle Garden survey site.



Photo 5. Reese Gulch within the Texas Creek survey site. Photo by Dina Clark.



Photo 6. Northern end of sandy wash drainage in Big Hole survey site.



Photo 7. Salida East survey area.



Photo 8. Five Points survey area.

*This page intentionally left blank*

## METHODS

Colorado Natural Heritage Program (CNHP) staff performed field surveys of the select properties (Table 1, Figure 1) in June through August of 2006. Surveys of the sites were scheduled at times appropriate for finding rare plant species that were known or may potentially occur at the sites (see Table 3 and see Appendix A for Natural Heritage methodology and ranking). There were no known locations of rare species in the OTR sections, but known locations of rare species on the remaining BLM parcels are listed in Table 1. Existing element occurrence records were revisited at each survey site. Aerial photos and topographic and geology maps were used during field work to characterize and to survey each area as completely as possible and to maximize the likelihood of finding additional rare plant occurrences. In general, the entirety of survey sites were traversed, but where parcels were sufficiently large, we focused on habitats within the survey sites that had the greatest probability for harboring rare species, i.e. rock outcrops, sand washes, roadsides. Surveys were conducted by hiking through each inventory area, examining unusual topographic or edaphic features as well as typical habitat at the sites. Photographs were taken at each site to characterize the habitats of the target species. For the OTR sections, CNHP staff hiked along each side of the river along all panel sections where it was safe to do so. We utilized the railroad corridor to evaluate the north side of the river and leapfrogged along various pullouts on Highway 50 to search the

Table 3. List of rare plant species found during the survey period. Species in bold are considered regional endemics.

Global Scientific Name	State Scientific Name <sup>1</sup>	Common Name	Global Rank	State Rank	Flowering Period <sup>1</sup>
<i>Argyrochosma fendleri</i>	<i>Argyrochosma fendleri</i>	Fendler's false cloak fern	G3	S3	n/a
<b><i>Eriogonum brandegeei</i></b>	<b><i>Eriogonum brandegeei</i></b>	<b>Brandegee wild buckwheat</b>	<b>G1G2</b>	<b>S1S2</b>	<b>July-August</b>
<i>Lesquerella calcicola</i>	<i>Lesquerella calcicola</i>	<b>Rocky Mountain bladderpod</b>	<b>G2</b>	<b>S2</b>	<b>late May-early June<sup>2</sup></b>
<i>Mentzelia densa</i>	<i>Nuttallia densa</i>	<b>Arkansas Canyon stickleaf</b>	<b>G2</b>	<b>S2</b>	<b>July-early August</b>
<i>Mentzelia speciosa</i>	<i>Nuttallia speciosa</i>	jeweled blazingstar	G3?	S3?	July-September <sup>2</sup>
<i>Neoparrya lithophila</i>	<i>Aletes lithophilus</i>	rock-loving neoparrya	G3	S3	May-early July
<i>Pellaea wrightiana</i>	<i>Pellaea wrightiana</i>	Wright's cliffbrake	G5	S2	n/a
<b><i>Penstemon degeneri</i></b>	<b><i>Penstemon degeneri</i></b>	<b>Degener beardtongue</b>	<b>G2</b>	<b>S2</b>	<b>mid June-mid July</b>
<i>Townsendia fendleri</i>	<i>Townsendia fendleri</i>	Fendler's Townsend daisy	G2	S1	July-Sept <sup>2</sup>

<sup>1</sup> From Spackman et al. (1997) and Weber and Whittman (2001)

<sup>2</sup> CU Museum (2006)

south side of the river. The south side of the highway was also searched when safety concerns permitted, especially where known occurrences of rare plants occurred in the highway corridor.

When rare plants were encountered, data were collected following Natural Heritage Methodology (Appendix A). Data collected using this methodology includes location information, plant population parameters, and habitat characteristics. Location data are collected as GPS coordinates or are depicted on topographic maps or aerial photos from which a legal description (township, range, and section) can be determined. Data collected on plant populations include occurrence size and condition parameters. Abundance is determined by censusing the occurrence or by estimating the number of individuals if the population is large. Size of the area covered by the population is also estimated or calculated using GIS. Condition of plant populations is assessed by data collected on phenology (percent of the plants that are vegetative, percent in flower, and percent in fruit at the time of survey); reproductive success (evidence of seed dispersal and establishment); age class structure; symbiotic or parasitic relationships (*e.g.* pollinators present); and evidence of disease, predation or injury. Habitat information collected includes descriptions of the surrounding landscape, dominant plant community or associated plant species, elevation, topographic position, slope, shape of slope, aspect, light exposure, soil texture, moisture gradient, and geomorphic landform. Additionally, information is collected to evaluate the likelihood of continued existence of the plant population at the location as well as the means of increasing the viability and recoverability. Such information can assist with management of the areas by identifying threats and natural or unnatural disturbance (*e.g.* effects on population viability due to mining, recreation, grazing, and/or exotic species). The information gathered also refers to any protection plans or strategies that are in place for the species or for a location. Herbarium voucher specimens are collected and deposited in Colorado herbaria for new occurrences when the population size is sufficient to support collecting. Where population size is insufficient, photographs of diagnostic characters are taken.

Field survey data were incorporated into existing information in the CNHP Biotics database (Element Occurrence Records, plant characterization abstracts, global ranking forms, and Potential Conservation Areas) to present a complete picture of the distribution, habitat requirements, and threats to rare plant species encountered.

## RESULTS

### *Element occurrence records*

Occurrences of rare plant species on BLM parcels are listed in Table 4. New locations of rare plant species were discovered at Big Hole (Arkansas Canyon stickleaf; Photo 9), Five Points (Arkansas Canyon stickleaf), Grape Creek (Rocky Mountain bladderpod, Photo 10; Wright's cliffbrake, Photo 11), King Gulch (Fendler's Townsend daisy; Photo 12), Tenderfoot Hill (Arkansas Canyon stickleaf; rock-loving neoparrya, Photo 13), and Texas Creek (Fendler's false cloak fern, Photo 14). Element occurrences records of plant species known from each site (see Table 1) were verified except for Degener beardtongue at Five Points and jeweled blazingstar at Texas Creek. Brandegee wild buckwheat (Photo 15) was relocated at Castle Garden. A plant characterization abstract for each species found on the surveyed parcels is found in Appendix B.

Table 4. Natural heritage features at BLM parcels.

<b>Parcel Name</b>	<b>PCA Name</b>	<b>Elements Present*</b>
Big Hole	McIntyre Hills	<i>Argyrochosma fendleri</i> , <i>Mentzelia densa</i>
Castle Garden	Castle Gardens	<i>Eriogonum brandegeei</i>
Five Points	McIntyre Hills	<i>Mentzelia densa</i> , <i>Penstemon degeneri</i>
Grape Creek	Grape Creek Water Gap	<i>Lesquerella calcicola</i> , <i>Pellaea wrightiana</i>
Kings Gulch	Kings Gulch	<i>Neoparrya lithophila</i> , <i>Townsendia fendleri</i> *
Tenderfoot Hill Area	Tenderfoot Hill	<i>Neoparrya lithophila</i> , <i>Mentzelia densa</i>
Salida East AHRA	none	none; potential, but unverifiable, occurrence of <i>Mentzelia speciosa</i>
Texas Creek area	McIntyre Hills	<i>Argyrochosma fendleri</i> , <i>Mentzelia densa</i> , <i>Mentzelia speciosa</i>

\*marks new occurrences within the parcel area

In the OTR panels, Arkansas Canyon stickleaf was found in abundance in each section and Fendler's false cloak fern was additionally found at the County Line section (Table 5). The numbers of Arkansas Canyon stickleaf individuals observed in each panel section is listed in Table 6.

### *Potential conservation areas (PCAs)*

Four new PCAs resulted from the field work in the designated search areas of this project and six were updated (Table 7). All PCAs and associated maps are in Appendix C.

Among the updates, the boundary of King Gulch PCA was slightly modified, and the boundaries for Badger Creek Tunnel PCA (formerly called Badger Creek PCA) and for McIntyre Hills PCA were significantly expanded relative to their original sizes.

Discovery of significant numbers of Arkansas Canyon stickleaf between Texas Creek and Parkdale led to merging the Texas Creek Gulch PCA (formerly within Echo Canyon at



East Gulch PCA) into the McIntyre Hills PCA, which now encompasses the breadth of the most significant known concentration of Arkansas Canyon stickleaf in the world. Additional PCAs known within the study areas were reviewed and included in Appendix C. All PCAs are shown in Figure 2.

Table 5. Natural heritage features at Over The River panels.

Panel Section	PCA Name	Elements Present
County Line Section	County Line	<i>Mentzelia densa</i> , <i>Argyrochosma fendleri</i>
Tunnel Section	Badger Creek Tunnel	<i>Mentzelia densa</i>
Vallie Bridge Section	Vallie	<i>Mentzelia densa</i>
Texas Creek Section	McIntyre Hills	<i>Mentzelia densa</i>
Maytag Section	McIntyre Hills	<i>Mentzelia densa</i>
Three Rocks Section	McIntyre Hills	<i>Mentzelia densa</i>
Spike Buck Section	McIntyre Hills	<i>Mentzelia densa</i>
Parkdale Section	McIntyre Hills	<i>Mentzelia densa</i>

Table 6. Numbers of Arkansas Canyon stickleaf individuals within OTR section areas.

Panel Section	Number of plants counted in 2006		
	N side of river	S side of river	S side of Highway 50
County Line Section*	383	0	0
Tunnel Section	151	0	0
Vallie Bridge Section*	0	12	46
Texas Creek Section	1577	1	0
Maytag Section	169	9	0
Three Rocks Section	183	15	0
Spike Buck Section	706	194	307
Parkdale Section	1041	69	87

\*A majority of plants are downstream from the end of the panel sections.

Table 7. Biodiversity ranks (B-rank) of potential conservation areas.

PCA Name	B-rank	New/Update
Badger Creek Tunnel	B2	update
Box Canyon at Wellsville	B3	update
Bumback Gulch Parkdale	B3	update
Castle Gardens	B1	update
Cotopaxi	B2	update
County Line	B2	new
Grape Creek Water Gap	B2	new
King Gulch	B2	update
McIntyre Hills	B2	update
Tenderfoot Hill	B2	new
Vallie	B3	new



Photo 9. Arkansas Canyon stickleaf (*Mentzelia densa*).



Photo 10. Rocky Mountain bladderpod (*Lesquerella calcicola*).



Photo 11. Wright's cliffbrake (*Pellaea wrightiana*).



Photo 12. Fendler's Townsend daisy (*Townsendia fendleri*).



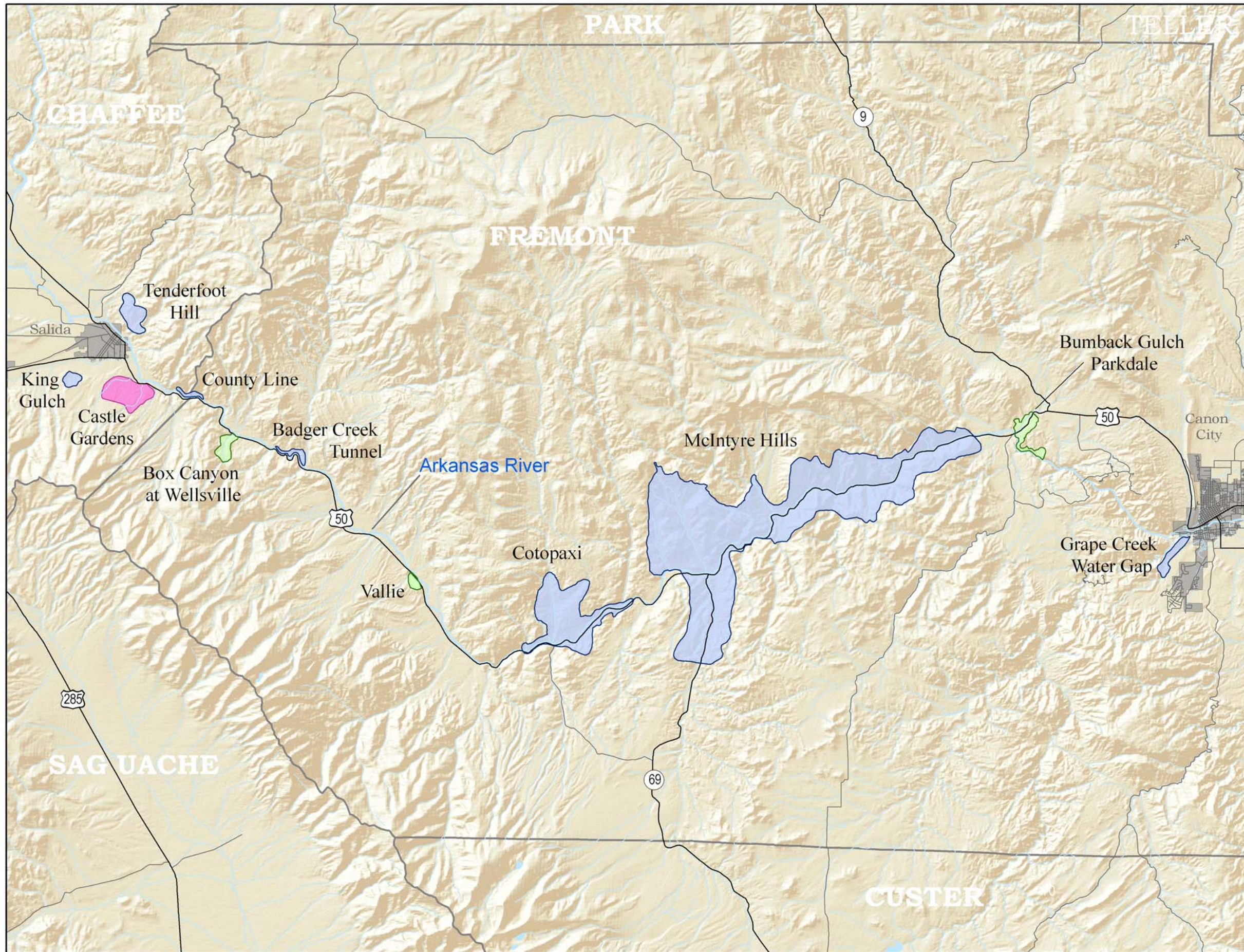
Photo 13. Rock-loving neoparrya (*Neoparrya lithophila*).



Photo 14. Fendler's false cloak-fern (*Argyrochosma fendleri*).



Photo 15. Brandegee wild buckwheat (*Eriogonum brandegeei*).



Colorado Natural Heritage Program  
 Colorado State University  
 254 General Services Building  
 8002 Campus Delivery  
 Fort Collins, CO 80523-8002

Ph (970) 491-1309  
 Fax (970) 491-3349  
 www.cnhp.colostate.edu

Map Date: 04/11/2007

**Legend**

**CNHP Potential Conservation Areas (PCAs) by Biodiversity Significance Rank**

- B1: Outstanding Biodiversity Significance
- B2: Very High Biodiversity Significance
- B3: High Biodiversity Significance

Only PCAs highlighted in the report are displayed on this map

**Colorado Base Data**

- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

Digital Elevation Model Produced by the USGS



*PCAs represent CNHP's best estimate of the primary area supporting long-term survival of targeted species, subspecies and natural communities.*

N

0 1.5 3 6 Miles

Figure 2. CNHP Potential Conservation Areas in the Arkansas Canyon

## DISCUSSION

*Species Accounts* (alphabetical by global name; see Table 3)

### **Fendler's false cloak-fern (*Argyrochosma fendleri*); Maidenhair Fern Family (Pteridaceae)**

Three new locations of Fendler's false cloak-fern were discovered during these field surveys. Fendler's false cloak-fern is a xeric fern known from the southern Rocky Mountains in Colorado and extreme southeastern Wyoming. It extends south through New Mexico to the Sonora region of Mexico. This fern grows in crevices of granitic or volcanic cliffs and rock outcrops (Flora of North America Editorial Committee 1993), often in very small numbers. Given its habitat, sporadic occurrence, and generally small population size, it is difficult to detect. Little is known about the habitat restrictions for this species; there is much suitable, but unoccupied habitat immediately surrounding most occurrences of this species. Threats to Fendler's false cloak-fern tend to be minimal due to the ruggedness and relative inaccessibility of its habitat (Fertig 1999).

### **Brandege wild buckwheat (*Eriogonum brandegeei*); Buckwheat Family (Polygonaceae)**

Brandege wild buckwheat was re-verified at Castle Garden. Brandege wild buckwheat is a narrow endemic known only from Chaffee and Fremont counties in Colorado. It grows on steep, eroding slopes within a barrens habitat derived from specific bedrock geology that is limited in extent. Brandege wild buckwheat was first discovered at Garden Park in Fremont County on bedrock from the Morrison Formation (sandstone with calcareous lenses) and was subsequently found near Salida on Dry Union Formation (lacustrine alluvium) (O'Kane 1988). The elevation range of the species is 5775-8400 feet, which is dominated by pinyon-juniper woodlands in these areas. The total area occupied by Brandege wild buckwheat is calculated to be only 1.3 square miles throughout all the known occurrences (Anderson 2006a).

Primary threats to Brandege wild buckwheat are inappropriate recreational use, residential and commercial development, and bentonite mining (Anderson 2006a, O'Kane 1988). Proximity of Brandege wild buckwheat occurrences to growing human population centers increases the likelihood of these threats. Impacts to any known Brandege wild buckwheat occurrences will increase the overall vulnerability of the species.

The Brandege wild buckwheat populations at Castle Garden (also known as Cleora) may be the largest known occurrence of the species (Anderson 2006a). The nature of how this plant occurs on the landscape as well as its habitat makes it inherently difficult to precisely map certain occurrences. However, several historical polygons were ground-truthed at both areas of Castle Garden and remapped using GPS. Brandege wild buckwheat grows in the greatest densities on fine-textured soils on steep, eroding slopes

where there is virtually no other vegetation, but it can also occur sporadically in variously sized clusters within adjacent pinyon-juniper woodlands.

**Rocky Mountain bladderpod (*Lesquerella calcicola*); Mustard Family (Brassicaceae)**

The new location for Rocky Mountain bladderpod at Grape Creek is the westernmost occurrence of this species outside of the San Luis Valley. Rocky Mountain bladderpod is a regional endemic that grows on shale barrens and calcareous hills and ravines between 5000-7500 feet (Rollins 1993). It occurs in El Paso, Fremont, Pueblo, and Las Animas counties in Colorado and has been reported from one county in New Mexico (USDA NRCS 2006). In Colorado, it grows on shale derived from the Niobrara Formation.

Little is known about the biology, demography, or abundance of Rocky Mountain bladderpod. Its distribution is restricted to shale barrens habitat, but it is not known why it does not occupy certain areas of apparently suitable habitat. Little is known about direct threats to the species; threats to the species are understood to include any threats to its shale barrens habitat. The primary threat is habitat conversion from residential and often consequent resource development to support it, such as gravel mining, water reservoir building, and road construction (and its associated maintenance). Secondary to development threats themselves, these activities increase the likelihood of invasion by weedy species, which can alter the dynamics of these areas. Barrens habitat is also targeted for mining of gypsum and landscaping materials. Past mining has altered or destroyed habitat, especially around Canon City.

**Arkansas Canyon stickleaf (*Mentzelia densa*); Blazing Star Family (Loasaceae)**

Three new locations of Arkansas Canyon stickleaf were discovered in 2006 and several other known occurrences were significantly expanded. Two of these new locations occur in Chaffee County, where Arkansas Canyon stickleaf was not previously known until it was discovered in the Tenderfoot Hill area and along the Arkansas River where it crosses the Chaffee-Fremont county line. Although these new locations are only about five linear miles away from the previously known westernmost occurrence near Wellsville in western Fremont County, the Tenderfoot Hill location expanded the elevation range from a maximum of 7200 feet (2195m) to 7460 feet (2275m). The Tenderfoot Hill location is also found on dark shale, which is different bedrock than the rest of the known occurrences of Arkansas Canyon stickleaf; prior to the discovery of this occurrence, Arkansas Canyon stickleaf was only known from granitic bedrock.

Arkansas Canyon stickleaf (also known as the Royal Gorge stickleaf) is locally common within a very limited geographic range (Spackman Panjabi 2004, Colorado Native Plant Society 1997, O’Kane 1988). It is endemic to the Arkansas River Canyon between Salida and Canon City, especially between Texas Creek and Parkdale. Arkansas Canyon stickleaf is a short, shrubby plant that grows in the shape of a tumbleweed. It has lemon yellow flowers that open after 6pm and close by around 9pm (Spackman Panjabi 2004). The flowers open briefly in the early morning hours as well. Weber and Wittmann (2001) do not recognize this taxon and have lumped it into jeweled blazingstar (*M. speciosa*). However, most other sources (e.g., USDA NRCS 2006, Darlington 1934) consider the Arkansas Canyon stickleaf to be a distinct species.



Although little demographic research has been done on this species, Arkansas Canyon stickleaf most closely approximates characteristics of a stress-tolerant ruderal species, the most consistent feature of which is an annual or short-lived perennial life history (Grime 2001). Like many species of *Mentzelia*, Arkansas Canyon stickleaf is found on moderately disturbed sites and like other members of *Mentzelia* section *Bartonia*, Arkansas Canyon stickleaf devotes much of its reserves to producing numerous flowers and dies after setting seed (Darlington 1934). As a short-lived perennial, Arkansas Canyon stickleaf may be inherently mobile on the landscape. Its high mobility and rapid turnover may result in a metapopulation structure requiring substantial suitable, but not necessarily occupied, habitat.

The occurrences of Arkansas Canyon stickleaf in the Arkansas River canyon are spatially complex. In natural settings, which include sparsely vegetated areas with gravelly substrates like rock cliffs and outcrops as well as sand and gravel washes (O’Kane 1988), the species tends to occur in small to large groups of tens to hundreds of individuals. The granitic canyon walls and sand wash tributaries of the Arkansas River are considered natural habitat for Arkansas Canyon stickleaf. However, this plant is relatively common and can be quite dense and abundant in disturbed areas like roadsides and railroad embankments that parallel the river for its entire length in the study region. Along the railroad corridor north of the river Arkansas Canyon stickleaf tends to form groups of hundreds to thousands of individuals, although there are areas of scattered individuals and small groups as well. However, this type of disturbed habitat also attracts significant numbers of weedy, invasive species like cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola australis*), kochia (*Kochia scoparia*), tamarisk (*Tamarix ramosissimum*), Jim Hill mustard (*Sisymbrium altissimum*), and knapweeds (*Acroptilon* spp., *Centaurea* spp.), among others.

It stands to reason that gravity is the primary seed and propagule dispersal mechanism for Arkansas Canyon stickleaf. Thus, the natural habitat above the river, highway, and railroad can be considered an important natural “source” of establishment for the species. Where it is found between Highway 50 and the Arkansas River, Arkansas Canyon stickleaf most often grows as solitary individuals or in small groups of individuals in the roadside rip rap. These areas are probably “sinks”; plants can occur here, but they likely will not thrive or make important contributions to the long-term viability of the species. However, individual plants in these places serve to geographically connect larger groups of plants from nearby areas, and it appears that the right-of-ways along Highway 50 and the railroad are acting as corridors for dispersal. The influence of these corridors on population dynamics and gene flow in Arkansas Canyon stickleaf is unknown.

Although the steeply sloping natural habitat of canyon walls and the sparse vegetation and unconsolidated substrate protect Arkansas Canyon stickleaf from trampling or grazing threats, the greatest current threats to the species are from transportation infrastructure maintenance. Since the vast majority of known individuals of Arkansas Canyon stickleaf are currently found in railroad or road rights-of-way, these plants are susceptible to threats from road maintenance activities such as widening, mowing, and

pesticide spraying (Grunau and Lavender 2002). Arkansas Canyon stickleaf plants along Highway 50 face road maintenance threats. However, most individuals are growing in rip rap areas in the narrow corridor between the Arkansas River and Highway 50 and are not subject to mowing. Pesticide spraying is a valid threat to the plants. Secondary threats to Arkansas Canyon stickleaf along the highway are the result of heavy visitation and traffic that flows through these areas; direct impacts to individual plants are probably most often the result of inadvertent trampling.

**Jeweled blazingstar (*Mentzelia speciosa*); Blazing Star Family (Loasaceae)**

Jeweled blazingstar is a species known only from Colorado, primarily on the Front Range, and possibly from just across the border in southeastern Wyoming. Little is known about the biology of this species (Anderson 2006b). It is a biennial or short-lived perennial from a stout rootstalk (Hill 1976). It is considered to be a relatively recently evolved taxon and therefore similar to other species within the genus *Mentzelia* (Hill 1976). Weber and Wittman (2001) do not recognize this species as separate from Arkansas Canyon stickleaf (*M. densa*), but it is considered distinct by many other sources (USDA NRCS 2006). As with many species in the genus *Mentzelia*, jeweled blazingstar has bright yellow flowers that generally open after 6pm (Spackman Panjabi 2004). Thus it is very likely to be pollinated by insects.

Jeweled blazingstar is documented from sand wash alluvium derived from granitic bedrock and it is also known from roadsides. These are the habitats in which it is known from Texas Creek. This occurrence was searched for but not found in 2006. Threats to the species are thus similar to those to Arkansas Canyon stickleaf (*Mentzelia densa*) with regard to transportation corridor maintenance. Jeweled blazingstar is susceptible to mowing and pesticide spraying as well as road grading or widening activities.

**Rock-loving neoparrya (*Neoparrya lithophila*); Parsley Family (Apiaceae)**

Rock-loving neoparrya is a narrow endemic largely known from the San Luis Valley. It was first collected by C.C. Parry in 1867 while surveying possible railroad routes in the southern Rocky Mountains, but the presence of this species in Colorado remained a mystery for ninety years due to poor locational information affiliated with the specimen. Its original location was re-discovered by Dr. William Weber after a concerted effort and some thoughtful botanical sleuthing (Anderson 2004).

This member of the Parsley Family is a slow-growing, long-lived, stress tolerant perennial species (Anderson 2004). Rock-loving neoparrya tends to occur in isolated occurrences ranging from tens to thousands of plants. It grows on mostly open, exposed, rocky or sandy, xeric sites with little soil development such as shelves, crevices, or loose gravel on steep, inaccessible cliffs and outcrops. Rock-loving neoparrya most often grows on late Tertiary volcanic rocks except for the location at King Gulch where it occurs on Dry Union Formation. However, at several known locations for rock-loving neoparrya, it seems to be restricted to localized areas within the bedrock exposures. Much habitat around several occurrences, including at Tenderfoot Hill, is apparently suitable but not occupied (Anderson 2004).

The relatively inaccessible habitat of many occurrences (including King Gulch and Tenderfoot Hill areas) provides natural protection from anthropogenic threats such as motorized or non-motorized recreation, grazing, and development. Mining and timber harvest are potential threats that could impact occurrences (Anderson 2004).

**Wright's cliffbrake (*Pellaea wrightiana*); Maidenhair Fern Family (Pteridaceae)**

Wright's cliffbrake is another southwestern, xeric fern that is thought to reach its northern extent in Colorado. It is known from northern Mexico and from Arizona to Texas, extending north into southern Utah and Colorado (eFloras.org 2006). It grows in crevices on acidic to mildly basic igneous or limestone rocks on gravelly hillsides and cliffs. It tends to occur in full sun or partial shade between 1400-2300 m (Tryon 1957). The new location at the Grape Creek area is the westernmost known occurrence in Colorado. Like Fendler's false cloak-fern, threats to Wright's cliffbrake tend to be minimal due to the ruggedness and relative inaccessibility of its habitat.

**Degener beardtongue (*Penstemon degeneri*); Figwort Family (Scrophulariaceae)**

Abnormal climatic conditions during the 2006 growing season confounded the search for Degener beardtongue during the survey. Temperatures were above average during the entire growing season, from April to September. Spring moisture was negligible; less than one inch of rain fell in both May and June throughout the study area. Conditions did not ameliorate until late June and early July when record monsoon precipitation began to fall. Reports of anomalies in emergence and reproductive output for several of the targeted rare species trickled in from various field biologists following the monsoonal moisture. For example, Degener beardtongue was greatly reduced in emergence during its flowering season, if it surfaced at all, but emerged and flowered in September at certain locations (Anderson 2006d, Anderson personal communication 2006c, Olson personal communication 2006). However, Degener beardtongue did not emerge at all at known lower-elevation locations (*e.g.* Five Points campground) throughout the entire growing season (Neid and Clark 2006).

One element occurrence record for Degener beardtongue is known from Five Points where it was last observed in 2003. Efforts to relocate it in 2006 were indeterminate. However, in general it is understood that Degener beardtongue exhibited poor flowering this season due to climatic conditions early in the growing season.

Degener beardtongue is a low-growing herb that is locally common on loose, poorly-developed, granitic soils in open ponderosa pine or pinyon-juniper woodlands. It is endemic to the general vicinity of the Wet Mountains and Wet Mountain Valley in Fremont, Custer, and Huerfano counties (Spackman Panjabi 2004, Colorado Native Plant Society 1997, O'Kane 1988). Diagnostic features are primarily floral characteristics (Spackman et al. 1997) meaning that surveys for the plant need to occur when it is flowering. *Penstemon* species can vary in both abundance and phenology from year to year; it is known to exhibit prolonged dormancy (Beatty et al. 2004) likely depending on local climatic conditions.

Threats to Degener beardtongue vary from site to site. Generally, motorized or non-motorized recreation, trail or road construction and maintenance, livestock activities, invasive species introduction and small-scale mining are the most common threats that have direct impacts on individual plant vigor and reproductive success or indirect impacts on habitat. The AHRA management plan acknowledges that “development of facilities to support recreation use will very likely affect [this] species” (as cited in Beatty et al. 2004).

**Fendler’s Townsend daisy (*Townsendia fendleri*); Sunflower Family (Asteraceae)**

Little is currently known about the small Fendler’s Townsend daisy. It is currently only known from northern New Mexico and from disparate locations in south-central and southeast Colorado. It flowers from June through August and grows in pinyon-juniper woodland or desert scrub on rocky soils or on rock outcrops (eFloras.org 2006), becoming more extensively distributed on exposed sedimentary outcrops southwest of Canon City (Kelso 1999). It can grow on soils with a moderate gypsum and selenium content (Lowrey and Knight 1994). In addition to the new occurrence at King Gulch, Fendler’s Townsend daisy was discovered during several other CNHP projects in 2006, both in Chaffee County and in southeast Colorado.

***Recommendations:***

Potential threats to species listed above can hopefully be minimized with good planning where critical habitat occurs. General threats to biodiversity include recreation, roads and requisite maintenance activities, livestock grazing, non-native species, timber harvest, mining, oil and gas development, and residential development, among others. Of these, recreation, non-native species, and road maintenance activities are identified as the greatest potential threats at the study sites in this report.

Recreation, once very local and perhaps even unnoticeable, is increasing and having a greater impact on natural ecosystems in the Arkansas River valley. Different types of recreation (e.g., motorized versus non-motorized activities) typically have different effects on ecosystem processes. Shale barrens and riparian zones are routes and destinations for many established trails. Thus, impacts to native vegetation (mainly trampling) in these areas can be high. All-terrain vehicles (ATVs) can disturb and fragment habitat for native species. Non-motorized recreation, mostly hiking but also some mountain-biking and rock climbing, presents a different set of issues. Hikers, mountain bikes, horses, and ATVs have also been identified as a vector for spreading invasive non-native plant species.

Non-native plants or animals can have wide-ranging impacts. Non-native plants can increase dramatically under the right conditions and dominate a previously natural area (e.g., a native grassland adjacent to a railroad right-of-way). This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Removal of non-native, invasive species is preferred although careful planning of management activities in rare plant habitat is encouraged when selecting control measures for non-native species.

The primary concerns for potential impacts to rare plants from road maintenance include road widening, mowing, and herbicide application (Grunau and Lavender 2002). Secondly, impacts of these activities on pollinators of rare plants are of concern (Spackman Panjabi 2004). Avoiding pesticide application in known areas of rare plant habitat would be beneficial to the populations; this may require hand-spraying of invasive species so as to avoid directly impacting rare plant individuals. A delay of mowing in rare plant habitat until after mid-September would protect Arkansas Canyon stickleaf during its reproductive stage along Highway 50.

#### Species-Specific Recommendations:

##### Arkansas Canyon stickleaf (*Mentzelia densa*)

- Support research studying the demography of Arkansas Canyon stickleaf. Such research may answer several questions like how long do individual plants live, how mobile are they on the landscape, what is reproductive output of individuals, what factors favor plant establishment at a site, and how does this species respond to management activities like mowing, burning, and herbicide spraying.

##### Degener beardtongue (*Penstemon degeneri*)

- Support future inventories with flexible field schedule to observe the species over several weeks to accommodate the potential fluctuations in phenology.
- Re-evaluation of the potential needs for development on AHRA sites that may impact the species; commit to evaluating alternative development plans in order to facilitate perpetuation of the species on AHRA sites.

## **ACKNOWLEDGEMENTS**

Special thanks to Erik Brekke of the Royal Gorge Office of the BLM for assistance with all aspects of this project and especially facilitating field survey logistics and for showing dedication to the protection of natural resources and for thoughtful approach to managing multiple use on public lands. Special thanks to the artists Christo and Jean-Claude for financial contribution to support this study. Thanks also to Colorado State Parks AHRA river rangers for shuttling CNHP staff across the Arkansas River; this greatly increased the efficiency and effective use of field survey time and energy during the hot summer. Thanks to Dina Clark, Ron Abbott, and Emily Sherman for assistance with field work, especially to Dina for leading field crews in my absence. Thanks to Dave Anderson, Susan Spackman Panjabi, and Renee Rondeau for their institutional knowledge of this botanically rich area. Thanks also to Fagan Johnson of the CNHP Conservation Data Services Team for implementing database improvements to facilitate the development of database products for this report; to Amy Lavender for producing the maps for this report; and to Melissa Landon for assisting with data sharing issues. Finally, thanks to Mary Olivas and Angie Nielson for accounting assistance.

## REFERENCES

- Anderson, D.G. (2004). *Neoparrya lithophila* Mathias (Bill's neoparrya): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/neoparryalithophila.pdf> [June 15, 2006].
- Anderson, D.G. 2006a. *Eriogonum brandegeei* Reveal (Brandegee's buckwheat): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/eriogonumbrandegeei.pdf> [July 17, 2006].
- Anderson, D.G. 2006b. *Mentzelia chrysantha* Engelman ex Brandegee (golden blazing star): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available at <http://www.fs.fed.us/r2/projects/scp/assessments/mentzeliachrysantha.pdf> [July 17, 2006].
- Anderson, D. 2006c. Botanist, Colorado Natural Heritage Program. Personal communication.
- Anderson, D. 2006d. The 3rd Annual Colorado Rare Plant Symposium: G2 Plants of Southeastern Colorado, Meeting Minutes. Colorado Natural Heritage Program. Ft. Collins, CO.
- Beach, B.W. 1982. Florence City quadrangle geologic maps. Colorado Geological Survey, Dept. of Natural Resources, Denver, CO.
- Beatty, B.L., W.F. Jennings, and R.C. Rawlinson 2004. *Penstemon degeneri* Crosswhite (Degener's beardtongue): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available at <http://www.fs.fed.us/r2/projects/scp/assessments/penstemondegeneri.pdf> [July 17, 2006].
- Christo and Jeanne-Claude. 2007. Over the River Project for the Arkansas River, Colorado. Available at <http://www.christojeanneclaude.net/otr.html>. [January 12, 2007].
- Colorado Geological Survey 2003. Messages in Stone. Colorado Geological Survey, Denver, CO.
- Colorado Native Plant Society. 1997. Rare Plants of Colorado, Second Edition. Falcon Press, Helena, Montana.
- Colorado State Parks. 2006. Arkansas Headwaters Recreation Area. Available at <http://parks.state.co.us/Parks/arkansasheadwaters> [October 30, 2006].
- Cooley, C., Gilbert, D., and Backstrand, J. 2001. Riparian analysis of the Arkansas River from Leadville Junction to Pueblo Reservoir. Bureau of Land Management, Canon City, CO.

- CU Museum (University of Colorado Museum of Natural History). 2006. Specimen Database of Colorado Vascular Plants. Accessible at <http://cumuseum.colorado.edu/Research/Botany/Databases/search.php>.
- Darlington, J. 1934. A monograph of the Genus *Mentzelia*. *Annals of the Missouri Botanical Garden* 21(1): 103-226.
- Doesken, N.J., Pielke, R.A., and Bliss, O.A.P. 2003. *Climate of Colorado. Climatology of the United States No. 60*, Colorado Climate Center, Colorado State University, Ft. Collins, CO.
- eFloras.org. 2006. *Flora of North America* [Online]. Accessible at [http://efloras.org/flora\\_page.aspx?flora\\_id=1](http://efloras.org/flora_page.aspx?flora_id=1). [October 1, 2006]
- Epis, R.C., Wobus, R.A., and Scott, G.R. 1979. Geologic map of the Black Mountain quadrangle, Fremont and Park Counties, Colorado. U.S. Geological Survey, Open-File Report 79-652, Washington, DC.
- Fertig, W. 1999. *Argyrochosma fendleri* (Fendler cloak-fern) State Species Abstract. Wyoming Natural Diversity Database. Available at [http://uwadmnweb.uwyo.edu/wyndd/Plants/state\\_spp\\_abstracts/A/Argyrochosma\\_fendleri.pdf#search=%22Argyrochosma%20fendleri%22](http://uwadmnweb.uwyo.edu/wyndd/Plants/state_spp_abstracts/A/Argyrochosma_fendleri.pdf#search=%22Argyrochosma%20fendleri%22).
- Flora of North America Editorial Committee, eds. 1993. *Flora of North America North of Mexico, Volume 2: Pteridophytes and Gymnosperms*. Oxford University Press. New York and Oxford.
- Gerhard, L.C. 1967. Paleozoic geologic development of Canon City Embayment, Colorado. *American Association of Petroleum Geologists Bulletin* 51: 2260-2280.
- Grime, J.P. 2001. *Plant Strategies, Vegetation Processes, and Ecosystem Properties*. Second edition. John Wiley & Sons, Chichester, West Sussex, England.
- Grunau, L. and A. Lavender. 2002. Estimating impacts of highway projects on select rare, sensitive, or declining species on Colorado's central shortgrass prairie. Unpublished report prepared for the Colorado Department of Transportation by the Colorado Natural Heritage Program. Ft. Collins, Colorado.
- Henry, T.W., Evanoff, E., Grenard, D.A., Meyer, H.W., and Vardiman, D.M. 2004. *Geologic Guidebook to the Gold Belt Byway, Colorado*. Gold Belt Tour Scenic and Historic Byway Association, Colorado.
- Hill, R.J. 1976. *Mentzelia sinuata* (Rydb.)R.J. Hill comb. Nov. and *M. speciosa* Osterh. (Loasaceae), a species pair from the Rocky Mountain Front Range. *Bulletin of the Torrey Botanical Club* 103(5): 212-217.

- Kelso, S. 1999. Botany of the Pikes Peak Region. Unpublished report. Available at [http://www.coloradocollege.edu/ Dept/BY/ppbotany.pdf](http://www.coloradocollege.edu/Dept/BY/ppbotany.pdf).
- Kelso, S., N. Bower, K. Heckmann, P.M. Beardsley, and D. Greve. 2003. Geobotany of the Niobrara Chalk Barrens in Colorado: A Study of Edaphic Endemism and Rarity. Department of Biology, Colorado College, Colorado Springs, CO. *Western Great Basin Naturalist* 63(3):299-313.
- Lowrey, T.K. and P.J. Knight. 1994. *Townsendia gypsophila* (Compositae: Asteraea): A new species from northern New Mexico. *Brittonia* 46(3): 194-199.
- Neid, S.L. and D. Clark. 2006. Field survey at Curley Peak in Fremont County, Colorado. Colorado Natural Heritage Program. Ft. Collins, Colorado.
- O’Kane, S. 1988. Colorado’s rare flora. *Great Basin Naturalist* 48(4): 434-484.
- Olson, S. 2006. Botanist, Pike and San Isabel National Forests & Comanche and Cimarron National Grasslands. Personal communication.
- Rollins, R.C. 1993. The Cruciferae of continental North America. Stanford University Press, Stanford, CA.
- Scott, G.R. 1977. Reconnaissance geologic map of the Canon City quadrangle, Fremont County, Colorado. U.S. Geological Survey, Reston, VA.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program. <http://www.cnhp.colostate.edu/rareplants/intro.html>.
- Spackman Panjabi, S. 2004. Visiting insect diversity and visitation rates from seven globally imperiled plant species in Colorado’s middle Arkansas Valley. Colorado Natural Heritage Program. Ft. Collins, Colorado. Available at [http://www.cnhp.colostate.edu/documents/2004/Arkansas\\_pollinators.pdf](http://www.cnhp.colostate.edu/documents/2004/Arkansas_pollinators.pdf).
- Taylor, R.B., Scott, G.R., Wobus, R.A., and Epis, R.C. 1975. Reconnaissance geologic map of the Royal Gorge quadrangle, Fremont and Custer Counties, Colorado. U.S. Geological Survey, Reston, VA.
- The Nature Conservancy. 2001. Arkansas Valley Barrens Site Conservation Plan. Colorado Chapter of The Nature Conservancy. Boulder, Colorado.
- Tryon, A.F. 1957. A revision of the fern Genus *Pellaea* Section *Pellaea*. *Annals of the Missouri Botanical Garden* 44(2): 125-193.
- USDA NRCS. 2006. The PLANTS Database (<http://plants.usda.gov>, 17 July 2006). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.



- Van Alstine, R.E. 1969. Geology and mineral deposits of the Poncha Springs NE quadrangle, Chaffee County, Colorado. U.S. Geological Survey Professional Paper 626.
- Wallace, C.A., Cappa, J.A., and Lawson, A.D. 1999. Geologic map of the Gribbles Park quadrangle, Park and Fremont Counties, Colorado. Colorado Geological Survey, Denver, CO.
- Wallace, C.A. and Lawson, A.D. 1998. Geologic map of the Cameron Mountain quadrangle, Chaffee, Park, and Fremont Counties, Colorado. Colorado Geological Survey, Division of Minerals and Geology, Denver, CO.
- Weber, W.A. and R.C. Wittmann. 2001. Colorado Flora: Eastern Slope, Third Edition. University Press of Colorado. Boulder, Colorado.
- Western Regional Climate Center. 2006. Monthly Climate Summaries. Available at <http://www.wrcc.dri.edu/index.html>. [October 30, 2006].
- Wheeler, T.J., Anderson, D.L., Engel, S., Hogan, A.M., Laresen, L.S., Neve, L.A., and Romano, R.R. 1995. Soil Survey of Fremont County Area, Colorado. United States Department of Agriculture, Natural Resources Conservation Service; in cooperation with Colorado Agricultural Experiment Station and United States Department of the Interior, Bureau of Land Management., Washington, D.C.
- Wobus, R.A., Epis, R.C., and Scott, G.R. 1979. Geologic map of the Cover Mountain quadrangle, Fremont, Park, and Teller counties, Colorado. U.S. Geological Survey, Reston, VA .
- Wobus, R.A., Epis, R.C., and Scott, G.R. 1977. Reconnaissance geologic map of the Cripple Creek - Pikes Peak area, Teller, Fremont, and El Paso counties, Colorado. Miscellaneous Field Studies Map MF-805. U.S. Geologic Survey, Reston, VA.
- Wynne, M.E. 1962. Geology of a portion of Fremont County, Colorado. M.S. Thesis. University of Kansas, Lawrence, KS.

*This page intentionally left blank*

# Appendix A. Natural Heritage Methodology and Ranking System

Natural Heritage Methodology and Ranking System .....	30
Element Occurrences and their Ranking.....	31
Potential Conservation Areas.....	32
Ranking of Potential Conservation Areas.....	33
Protection Urgency Ranks .....	33
Management Urgency Ranks.....	35

## **Natural Heritage Methodology and Ranking System**

Key to the functioning of Natural Heritage Programs is the concept of setting priorities for gathering information and conducting inventories. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The financial and human resources available to gather such information are not. Because biological inventories tend to be under-funded, there is a premium on devising systems that are both effective in providing information that meets users' needs and efficient in gathering that information. The cornerstone of Natural Heritage inventories is the use of a ranking system to achieve these twin objectives of effectiveness and efficiency.

Ranking species and ecological communities according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species and communities deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, these constitute the majority of most groups of organisms. On the other hand, for those species and communities that are by their nature rare, more detailed information is needed. Because of their rarity, gathering comprehensive and detailed data can be less daunting than gathering similarly comprehensive information on more abundant species.

To determine the status of species within Colorado, CNHP gathers information on plants, animals, and plant communities. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because an element found in one place is more vulnerable to extinction than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data

are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table A-1.

Table A-1. Definition of Natural Heritage Imperilment Ranks

<b>G/S1</b>	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
<b>G/S2</b>	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
<b>G/S3</b>	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
<b>G/S4</b>	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
<b>G/S5</b>	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
<b>G/SX</b>	Presumed extinct globally, or extirpated within the state.
<b>G#?</b>	Indicates uncertainty about an assigned global rank.
<b>G/SU</b>	Unable to assign rank due to lack of available information.
<b>GQ</b>	Indicates uncertainty about taxonomic status.
<b>G/SH</b>	Historically known, but usually not verified for an extended period of time.
<b>G#T#</b>	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
<b>SA</b>	Accidental in the state.
<b>SR</b>	Reported to occur in the state but unverified.
<b>S?</b>	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

### Element Occurrences and their Ranking

Actual locations of elements, whether they are single organisms, populations, or plant communities, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

**Size** – a measure of the area or abundance of the element’s occurrence. This factor takes into account aspects such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to

ensure survival or re-establishment of an element after natural disturbance). This factor for an occurrence is evaluated relative to other known, and/or presumed viable, examples.

**Condition/Quality** – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).

**Landscape Context** – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances. Connectivity includes aspects such as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent rank and D representing a poor rank. These ranks for each factor are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table A-2.

Table A-2. Element Occurrence Ranks and their Definitions

<b>A</b>	Excellent viability.
<b>B</b>	Good viability
<b>C</b>	Fair viability.
<b>D</b>	Poor viability.
<b>H</b>	Historic: known from historical record, but not verified for an extended period of time.
<b>X</b>	Extirpated (extinct within the state).
<b>E</b>	Extant: the occurrence does exist but not enough information is available to rank.
<b>F</b>	Failed to find: the occurrence could not be relocated.

### **Potential Conservation Areas**

In order to successfully protect populations or occurrences, it is helpful to delineate Potential Conservation Areas (PCAs). These PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Potential Conservation Areas may include a single occurrence of a rare element, or a suite of rare element occurrences or significant features.

The PCA is designed to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, and

hydrologic features; vegetative cover; and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the PCA and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater;
- land intended to buffer the PCA against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

The boundaries presented are meant to be used for conservation planning purposes and have no legal status. The proposed boundary does not automatically recommend exclusion of all activity. Rather, the boundaries designate ecologically significant areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA affect the natural heritage resources and sensitive species on which the PCA is based. Please note that these boundaries are based on our best estimate of the primary area supporting the long-term survival of targeted species and plant communities. A thorough analysis of the human context and potential stresses has not been conducted. However, CNHP's conservation planning staff is available to assist with these types of analyses where conservation priority and local interest warrant additional research.

### **Off-Site Considerations**

Frequently, all necessary ecological processes cannot be contained within a PCA of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every PCA to include the entire planet. The boundaries described in this report indicate the immediate, and therefore most important, area to be considered for protection. Continued landscape level conservation efforts that may extend far beyond PCA boundaries are necessary as well. This will involve regional efforts in addition to coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

### **Ranking of Potential Conservation Areas**

CNHP uses element and element occurrence ranks to assess the overall biological diversity significance of a PCA, which may include one or many element occurrences. Based on these ranks, each PCA is assigned a biological diversity rank (or B-rank). See Table A-3 for a summary of these B-ranks.

### **Protection Urgency Ranks**

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occur. In most cases, this rank refers to the need for a major

Table A-3. Natural Heritage Program Biological Diversity Ranks and their Definitions

<b>B1</b>	<p>Outstanding Significance (indispensable):  only known occurrence of an element  A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence)  concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)</p>
<b>B2</b>	<p>Very High Significance:  B- or C-ranked occurrence of a G1 element  A- or B-ranked occurrence of a G2 element  One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element.  Concentration of A- or B-ranked G3 elements (four or more)  Concentration of C-ranked G2 elements (four or more)</p>
<b>B3</b>	<p>High Significance:  C-ranked occurrence of a G2 element  A- or B-ranked occurrence of a G3 element  D-ranked occurrence of a G1 element (if best available occurrence)  Up to five of the best occurrences of a G4 or G5 community (at least A- or B-ranked) in an ecoregion (requires consultation with other experts)</p>
<b>B4</b>	<p>Moderate Significance:  Other A- or B-ranked occurrences of a G4 or G5 community  C-ranked occurrence of a G3 element  A- or B-ranked occurrence of a G4 or G5 S1 species (or at least C-ranked if it is the only state, provincial, national, or ecoregional occurrence)  Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more)  D-ranked occurrence of a G2 element  At least C-ranked occurrence of a disjunct G4 or G5 element  Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more)</p>
<b>B5</b>	<p>General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species.</p>

change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table A-4 summarizes the P-ranks and their definitions.

Table A-4. Natural Heritage Program Protection Urgency Ranks and their Definitions

<b>P1</b>	<p>Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.</p>
<b>P2</b>	<p>Protection actions may be needed within 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA within this approximate timeframe.</p>
<b>P3</b>	<p>Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA if protection action is not taken.</p>
<b>P4</b>	<p>No protection actions are needed in the foreseeable future.</p>
<b>P5</b>	<p>Land protection is complete and no protection actions are needed.</p>



A protection action involves increasing the current level of protection accorded one or more tracts within a potential conservation area. It may also include activities such as educational or public relations campaigns, or collaborative planning efforts with public or private entities, to minimize adverse impacts to element occurrences at a site. It does not include management actions. Situations that may require a protection action may include the following

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;
- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

**Management Urgency Ranks**

Management urgency ranks (M-ranks) indicate the timeframe in which it is recommended that a change occur in management of the PCA. This rank refers to the need for management in contrast to protection (for example, increased fire frequency, decreased grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, re-routing trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. Table A-5 summarizes M-ranks and their definitions.

Table A-5. Natural Heritage Program Management Urgency Ranks and their Definitions

<b>M1</b>	Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
<b>M2</b>	New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
<b>M3</b>	New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
<b>M4</b>	Current management seems to favor the persistence of the elements in the PCA, but management actions may be needed in the future to maintain the current quality of the element occurrences.
<b>M5</b>	No management needs are known or anticipated in the PCA.

*This page intentionally left blank*

## Appendix B. Plant Characterization Abstracts

Abstracts are alphabetical by state name (see Table 3), although global name is listed in the following Table of Contents.

<i>Neoparrya lithophila</i> (rock-loving neoparrya) .....	37
<i>Argyrosma fendleri</i> (Fendler cloak-fern) .....	40
<i>Eriogonum brandegeei</i> (Brandegee wild buckwheat) .....	43
<i>Lesquerella calcicola</i> (Rocky Mountain bladderpod) .....	46
<i>Mentzelia densa</i> (Arkansas Canyon stickleaf) .....	48
<i>Mentzelia speciosa</i> (jeweled blazingstar) .....	51
<i>Pellaea wrightiana</i> (Wright's cliff-brake).....	53
<i>Penstemon degeneri</i> (Degener beardtongue) .....	55
<i>Townsendia fendleri</i> (Fendler's townsend-daisy) .....	59

Excerpt from Table 3.

Global Scientific Name	State Scientific Name	Common Name	Global Rank	State Rank
<i>Argyrosma fendleri</i>	<i>Argyrosma fendleri</i>	Fendler's false cloak fern	G3	S3
<i>Eriogonum brandegeei</i>	<i>Eriogonum brandegeei</i>	Brandegee wild buckwheat	G1G2	S1S2
<i>Lesquerella calcicola</i>	<i>Lesquerella calcicola</i>	Rocky Mountain bladderpod	G2	S2
<i>Mentzelia densa</i>	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2
<i>Mentzelia speciosa</i>	<i>Nuttallia speciosa</i>	jeweled blazingstar	G3?	S3?
<i>Neoparrya lithophila</i>	<i>Aletes lithophilus</i>	rock-loving neoparrya	G3	S3
<i>Pellaea wrightiana</i>	<i>Pellaea wrightiana</i>	Wright's cliffbrake	G5	S2
<i>Penstemon degeneri</i>	<i>Penstemon degeneri</i>	Degener beardtongue	G2	S2
<i>Townsendia fendleri</i>	<i>Townsendia fendleri</i>	Fendler's Townsend daisy	G2	S1

**State Name: *Aletes lithophilus* (rock-loving neoparrya)**  
**Global Name: *Neoparrya lithophila* (Rock-loving Aletes)**

**Taxonomy**

Class: Dicotyledoneae

Order: Apiales

Family: Apiaceae

Taxonomic Comments: Weber and Wittmann (2001) treat as *Aletes lithophilus*.



**Ranks and Status**

Global Rank: G3

State Rank: S3

Federal Protection Status: BLM and USFS Sensitive Species

State Protection Status: None

**Description and Phenology**

Non-Technical Description: *Neoparrya lithophila* is an herbaceous perennial that produces new leaves and leafless inflorescences each year. The plants grow in clumps, are taprooted, and 8 to 29 cm tall. Large clumps of vegetation more than two feet in diameter can form, but it is sometimes unclear whether these clumps are a single individual or represent multiple individuals that have coalesced. *Neoparrya lithophila* has thick, glossy, leathery leaves that are once pinnate, with linear, remote pinnae that are 5 to 32 millimeters long and 1.5 to 4 millimeters broad (Anderson 2004).

Diagnostic Characteristics: *Neoparrya lithophila* is distinguished from *Aletes humilis* and *A. acaulis* in having linear lateral leaf lobes rather than broad and incised lobes with flaring tips. It also differs from these species, as well as *A. anisatus* and most other members of the Apiaceae, in having reflexed umbel rays, giving the inflorescence a ball-shaped appearance. Although it is quite aromatic, it lacks the strong anise odor of *A. anisatus* (Anderson 2004).

Look Alikes: May be mistaken at a distance for *Gutierrezia sarrothrae* or *Hymenoxys richardsonii*. Its bright green color is otherwise distinctive (pers. comm. Coles 1994).

Phenology: This species flowers from May through early July; fruiting late June to September (Spackman et al. 1997).

**Habitat**

Habitat Comments: *Neoparrya lithophila* grows on volcanic substrates, in cracks or shelves usually with minimal talus. It is seen in moderate to steep rock outcrops, or outcrops of volcanic soils. It also occurs on sedimentary rock derived from extrusive volcanics (Dry Union Formation at Salida). The surrounding habitat is typically

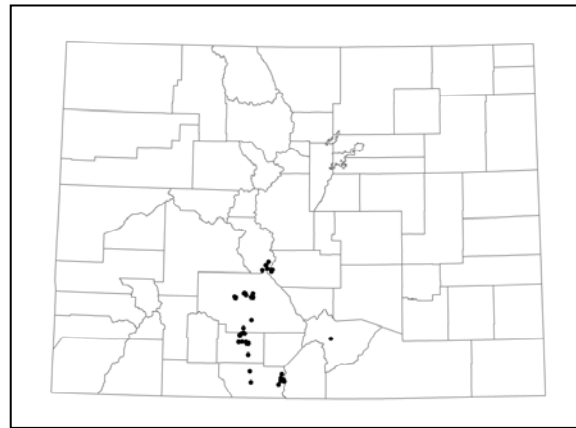
grasslands or pinon-juniper woodlands. Associated taxa often include: *Festuca*, *Artemisia*, *Muhlenbergia*, *Hymenoxys*, and *Ribes* (Neely 1986; O'Kane, 1986). Although *Neoparrya lithophila* is found on all aspects, reports in element occurrence records suggest that it favors north slopes (Anderson 2004). This species occurs east and (mostly) west of the Sangre de Cristo Mountain Range. The occurrences range from about 7,000 to just over 10,000 feet in elevation. Average rainfall is about 7 to 16 inches (180-410 mm) annually.

Elevation Range Feet: 7,200 - 10,200

Elevation Range Meters: 2,194 - 2,194

### Distribution

Global Range: Endemic to south central Colorado where it is restricted to six counties: Chaffee, Conejos, Fremont, Huerfano, Rio Grande, and Saguache. Estimated range is 11,160 square kilometers (4,309 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences. *Neoparrya lithophila* has been reported erroneously in New Mexico. It likely occurs in Costilla County, Colorado.



### Threats and Management Issues

Known Threats and Management Issues: Motorized recreation is considered to be the primary threat to the species at this time (CNHP Scorecard 2006). Recreational activities and livestock grazing are potential threats to the populations. Many of the sites are on land subject to moderate to heavy grazing, although the populations themselves are often inaccessible (i.e., steep rock outcrops). In some cases, this has resulted in a flourish of exotics (e.g., *Bromus tectorum*, *Plantago patagonica*), which may compete for *N. lithophila* habitat. At the Elephant Rocks site in Rio Grande County, recreational impacts such as fire rings, trash and trampling have combined with overgrazing to damage a large portion of the landscape. These activities do not seem to be an immediate threat to *N. lithophila*, but continued use of this kind could be detrimental (O'Kane, 1986). The Farisita Dike occurrence showed signs of deer occupation (numerous pellets), although no individuals exhibited signs of having been grazed (Carpenter & Carron pers. obs.). Most of the *N. lithophila* individuals at Farisita Dike are inaccessible to cows. O'Kane (1986) noted that its "palatability is probably low because of aromatic oils present in the herbage."

## References

- Anderson, D.G. (2004, November 8). *Neoparrya lithophila* Mathias (Bill's neoparrya): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/neoparryalithophila.pdf> [April 18, 2007].
- Coles, J. 1994. Personal communication about Rare Plant Guide Species.
- Colorado Native Plant Society. 1989. Rare Plants of Colorado. Published jointly by Rocky Mountain Nature Association and Colorado Native Plant Society, Estes Park, CO.
- Colorado Natural Heritage Program. 2006. Biological Conservation Datasystem. Colorado State University, Ft. Collins, CO.
- Neely, B.E. 1986. Farisita Dike Preserve Design. Unpublished Prepared for The Nature Conservancy.
- O'Kane, S.L. Jr. 1986. Floristic reconnaissance of the San Luis Valley. Unpublished report, Colorado Natural Areas Program, Denver, Colorado. 18pp + appendices.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.
- Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

**Version Date:** 03/02/2007

**State Name:** *Argyrochosma fendleri* (Fendler cloak-fern)

**Global Name:** *Argyrochosma fendleri* (Fendler Cloak-fern)

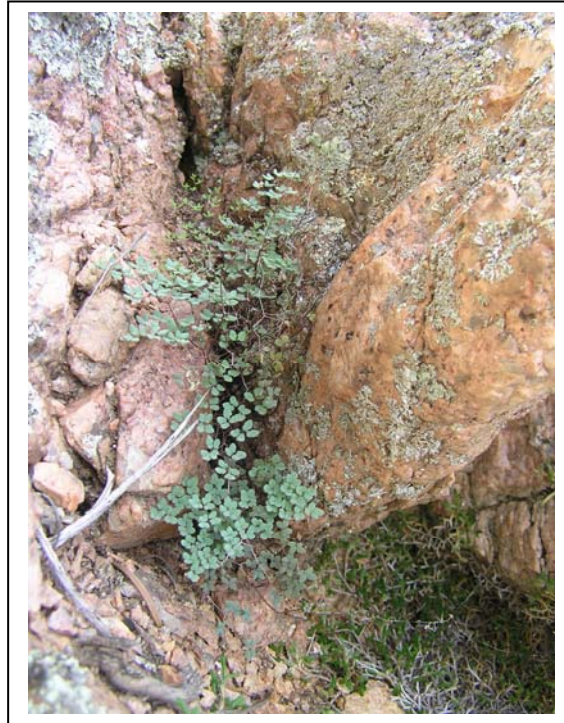
**Taxonomy**

Class: Filicopsida

Order: Filicales

Family: Pteridaceae

Taxonomic Comments: Weber and Wittmann (2001) include this species in the Sinopteridaceae, the Lipfern family. Lellinger (1985) lists as *Notholaena fendleri*.



**Ranks and Status**

Global Rank: G3

State Rank: S3

Federal Protection Status: None

State Protection Status: None

**Description and Phenology**

Non-Technical Description: A very delicate looking fern. Stipes (petioles) are 3-16 cm long. Rachis branches are widely spreading and zigzag. Leaves are 4-6 pinnate, and have very small pinnules with a white waxy covering on the underside. Plants are rhizomatous (Weber and Wittmann 2001, Lellinger 1985, Harrington 1954 ).

Diagnostic Characteristics: The fronds are widely branched, with very small ternate pinnules, which are white waxy beneath.

Look Alikes: This species is not likely to be confused with other fern species in Colorado.

Phenology: The Colorado collections housed at the University of Colorado Herbarium were made between May 22 and September 28.

**Habitat**

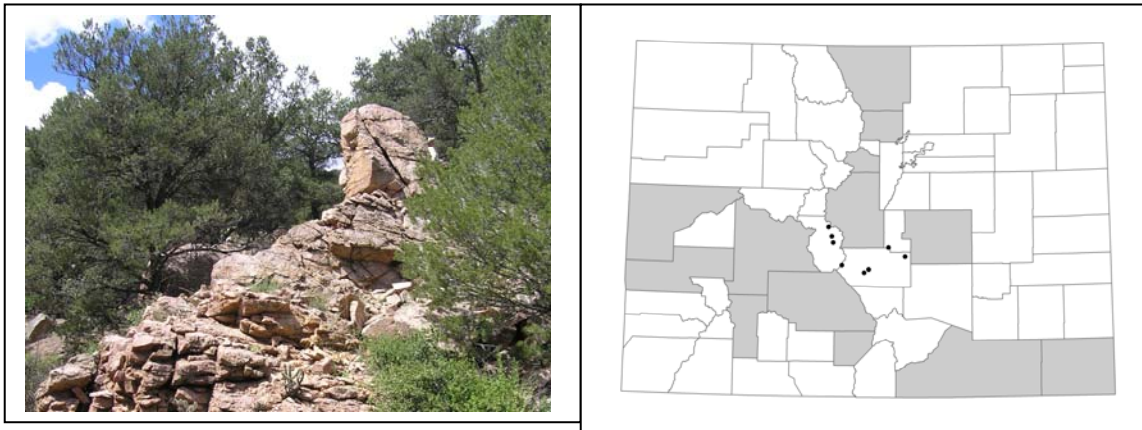
Habitat Comments: Weber and Wittmann (2001) report that in Colorado this species is found on talus and cliff crevices of arid canyonsides. Colorado Natural Heritage Program occurrence records (2007) show that the species is often found on volcanic substrates within Ponderosa Pine or Pinyon-Juniper woodlands or various types of shrublands including Gambel's Oak. Other commonly associated species include *Bouteloua gracilis* and *Selaginella mutica*. The species is found on slopes with variable aspects in Colorado, with an elevation range from just under 5000 feet in Baca County to about 9400 in Hinsdale County (University of Colorado Herbarium 2007).

Elevation Range Feet: 5,000 - 9,400  
Elevation Range Meters: 1,524 - 1,524

### **Distribution**

**Global Range:** This species is found in Colorado, New Mexico, and Wyoming (Kartesz and the Biota of North America Program 1998, USDA NRCS 2007), and Sonora, Mexico (Flora of North America Editorial Committee 1993). Peripheral in Laramie County, in southeastern Wyoming (pers. comm. Walt Fertig WYNDD 1999 to Kim Fayette CNHP). This species is ranked S3 in Colorado, SNR in New Mexico, and S1 in Wyoming (NaureServe 2006). It is known from 16 counties in Colorado, 5 counties in New Mexico, and 1 county in Wyoming (USDA NRCS 2007).

**Colorado State Range:** The University of Colorado Herbarium database (2007) shows that this species is known from 16 counties in Colorado: Alamosa, Baca, Boulder, Chaffee, Clear Creek, El Paso, Fremont, Gunnison, Hinsdale, Larimer, Las Animas, Mesa, Montrose, Park, Saguache, and Teller.



### **Threats and Management Issues**

**Known Threats and Management Issues:** Anthropogenic threats appear to be minimal. One occurrence may be threatened by foot traffic. Most occurrences are in remote, rocky sites in areas that are used for recreation and/or cattle grazing.

### **References**

- Flora of North America Editorial Committee. 1993. Flora of North America north of Mexico. Vol. 2. Pteridophytes and gymnosperms. Oxford Univ. Press, New York. xvi + 475 pp.
- Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.
- Kartesz, John and the Biota of North America Program. 1998. "A Synonymized Checklist of the Vascular Flora of the United States, Puerto Rico, and the Virgin Islands". <http://plants.usda.gov>. (May 15 1999).
- Lellinger, D. B. 1985. A Field Manual of the Ferns and Fern-allies of the United States and Canada. Smithsonian Institution Press, Washington D.C.
- USDA, NRCS. 2007. The PLANTS Database (, 16 February 2007). National Plant



Data Center, Baton Rouge, LA 70874-4490 USA.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

Weber, W.A. and R.C. Wittmann. 2001. Colorado Flora: Western Slope, Third Edition. University Press of Colorado, Niwot, CO.

**Version Date:** 02/23/2007

**State Name:** *Eriogonum brandegeei* (Brandegee wild buckwheat)

**Global Name:** *Eriogonum brandegeei* (Brandegee's Wild Buckwheat)

**Taxonomy**

Class: Dicotyledoneae

Order: Polygonales

Family: Polygonaceae

Taxonomic Comments: Often spelled 'brandegei' but the spelling 'brandegeei' was used by Kartesz in 1998 to conform to International Code of Botanical Nomenclature.



**Ranks and Status**

Global Rank: G1G2

State Rank: S1S2

Federal Protection Status: BLM and USFS Sensitive Species

State Protection Status: None

**Description and Phenology**

Non-Technical Description: *Eriogonum brandegeei* is a mat-forming perennial herb. It is typically 10 to 25 cm tall, and mats have been observed from 1 inch in diameter to more than 2 ft. in diameter. *Eriogonum brandegeei* has a deep, woody taproot that, along with its spreading habit, leaves it well adapted to surviving on steep, unstable slopes. Plants have been observed on "pedestals," with much of their woody root exposed. Its leaves are erect and densely hairy on both sides. The dense hair gives the plant a blue-green appearance. *Eriogonum brandegeei* produces leafless, unbranched flowering stalks that bear terminal clusters of white to pink or rose-colored flowers that are 3 to 3.5 mm long. The stamens are slightly exserted from the flower (Anderson 2006).

Diagnostic Characteristics: *Eriogonum brandegeei* is distinguished from other local *Eriogonum* species by its leaves, which are densely tomentose on both sides, and by its unbranched flowering stalk (Spackman et al. 1997).

Look Alikes: *Eriogonum brandegeei* is distinguished from other local *Eriogonum* species by its leaves, which are densely tomentose on both sides, and by its unbranched flowering stalk (Spackman et al. 1997).

Phenology: Flowering may occur any time from late June through August, and fruits mature in August or September (Anderson 2006).

**Habitat**

Habitat Comments: Occurrences of *Eriogonum brandegeei* are limited mostly to outcrops of the Dry Union Formation (in Chaffee County) and lower members of the Morrison Formation (in Fremont County), or to Quaternary strata that are derived from these formations (O'Kane 1988, Spackman et al. 1997, Anderson 2006). The unifying feature

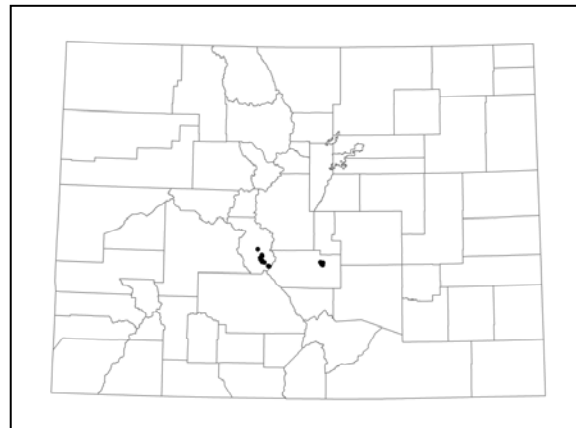
of all the known occurrences is the presence of a significant fraction of bentonite clay in the soil (Anderson 2006). Bentonite is derived from the decomposition of volcanic ash, and is a type of shrink-swell, or 2:1 clay. *Eriogonum brandegeei* is most commonly found on active slopes that can be as steep as 90 percent. It has been also been documented on flat sites, particularly where erosion has deposited clay soil in small basins (Anderson 2006). In general, this species is found on barren outcrops of white to grayish soils within open sagebrush and pinyon-juniper communities. Frequently associated species include: *Atriplex canescens*, *Opuntia imbricata*, *Bouteloua gracilis*, *Oryzopsis hymenoides*, *Aristida fendleriana*, *Sphaeralcea coccinea*, *Cleome serrulata*, *Melilotus alba*, *Salsola iberica*, *Kochia iranica*, *Melilotus officialis*, and *Bouteloua curtipendula* (Johnston et al. 1981).

Elevation Range Feet: 5,800 - 7,840

Elevation Range Meters: 1,767 - 1,767

### Distribution

Global Range: Endemic to Colorado; Fremont and Chaffee counties. Six of the nine verified occurrences are located within a 5 by 15 mile area along the Arkansas River in Chaffee County. The other three are about 50 miles away in a 2 by 3 mile area at Garden Park, north of Canon City in Fremont County (Anderson 2006). Questionable reports of *E. brandegeei* in other areas are considered to be mislabeled (Anderson 2006). Estimated range is 6,828 square kilometers (2,636 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



### Threats and Management Issues

Known Threats and Management Issues: The primary threat at this time is considered to be off road vehicle use (Anderson 2006, CNHP Scorecard 2006). The species is also threatened by other recreational uses, residential and commercial development (especially near Salida), timber thinning and extraction, mining, right-of-way management, exotic species invasion, grazing, effects of small population size, rust, fire, global climate change, and pollution (Anderson 2006). Some threats are more urgent at some sites than at others; however, all sites are threatened by recreational impacts, particularly off road vehicle use. Residential development has encroached on one of the best occurrences. All of the known occurrences are now threatened by human activities (Anderson 2006). According to the CSU Extension Service, a rust species found on some plants in the Cleora site is not a threat as it rarely causes damage to plants (Grant and DePrenger-Levin 2005, Colorado Natural Heritage Program 2005).

## References

- Anderson, D.G. 2006. *Eriogonum brandegeei* Rydberg (Brandegees buckwheat): A Technical Conservation Assessment. [Online]. USDA Forest Service, Rocky Mountain Region.  
<http://www.fs.fed.us/r2/projects/scp/assessments/eriogonumbrandegeei.pdf>
- Colorado Native Plant Society. 1989. Rare Plants of Colorado. Published jointly by Rocky Mountain Nature Association and Colorado Native Plant Society, Estes Park, CO.
- Colorado Natural Heritage Program. 2005. The Second Annual Colorado Rare Plant Symposium: G1 Plants of Colorado. Symposium Minutes.
- Colorado Natural Heritage Program. 2006. Biological Conservation Datasystem. Colorado State University, Ft. Collins, CO.
- Grant, T. and M. DePrenger-Levin. 2005. *Eriogonum brandegeei* Demographic Monitoring Study 2004-2005. Prepared for U.S. Department of Interior Bureau of Land Management, Colorado State Office by the Denver Botanic Gardens' Research, Herbaria and Records Department.
- Johnston, B. C., J. S. Peterson and W. Harmon. 1981. Status Report for *Eriogonum brandegeei*. Unpublished report prepared for Colorado Natural Areas Program, Denver, CO.
- Kartesz, John and the Biota of North America Program. 1998. "A Synonymized Checklist of the Vascular Flora of the United States, Puerto Rico, and the Virgin Islands". <http://plants.usda.gov>. (May 15 1999).
- O'Kane, S. L. 1988. Colorado's Rare Flora. *Great Basin Naturalist*. 48(4):434-484.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

**Version Date:** 02/26/2007

**State Name:** *Lesquerella calcicola* (Rocky Mountain bladderpod)  
**Global Name:** *Lesquerella calcicola* (Rocky Mountain Bladderpod)

**Taxonomy**

Class: Dicotyledoneae  
Order: Capparales  
Family: Brassicaceae



**Ranks and Status**

Global Rank: G2  
State Rank: S2  
Federal Protection Status: None  
State Protection Status: None

**Description and Phenology**

**Non-Technical Description:** This perennial is silvery-stellate throughout. The caudex is simple or closely branched. Stems are 10-30 cm long with radial basal leaves. Leaves are oblanceolate to linear. The racemes do not elongate in fruit, the fruit are crowded at the top. Fruit is 5-9 mm long. Pedicel forms a sigmoid shape. Flowers are yellow (Harrington 1954, Weber and Wittmann 2001).

**Diagnostic Characteristics:** Most easily identified with fruit and flowers present. Flowers are yellow. The fruit are pubescent and on a sigmoid pedicel.

**Look Alikes:** *Lesquerella fendleri* co-occurs and is vegetatively indistinguishable from *L. calcicola*. *Lesquerella calcicola* has pubescent fruit while *L. fendleri* fruit are glabrous (Weber and Wittmann 2001).

**Phenology:** Colorado Natural Heritage Program occurrence records suggest that this species flowers in May and June, and produces fruit in June-September, or even later in the calendar year.

**Habitat**

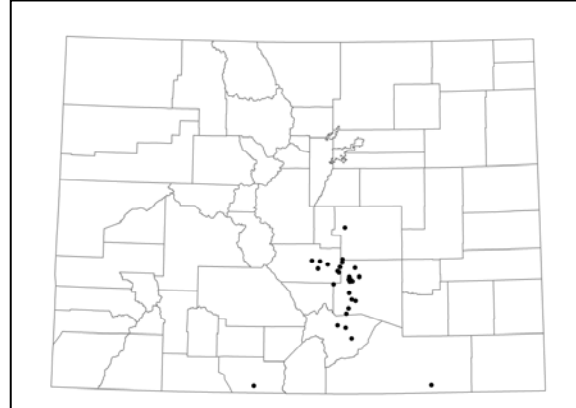
**Habitat Comments:** Shale barrens within grassland and pinyon-juniper mosaic. Other commonly associated species include *Cercocarpus montanus*, *Frankenia jamesii*, *Gutierrezia sarothrae*, *Oryzopsis hymenoides*, *Hilaria jamesii*, *Melampodium leucanthum*, *Oonopsis foliosa* ssp. *foliosa*, *Tetrandeum acaulis*, *Eriogonum* spp., as well as other globally rare shale barren species such as *Mirabilis rotundifolius* and *Oonopsis puebloensis*.

Elevation Range Feet: 4,800 - 6,700  
Elevation Range Meters: 1,463 - 1,463

## Distribution

Global Range: Colorado (Arkansas River Valley) and northern New Mexico.

Colorado State Range: Known from Conejos, El Paso, Fremont, Huerfano, Las Animas, and Pueblo counties in Colorado. Estimated range in Colorado is 22,758 square kilometers (8787 square miles), calculated in GIS by drawing a minimum convex polygon around the 20 occurrences in the CNHP database in 2006. Also known from New Mexico.



## Threats and Management Issues

Known Threats and Management Issues: The primary threat at this time is considered to be housing/urban development (CNHP Scorecard 2006). The species may also be threatened by military maneuvers (on military lands), recreational uses, and noxious weed invasions. This species occurs in areas that are experiencing rapid development pressures.

## References

- Bleakly, D.L. 1998. New Mexico Rare Plants: *Lesquerella calcicola* Rollins. New Mexico Rare Plant Technical Council, Albuquerque, New Mexico. Online. Available: <http://nmrareplants.unm.edu> (Accessed 2005).
- Colorado Natural Heritage Program. 2006. Biological Conservation Datasystem. Colorado State University, Ft. Collins, CO.
- Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.
- Martin, W.C., and C.R. Hutchins. 1980-1981. A flora of New Mexico. 1980, Vol. 1; 1981, Vol. 2. J. Cramer, in der A.R. Gantner Verlag, K.G., Vaduz, Liechtenstein. 2591 pp.
- Rollins, R.C., and E.A. Shaw. 1973. The genus *Lesquerella* (Cruciferae) in North America. Harvard Univ. Press. Cambridge, MA. 288 pp.
- Sivinski, R., and K. Lightfoot, eds. 1994. Inventory of the rare and endangered plants of New Mexico. 2nd edition. Miscellaneous Publication No. 3, New Mexico Forestry and Resources Conservation Division, New Mexico Energy, Minerals and Natural Resources Dept., Santa Fe. 46 pp.
- Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

**Version Date:** 03/21/2007

**State Name:** *Nuttallia densa* (Arkansas Canyon stickleaf)

**Global Name:** *Mentzelia densa* (Royal Gorge Stickleaf)

**Taxonomy**

Class: Dicotyledoneae

Order: Violales

Family: Loasaceae

Taxonomic Comments: Weber and Wittmann (2001) lumped *M. densa* within *Nuttallia speciosa*. However, the University of Colorado Herbarium does have 15 specimens identified as *Nuttallia densa* (= *Mentzelia densa*); all are from Fremont County.



**Ranks and Status**

Global Rank: G2

State Rank: S2

Federal Protection Status: BLM Sensitive Species

State Protection Status: None

**Description and Phenology**

Non-Technical Description: *Mentzelia densa* is a small perennial subshrub, usually less than 3 dm. tall. The stems branch from the base, giving the plant a hemispherical shape. The branches are white, curve upward and are covered with stiff hairs. The narrow leaves are also covered with stiff hairs. Bright yellow flowers occur singly or in threes at the ends of the branches, and open in the late afternoon. Flowers are about 2 cm. wide. The petals are narrow, widest at the middle, and pointed at the end. The fruit is oblong, 1.3 to 2 cm. long, 1 cm. in diameter and bears teeth that are about half as long as the fruit. Seeds are flattened and are surrounded by a thin, winglike membrane (Coles 1990).

Diagnostic Characteristics: Distinguished from other *Mentzelia* species by its tumbleweed growth form and the presence of the previous years dried stems (Spackman et al. 1997). The species is also recognized by its bright yellow flowers opening in the late afternoon, and the sticky hairs which cover that plants and cling to hair and clothing (Coles 1990).

Look Alikes: *Mentzelia speciosa* has a stouter stem. The stem is branched, but the plants do not have the tumbleweed growth form seen in *M. densa*. *Mentzelia speciosa* leaves are typically wider than those of *M. densa*.

Phenology: Flowering occurs in July through early August; fruit are produced in September (Spackman et al. 1997). The flowers are only open from late afternoon (around 6 p.m.) until dark.

## Habitat

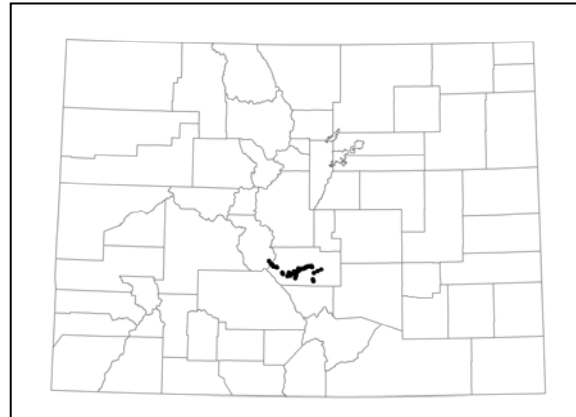
Habitat Comments: *Mentzelia densa* occupies dry open areas in washes, roadsides, naturally disturbed sites, and steep rocky slopes. Plants grow in gravel, scree, or on cliffs formed from Precambrian granodiorite and gneiss. The species occurs in pinyon-juniper woodland and lower montane shrubland communities with a poorly developed understory and an open canopy. It may dominate in very open, disturbed sites such as sandy washes. It occurs as scattered individuals generally occupying 5% or less of the total vegetative canopy. The associated species are *Pinus edulis*, *Juniperus monosperma*, *Juniperus scopulorum*, *Symphoricarpos oreophilus*, *Cercocarpus montanus*, *Artemisia tridentata*, *Eriogonum jamesii*, *Oryzopsis humenoides*, *Oryzopsis micrantha*, *Mentzelia multiflora* var. *leucopetala*, *Bouteloua gracilis*, *Rhus trilobata*, *Heterotheca villosa*, *Cylindropuntia inbricata*, and *Opuntia phaeacantha* (Coles 1990).

Elevation Range Feet: 5,800 - 7,500

Elevation Range Meters: 1,767 - 1,767

## Distribution

Global Range: Endemic to Colorado; known from Fremont County, and adjacent Chaffee County. Estimated range is 2,545 square kilometers (982 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



## Threats and Management Issues

Known Threats and Management Issues: Recreational use is considered to be the primary threat to the species at this time (CNHP Scorecard 2006). Plants are restricted to the Arkansas River Valley and threats in the area are high (general area is being developed at a rapid rate, recreational development including ORV use, and highway construction and maintenance). Recreational use of the area is expected to increase. Plants are restricted to specific habitats within a small area.

## References

Coles, J. 1990. Status report for *Mentzelia densa*. Unpublished report prepared for the Colorado Natural Areas Program, Denver, CO.

Colorado Native Plant Society. 1989. Rare plants of Colorado. Rocky Mountain Nature Association, Colorado Native Plant Society, Estes Park, Colorado. 73 pp.

Colorado Natural Heritage Program. 2006. Biological Conservation Datasystem.



Colorado State University, Ft. Collins, CO.

O'Kane, S. L. 1988. Colorado's Rare Flora. *Great Basin Naturalist*. 48(4):434-484.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. *Colorado Rare Plant Field Guide*. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

Weber, W. and R. Wittmann. 2001. *Colorado Flora: Eastern Slope*. Third edition.

**Version Date:** 02/28/2007

**State Name:** *Nuttallia speciosa* (jeweled blazingstar)

**Global Name:** *Mentzelia speciosa* (Jeweled Blazingstar)

**Taxonomy**

Class: Dicotyledoneae

Order: Violales

Family: Loasaceae



**Ranks and Status**

Global Rank: G3?

State Rank: S3?

Federal Protection Status: None

State Protection Status: None

**Description and Phenology**

Non-Technical Description: Herbaceous perennial or biennial with bright yellow flowers. Stems are white, slender to stout, and branched. The leaves, especially the upper, are very narrow, linear, and coarsely dentate with acutely pointed teeth (Weber and Wittmann 2001). The leaves are light green and are covered with hairs that adhere to clothing or fur like velcro.

Look Alikes: *Mentzelia densa* is considered by Weber and Wittmann (2001) to be synonymous with *M. speciosa* (= *Nuttallia speciosa*). In comparison, *M. speciosa* has a stouter stem than *M. densa*. The stem is branched, but the plants do not have the tumbleweed growth form seen in *M. densa*. *Mentzelia speciosa* leaves are also typically wider than those of *M. densa*. *Mentzelia speciosa* could also be confused with *M. nuda*. *Mentzelia nuda* plants are taller and even more stout, and have white to light yellow flowers. *Mentzelia speciosa* flowers are bright yellow.

Phenology: Occurrence records (Colorado Natural Heritage Program 2007) indicate that plants may produce flowers from May through early September, and that fruit production occurs in August and September.

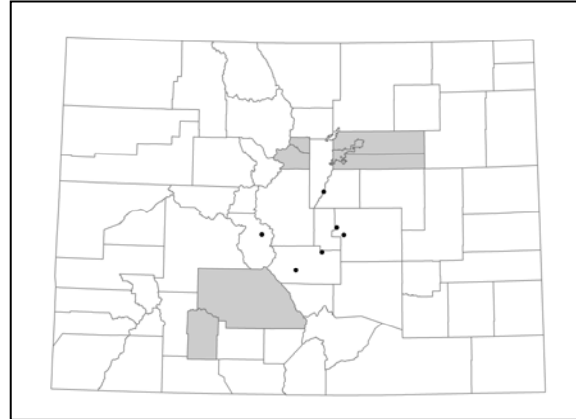
**Habitat**

Habitat Comments: The habitat for this species has not been clearly defined. Many of the occurrences are found in sandy soils derived from granitic parent materials within pinyon-juniper woodlands. Plants have also been documented in gravel and ash soils, and in association with Ponderosa pine, Douglas fir, and Gambel's oak (Colorado Natural Heritage Program occurrence records, University of Colorado Herbarium 2007).

Elevation Range Feet: 6,280 - 9,000  
Elevation Range Meters: 1,914 - 1,914

### Distribution

Global Range: Known from Colorado and Wyoming (USDA NRCS 2007). Colorado counties: Arapaho, Chaffee, Clear Creek, Denver, Douglas, El Paso, Fremont, Gilpin, Jefferson, Mineral, Saguache, Teller (CU Herbarium 3/07, USDA NRCS 2007). Known from one location in Wyoming (Atlas of the Flora of Wyoming 1996).



### Threats and Management Issues

Known Threats and Management Issues: Unknown. One occurrence record reports that the plants are growing along a roadside with *Salsola australis* (Russian thistle) in an area that is predominantly used for recreation.

### References

Atlas of the Flora of Wyoming. 1996. Rocky Mountain Herbarium, University of Wyoming. Accessed on-line at <http://www.sbs.utexas.edu/tchumley/wyomap/LOA/menspe.pdf>

Kartesz, J.T. 1996. Species distribution data at state and province level for vascular plant taxa of the United States, Canada, and Greenland (accepted records), from unpublished data files at the North Carolina Botanical Garden, December, 1996.

USDA, NRCS. 2007. The PLANTS Database (, 16 February 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

**Version Date:** 03/19/2007

**State Name:** *Pellaea wrightiana* (Wright's cliff-brake)

**Global Name:** *Pellaea wrightiana* (Wright's Cliffbrake)

**Taxonomy**

Class: Filicopsida

Order: Filicales

Family: Pteridaceae

Taxonomic Comments: Weber and Wittmann (2001) place this genus and species in the Sinopteridaceae (the Lipfern family).



**Ranks and Status**

Global Rank: G5

State Rank: S2

Federal Protection Status: None

State Protection Status: None

**Description and Phenology**

Non-Technical Description: Fronds are green and glabrous. The scales on the stems are bicolored with a dark central region and lighter brown margins. Fronds are 2-3 pinnate. The pinnae are sessile to short-stalked with up to four pairs of pinnules. The ultimate segments are narrowly oblong with white-bordered, recurved margins (Spackman et al. 1997, Weber and Wittmann 2001).

Diagnostic Characteristics:

Look Alikes: Similar in appearance to *P. atropurpurea* and *P. truncata*. In general, *P. atropurpurea* differs by having pinnae that are long-stalked, the basal ones stalked 5-15 mm. Fronds of *P. truncata* are lanceolate, usually widest near the base, and with more than four pairs of pinnules (Spackman et al. 1997).

Phenology: Specimens at the University of Colorado Herbarium (website checked in April 2007) were made between March 7 and September 11. Colorado Natural Heritage Program records (as of April 2007) also fall within those dates.

**Habitat**

Habitat Comments: Exposed or partially shaded cliffs of various rock types (Spackman et al. 1997).

Elevation Range Feet: 4,800 - 6,480

Elevation Range Meters: 1,463 - 1,975

**Distribution**

Global Range: This species is known from Arizona (S3S4), Colorado (S2), North Carolina (S1), New Mexico (not ranked), Oklahoma (not ranked), South Carolina (not

ranked), Texas (not ranked), and Utah (S1, NatureServe 2006).

Colorado State Range: Known from Baca, Boulder, Fremont, and Las Animas Counties (Colorado Natural Heritage Program database 2007, University of Colorado Herbarium database 2007).



### Threats and Management Issues

Known Threats and Management Issues: One occurrence record reports that erosion from overgrazing may be a potential threat. Very small population size and small area of occupied habitat may also make this species particularly vulnerable in Colorado.

### References

- Great Plains Flora Association. 1986. *Flora of the Great Plains*. University Press of Kansas, Lawrence, KS.
- Harrington, H. D. 1954. *Manual of the Plants of Colorado*. Sage Books, Denver, CO.
- Lellinger, D. B. 1985. *A Field Manual of the Ferns and Fern-allies of the United States and Canada*. Smithsonian Institution Press, Washington D.C.
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: February 16, 2007).
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. *Colorado Rare Plant Field Guide*. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.
- Weber, W. and R. Wittmann. 2001. *Colorado Flora: Eastern Slope*. Third edition.

**Version Date:** 03/05/2007

**State Name:** *Penstemon degeneri* (Degener beardtongue)

**Global Name:** *Penstemon degeneri* (Degener's Beardtongue)

**Taxonomy**

Class: Dicotyledoneae

Order: Scrophulariales

Family: Scrophulariaceae



**Ranks and Status**

Global Rank: G2

State Rank: S2

Federal Protection Status: BLM and USFS Sensitive Species

State Protection Status: None

**Description and Phenology**

Non-Technical Description: From Beatty et al. 2004: *Penstemon degeneri* is a perennial herb from 25 to 40 centimeters (cm) tall with five or more, slender (1.0 to 2.5 millimeters [mm] diameter at base), leafy, short-pubescent stems and a suffrutescent caudex. The basal leaves are lanceolate, entire, and up to 6 cm long and 16 mm wide (Spackman et al. 1997). The cauline leaves are more linear, more pubescent, and more sessile. The unleafy, sparingly glandular inflorescence is 3 to 10 cm high, with 2 to 10 tubular flowers at the ends of the stems. The dark blue to violet corolla of the flower is gradually inflated, 14 to 19 mm long and 4 to 5 mm wide at the mouth. The corollas are slightly two-ridged on the floor and have straight, reddish guidelines and sparse yellow hairs in the corolla throat. The staminode is also bearded with sparse golden hairs for about half its length. The anther sacs are 2.0 mm across the connective and are longer than wide. The papery calyx is persistent and the dehisced capsules are 7 to 9 mm long, with small, dark brown, irregularly angled seeds.

Diagnostic Characteristics: From Beatty et al. 2004: The characteristics used to distinguish *Penstemon degeneri* from other penstemons include leaf morphology, the size of the anther sacs, the color and density of hairs in the corolla throat, growth form, and geography. *Penstemon degeneri* can be easily confused with other *Penstemon* species that may overlap in distribution (i.e., *P. gracilis*, *P. virens*). *Penstemon gracilis*, of Colorado's eastern slope, has finely toothed leaves, a pale blue corolla, and whitish corolla hairs. *Penstemon virens* has a corolla 10 to 25 mm long and totally glabrous stems; it tends to grow in patches or mats with numerous stems, whereas *P. degeneri* tends to grow more singly and has minutely pubescent stems (Weber and Wittmann 2001). *Penstemon degeneri* generally lacks a basal rosette when in flower, but there can be conspicuous basal or low cauline leaves that make this characteristic confusing. *Penstemon radicosus* is found in north-central Colorado. The strongly two-ridged corolla floor and

staminode of *P. inflatus* (New Mexico) have such dense yellow hairs that the corolla throat is sometimes closed. *Penstemon griffinii* is found to the west of Fremont County, from Park County to Mineral and Conejos counties. Contrary to *P. degeneri*, *P. griffinii* retains a basal rosette throughout its flowering period, has smaller stem leaves (2 to 3 cm long and 2 cm wide), a slightly larger corolla, and dense golden hairs in its throat (Spackman et al. 1997, Weber and Wittmann 2001). Several observers noted other individual variations in *P. degeneri*, including smaller stature, few-flowered, whitish hairs in the flower throat, and lavender or magenta flowers (Colorado Natural Heritage Program element occurrence records 2003). Whenever possible, it is best to obtain a specimen of *P. degeneri* for identification verification (Spackman personal communication 2003). Technical descriptions of this species are presented in Crosswhite (1965a) and Peterson and Harmon (1981). Keys to *Penstemon* in Colorado are available in Weber and Wittmann (2001) and Jennings (1998). Photos and illustrations are available in Spackman et al. (1997).

Look Alikes: *Penstemon degeneri* is similar to *P. radicosus* in appearance, though *P. radicosus* is limited to Jackson County in northcentral, Colorado, and *P. degeneri* is found in southcentral Colorado. *Penstemon griffinii* is the only relative in the alliance in Colorado. It is characterized by having a deeply 2-ridged corolla and a dense covering of long, golden hairs on the floor and opening of the corolla and staminode. *Penstemon degeneri* has a less strongly ridged corolla and an opening with a few hairs and a glabrous floor. The staminode has an orange beard (Peterson and Harmon 1981). *Penstemon griffinii* has a basal rosette through the flowering period, and smaller, linear stem leaves (2-3 cm long, 2 mm wide), while *Penstemon degeneri* lacks a basal rosette at flowering time, and has longer and wider stem leaves (up to 6 cm long and 16 mm wide, Spackman et al. 1997). *Penstemon griffinii* has dense golden hairs in its corolla throat, while *P. degeneri* has sparser white to light yellow hairs. (Caution: both species have dense golden yellow hairs on the staminode which may be confused with hairs on the corolla itself).

Phenology: Flowering occurs June through mid July, and fruits set late July (Spackman et al. 1997).

### **Habitat**

Habitat Comments: This species is found in open pinyon-juniper woodlands and montane grasslands, in rocky soils with igneous bedrock. The plants grow mainly near the rim of canyons, and also in cracks of large rock slabs, in full sun or shade.

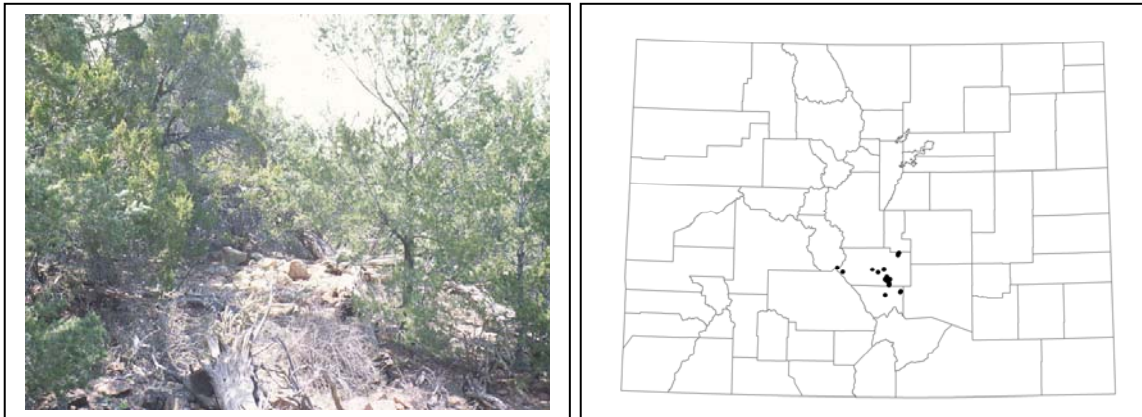
Associated species include *Arabis divaricarpa*, *Quercus gambelii*, *Bromus japonicus*, *Sitanion longifolium*, *Verbena bacteata*, *Lesquerella montana*, *Grindelia squarrosa*, *Heterotheca horrida*, *Artemisia frigida*, *Carex stenophylla*, *Eriogonum jamesii*, *Opuntia phaeacantha*, *Atriplex canescens*, *Pinus edulis*, and *Juniperus monosperma* (Peterson and Harmon, 1981).

Elevation Range Feet: 6,000 - 9,500

Elevation Range Meters: 1,828 - 1,828

### **Distribution**

Global Range: This species is currently only known from Fremont, Custer, and Chaffee counties, Colorado. Estimated range is 2,445 square kilometers (944 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



### Threats and Management Issues

Known Threats and Management Issues: Motorized recreation is considered to be the primary threat to the species at this time (CNHP Scorecard 2006). *Penstemon degeneri* is vulnerable because of its restricted geographic range, the small number of documented occurrences, and its vulnerability to human-related and environmental threats. Disturbances and land management activities may maintain suitable habitat for this species or negatively impact existing populations, depending on the disturbance intensity, frequency, and type. Threats to the long-term persistence of *P. degeneri* populations or habitats likely differ for each of the occurrences. The most significant threats to the occurrences on National Forest System lands include motorized and non-motorized recreation, non-native plant invasion, grazing and trampling, extensive herbivory, succession, and global environmental changes. Populations near roads, trails, or campgrounds are at higher risk for the detrimental effects of road or trail associated activities and non-native plant invasion (Beatty et al. 2004).

### References

- Beatty, B.L., W.F. Jennings, and R.C. Rawlinson (2004, February 23). *Penstemon degeneri* Crosswhite (Degeners beardtongue): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/penstemondegeneri.pdf> [March 2006].
- Colorado Native Plant Society. 1989. *Rare Plants of Colorado*. Published jointly by Rocky Mountain Nature Association and Colorado Native Plant Society, Estes Park, CO.
- Colorado Natural Heritage Program. 2006. *Biological Conservation Datasystem*. Colorado State University, Ft. Collins, CO.
- Crosswhite, F.S. 1965. Revision of *Penstemon* section *Penstemon* (Scrophulariaceae) II. A western alliance in series *Graciles*. *American Midland Naturalist* 74:429.
- Peterson, J.S. and W. Harmon. 1981 g. Status report on *Penstemon degeneri*. Unpublished report prepared for the Colorado Natural Areas Program, Denver, CO.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C.



Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

**Version Date:** 03/05/2007

**State Name:** *Townsendia fendleri* (Fendler's townsend-daisy)

**Global Name:** *Townsendia fendleri* (Fendler's Townsend-daisy)

**Taxonomy**

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae



**Ranks and Status**

Global Rank: G2

State Rank: S1

Federal Protection Status: None

State Protection Status: None

**Description and Phenology**

Non-Technical Description: A perennial species in the Asteraceae (Sunflower family) with decumbent, spreading, and much-branched stems. The ray flowers are white, disk flowers are yellow, and the phyllaries have acute tips (Weber and Wittmann 2001).

Diagnostic Characteristics: The decumbent stems distinguish this species from others in the genus *Townsendia*.

Phenology: Sparse information suggests that this species produces flowers and fruit in August-September.

**Habitat**

Habitat Comments: Sparsely vegetated shale barrens. Plants are generally found on flat mesa tops of the barrens. Dominant plant community: *Juniperus monosperma* with *Pinus edulis* and *Cercocarpus montanus* on tops of mesas; or shrubland dominated by *Atriplex canescens*, *Cercocarpus montanus*, and *Frankenia jamesii* at lower elevations.

Additional associated plant species: *Gutierrezia sarothrae*, *Oryzopsis hymenoides*, *Aristida purpurea*, *Hilaria jamesii*, *Bouteloua curtipendula*, *Erioneuron pilosum*, *Stipa neomexicana*, *Zinnia grandiflora*, *Eriogonum* sp., *Melampodium leucanthum*, *Chamaesyce glyptosperma*, *Mirabilis multiflora*. Two occurrences are found in association with occurrences of another globally rare plant, *Eriogonum brandegeei*.

Elevation Range Feet: 5,300 - 7,800

Elevation Range Meters: 1,615 - 1,615

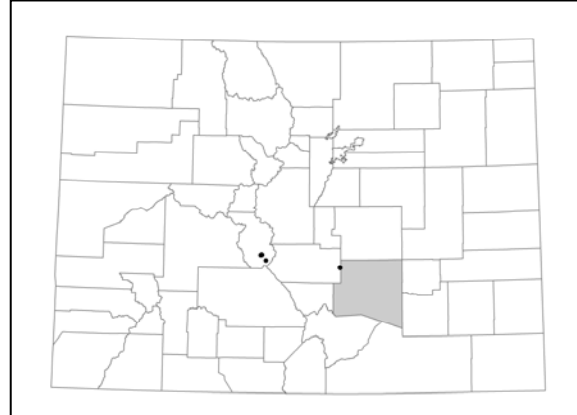
**Distribution**

Global Range: This species is known from Colorado and New Mexico (Kartesz and BONAP 1998). In Colorado it has been documented in Chaffee, Fremont, and Pueblo

counties (Colorado Natural Heritage Program 1999; Colorado State University Herbarium 1999). In New Mexico it is known from Catron, Cibola, Rio Arriba,

Sandoval, and Santa Fe counties (pers. comm. Jane Mygatt UNM Herbarium 1999 to Kim Fayette).

Colorado State Range: Arid hills and benches, upper Arkansas River drainage between Pueblo and Buena Vista; Huerfano Creek (Weber and Wittmann 2001).



### **Threats and Management Issues**

Known Threats and Management Issues: Primary threats appear to be off road vehicle use and noxious weed infestations. One occurrence is on military land and appears to be managed appropriately. Low cover of *Salsola* was noted.

### **References**

Kartesz, John and the Biota of North America Program. 1998. "A Synonymized Checklist of the Vascular Flora of the United States, Puerto Rico, and the Virgin Islands". <http://plants.usda.gov>. (May 15 1999).

Weber, W. and R. Wittmann. 2001. *Colorado Flora: Eastern Slope*. Third edition.

**Version Date:** 03/19/2007

*This page intentionally left blank*

## Appendix C. Potential conservation areas (PCAs) in the Arkansas Canyon.

PCAs are sorted by biodiversity rank (B-rank) and then alphabetically by PCA name.

Castle Gardens .....	62
Badger Creek Tunnel .....	65
Cotopaxi.....	68
County Line .....	71
Grape Creek Water Gap.....	74
King Gulch.....	77
McIntyre Hills.....	80
Tenderfoot Hill.....	84
Box Canyon at Wellsville .....	87
Bumback Gulch Parkdale .....	89
Vallie.....	92

Excerpt from Table 8 (Biodiversity ranks (B-rank) of PCAs)

<b>PCA Name</b>	<b>B-rank</b>
Badger Creek Tunnel	B2
Box Canyon at Wellsville	B3
Bumback Gulch Parkdale	B3
Castle Gardens	B1
Cotopaxi	B2
County Line	B2
Grape Creek Water Gap	B2
King Gulch	B2
McIntyre Hills	B2
Tenderfoot Hill	B2
Vallie	B3

Excerpt from Table A-3. Natural Heritage Program Biodiversity Ranks

<b>B1</b>	Outstanding Biodiversity Significance (indispensable):
<b>B2</b>	Very High Biodiversity Significance:
<b>B3</b>	High Biodiversity Significance:
<b>B4</b>	Moderate Biodiversity Significance:
<b>B5</b>	General or State-wide Biological Diversity Significance

## Castle Gardens

**Biodiversity Rank - B1: Outstanding Biodiversity Significance**  
**Protection Urgency Rank - P2: Threat/Opportunity within 5 Years**  
**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**U.S.G.S. 7.5-minute quadrangles:** Salida East, Salida West, Wellsville

**Size:** 1,031 acres (417 ha)                      **Elevation:** 7,020 - 7,380 ft. (2,140 - 2,249 m)

**General Description:** This site consists of an extensive badlands basin at the toeslope of the northern end of the Sangre de Cristo range south of Salida. It is an area of steep, eroding slopes comprised of fine-textured soils derived from Dry Union Formation (Tertiary deposits of siltstone, sandstone, and conglomerates). The landscape in this basin is barren; some of the steep and sharply eroded slopes and ridges are devoid of vegetation. Most of the basin has about 1-10% total vegetation cover of Brandegee wild buckwheat (*Eriogonum brandegeei*), ricegrass (*Oryzopsis hymenoides*), and yucca (*Yucca glauca*) with sparse mountain mahogany (*Cercocarpus montanus*), four-winged saltbush (*Atriplex canescens*), and silver buffaloberry (*Shepherdia argentea*). Ephemeral drainages with pockets of narrowleaf cottonwood (*Populus angustifolia*) and limited mesic shrubs are infrequent at the drainage bottoms of the barrens. Ridges and slopes are generally vegetated by pinon - juniper (*Pinus edulis*, *Juniperus monosperma*) woodland with mountain mahogany and blue grama (*Bouteloua gracilis*) that have coarse, gravelly surface soils.

**Key Environmental Factors:** Dry Union Formation bedrock

**Biodiversity Significance Rank Comments (B1):** The globally critically imperiled (G1G2/S1S2) Brandegee wild buckwheat (*Eriogonum brandegeei*) is a Colorado endemic restricted to Chaffee and Fremont counties. This site contains one of the three largest and highest quality occurrences of this species known.

Natural Heritage element occurrences at the Castle Gardens PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Eriogonum brandegeei</i>	Brandegee wild buckwheat	G1G2	S1S2			BLM/USFS	AB	2006-07-12

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

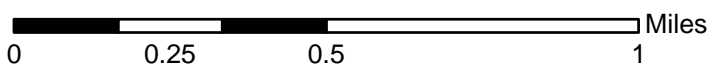
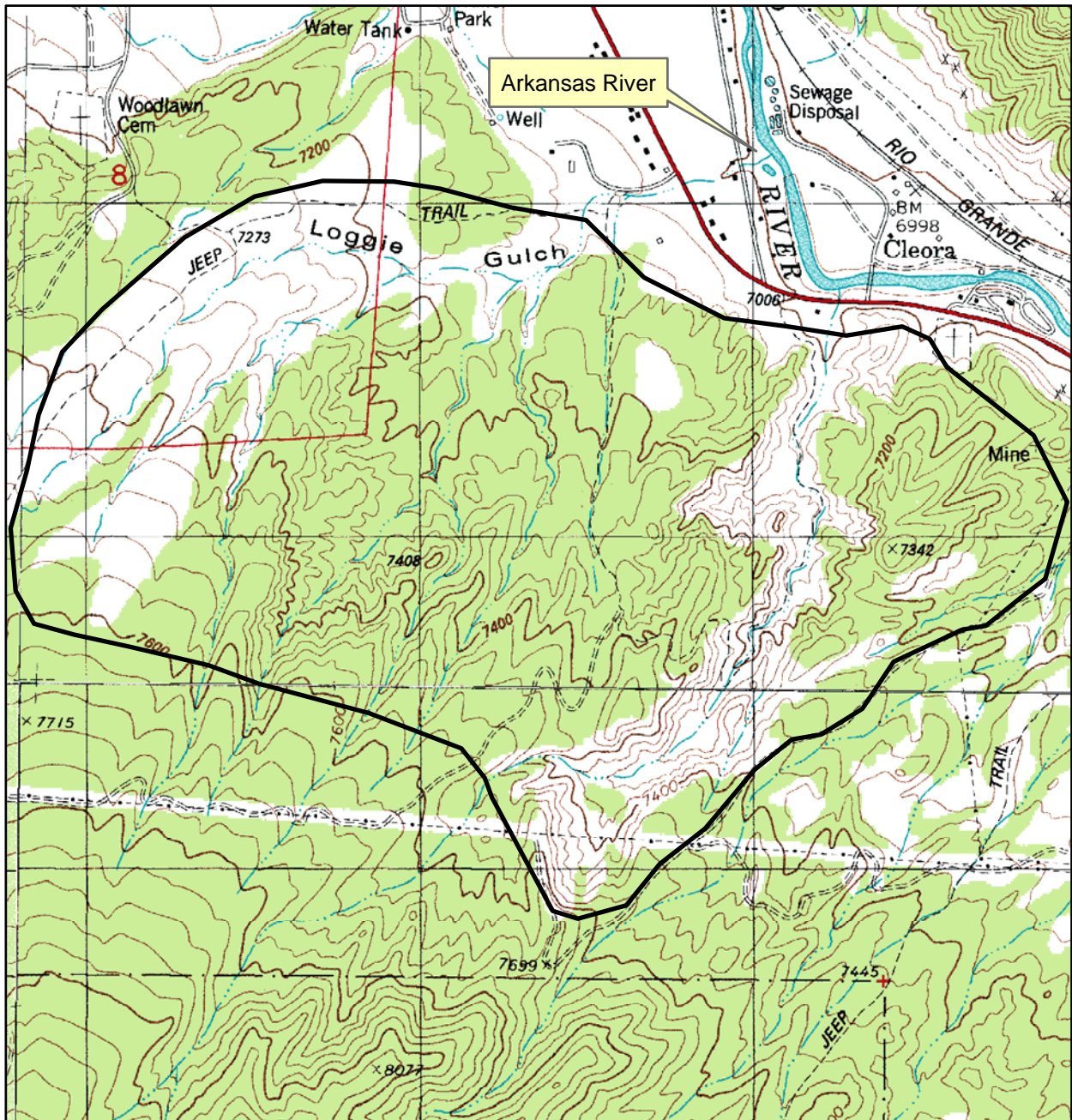
**Boundary Justification:** Boundary includes the barren slopes where *Eriogonum brandegeei* is most abundant as well as some adjacent pinon woods, where *Eriogonum brandegeei* was also documented.


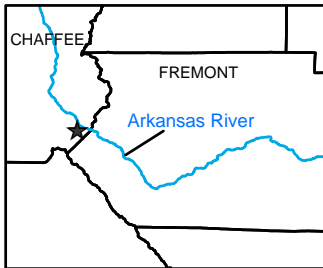
**Protection Urgency Rank Comments (P2):** Recreational use, especially mountain biking, threatens portions of the occurrence. Similar areas around Canon City are experiencing heavy ORV use. Special area designation of public lands recommended.

**Management Urgency Rank Comments (M2):** Prevent further spread of exotic plant species. Monitor response of *Eriogonum brandegeei* to observed disease/fungal pathogen; impact ameliorated by 2006. Manage recreational use to minimize impacts to *Eriogonum brandegeei*.

**Version Author:** Spackman, S.C.

**Version Date:** 03/29/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/11/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Wellsville, 38105-D8          Salida East, 38105-E8          Salida West, 38106-E1</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 1. Castle Gardens Potential Conservation Area, B1: Outstanding Biodiversity Significance



## Badger Creek Tunnel

**Biodiversity Rank - B2: Very High Biodiversity Significance**  
**Protection Urgency Rank - P4: No Threat or Special Opportunity**  
**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Howard, Wellsville

**Size:** 142 acres (58 ha)

**Elevation:** 6,775 - 7,115 ft. (2,065 - 2,169 m)

**General Description:** This site contains dry, open cliffs and rock outcrops above the north side of the Arkansas River where it winds around steep, rugged hillslopes before its confluence with Badger Creek. The steep hillsides above the river are sparsely-vegetated with rocky pinon - juniper woodland (*Pinus edulis* - *Juniperus* spp. / *Cercocarpus montanus* woodland). There is a railroad corridor on this side of the river with a tunnel through the hillside. The river winds around a point of land where Colorado State Parks has established a campground.

**Biodiversity Significance Rank Comments (B2):** This site includes an excellent to good (AB-ranked) and a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*). Arkansas Canyon stickleaf is a Colorado endemic restricted to the Arkansas River drainage.

Natural Heritage element occurrences at the Badger Creek Tunnel PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	AB	2006-07-13
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	C	1995-07-03

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes known occurrences of rare plants as well as adjacent suitable natural habitat (cliffs; outcrops; dry, sandy washes).

**Protection Urgency Rank Comments (P4):** The entirety of this site is BLM land, although a portion of it is leased to Colorado State Parks as a campground and river access area.

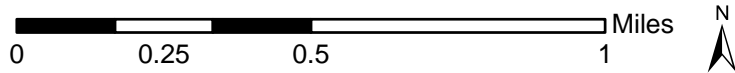
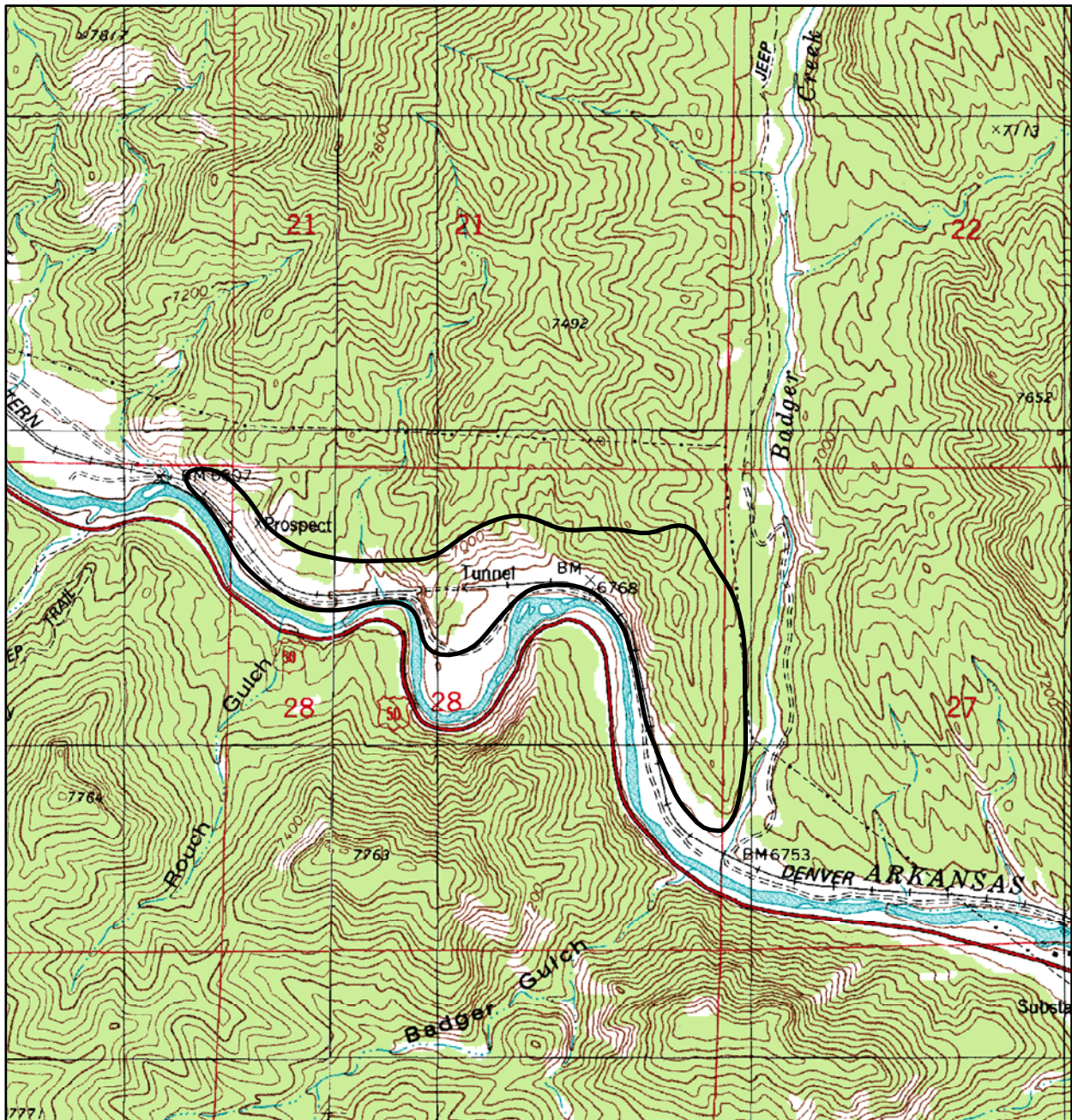
**Management Urgency Rank Comments (M3):** The rare plant species grows on cliffs that provide some natural protection. This species is fairly resistant to disturbance, but there are several infestations of exotic weeds such as cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola australis*), Jim Hill mustard (*Sisymbrium altissimum*),


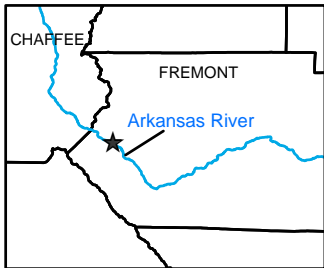
and others.

**Exotic Species Comments:** There are several infestations of exotic weeds such as cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola australis*), Jim Hill mustard (*Sisymbrium altissimum*), and others.

**Version Author:** Neid, S.L.

**Version Date:** 03/08/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Howard, 38105-D7          Wellsville, 38105-D8</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 2. Badger Creek Tunnel Potential Conservation Area, B2: Very High Biodiversity Significance

## Cotopaxi

**Biodiversity Rank - B2: Very High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Arkansas Mountain, Cotopaxi

**Size:** 3,362 acres (1,360 ha)

**General Description:** The site is characterized by outcrops of granodiorite in pinon - juniper woodland.

**Biodiversity Significance Rank Comments (B2):** This site includes an excellent (A-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*) that has multiple sub-occurrences. This species is a Colorado endemic.

Natural Heritage element occurrences at the Cotopaxi PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	A	1989-08-07
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	A	1989-99-99
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	A	1998-06-29
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	A	2001-07-24
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	C	1989-07-20
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	C	1990-07-07
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	D	1998-06-29

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundary is drawn to protect the occurrence from direct impacts from surface disturbances. A buffer is drawn to provide the plants with suitable habitat where additional individuals can become established over time. However, all of the area that has been identified as suitable habitat for the rare plant species was not included in the site because this area is very large and has not been

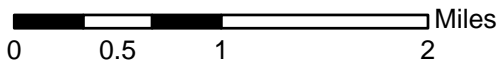
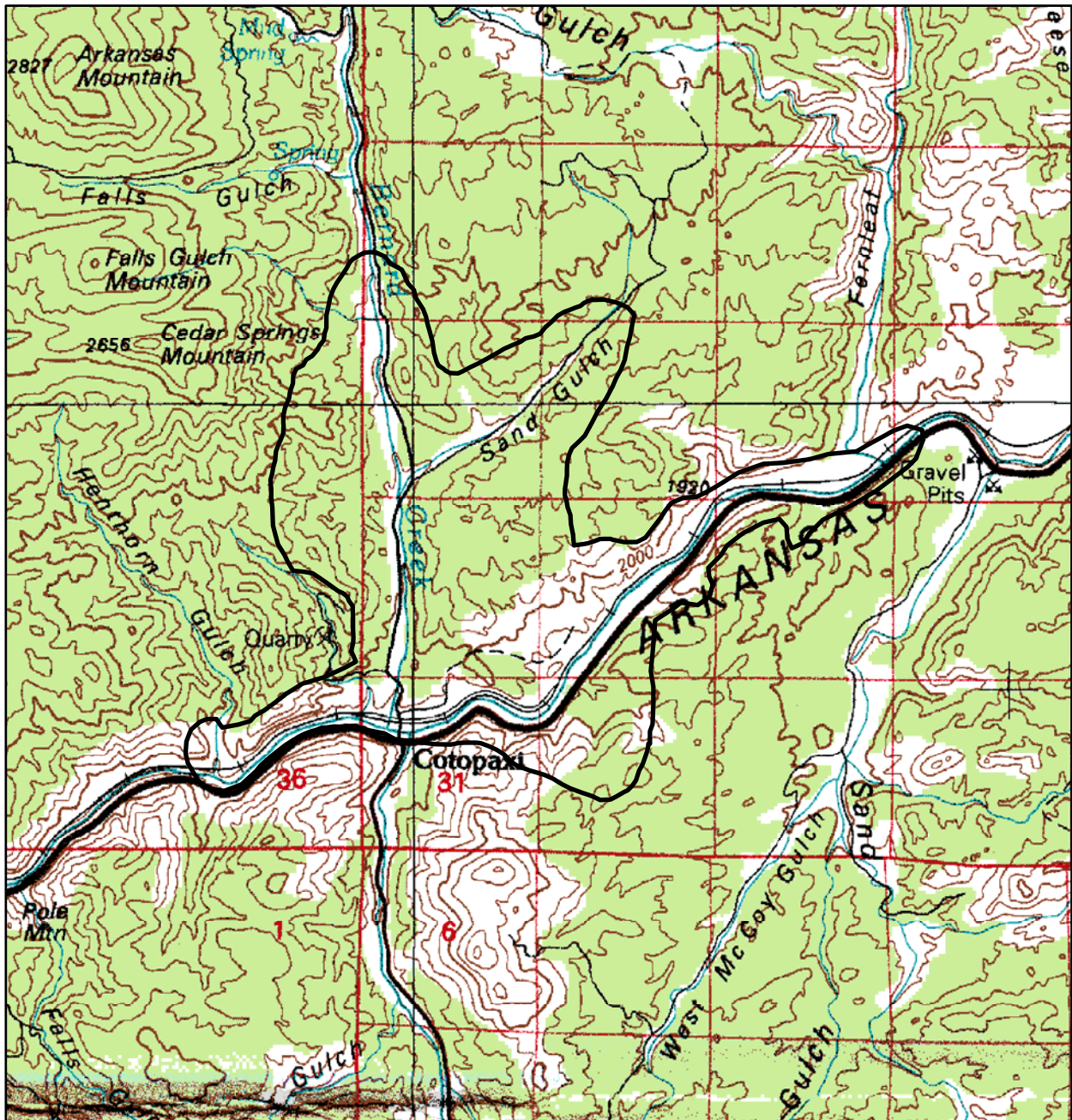
adequately surveyed.


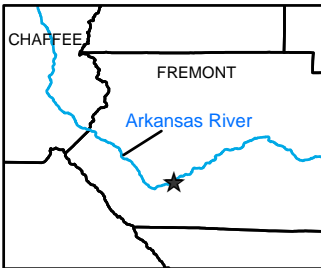
**Protection Urgency Rank Comments (P4):** Site falls within BLM and State Land Board lands and the rare plant species are on the BLM sensitive species list. However, a specific protection plan should be developed.

**Management Urgency Rank Comments (M4):** Current management appears to be adequate. The rare plant species appears to tolerate some disturbance fairly well, i.e. it has been observed to colonize roadcuts. Off-highway vehicle use should be restricted to existing roads and trails. Completing field surveys for the species prior to construction of new facilities or widening of the highway will allow careful planning for these natural resources. Educating river users and hikers to the rare species may help them to avoid unnecessarily disturbing it in its natural habitat.

**Version Author:** Spackman, S.C.

**Version Date:** 03/11/1999



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/09/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Canon City, 38105-A1</p> <p>30x60 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 3. Cotopaxi Potential Conservation Area, B2: Very High Biodiversity Significance

## County Line

**Biodiversity Rank - B2: Very High Biodiversity Significance**  
**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**  
**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Salida East

**Size:** 98 acres (40 ha)

**Elevation:** 6,920 - 7,085 ft. (2,109 - 2,160 m)

**General Description:** This site is bisected by the old Denver and Rio Grande Railroad that parallels the Arkansas River. It is on the north side of the river at the toeslope of rugged hillslopes that rise steeply out of the river valley. The hills are vegetated with rocky pinon - juniper woodland among myriad rock outcrops and ledges of gneiss bedrock. The dominant plant community in the uplands is pinon pine - juniper / blue grama (*Pinus edulis* - *Juniperus* spp. / *Bouteloua gracilis*) woodland. Additional associated plant species include skunkbush (*Rhus trilobata*), currant (*Ribes leptanthum*, *Ribes cereum*), fringed sage (*Artemisia frigida*), Scribner's needlegrass (*Stipa scribneri*), needle-and-thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), ricegrass (*Oryzopsis micrantha*), cactus species (*Echinocereus triglochidiatus*, *Opuntia polyacantha*), and bluntleaf spikemoss (*Selaginella mutica*), which are all common in this habitat.

**Biodiversity Significance Rank Comments (B2):** The site supports a good (B-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*) and an excellent to good (AB-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*). Arkansas Canyon stickleaf is a Colorado endemic restricted to the Arkansas River drainage.

Natural Heritage element occurrences at the County Line PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	B	2006-07-11
Vascular Plants	<i>Argyrochosma fendleri</i>	Fendler cloak - fern	G3	S3				AB	2006-07-11

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This boundary includes known occurrences of rare plants as well as adjacent suitable natural habitat (cliffs; outcrops; dry, sandy washes).

**Protection Urgency Rank Comments (P3):** The majority of the site is within BLM

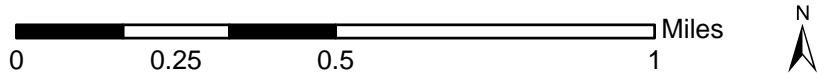
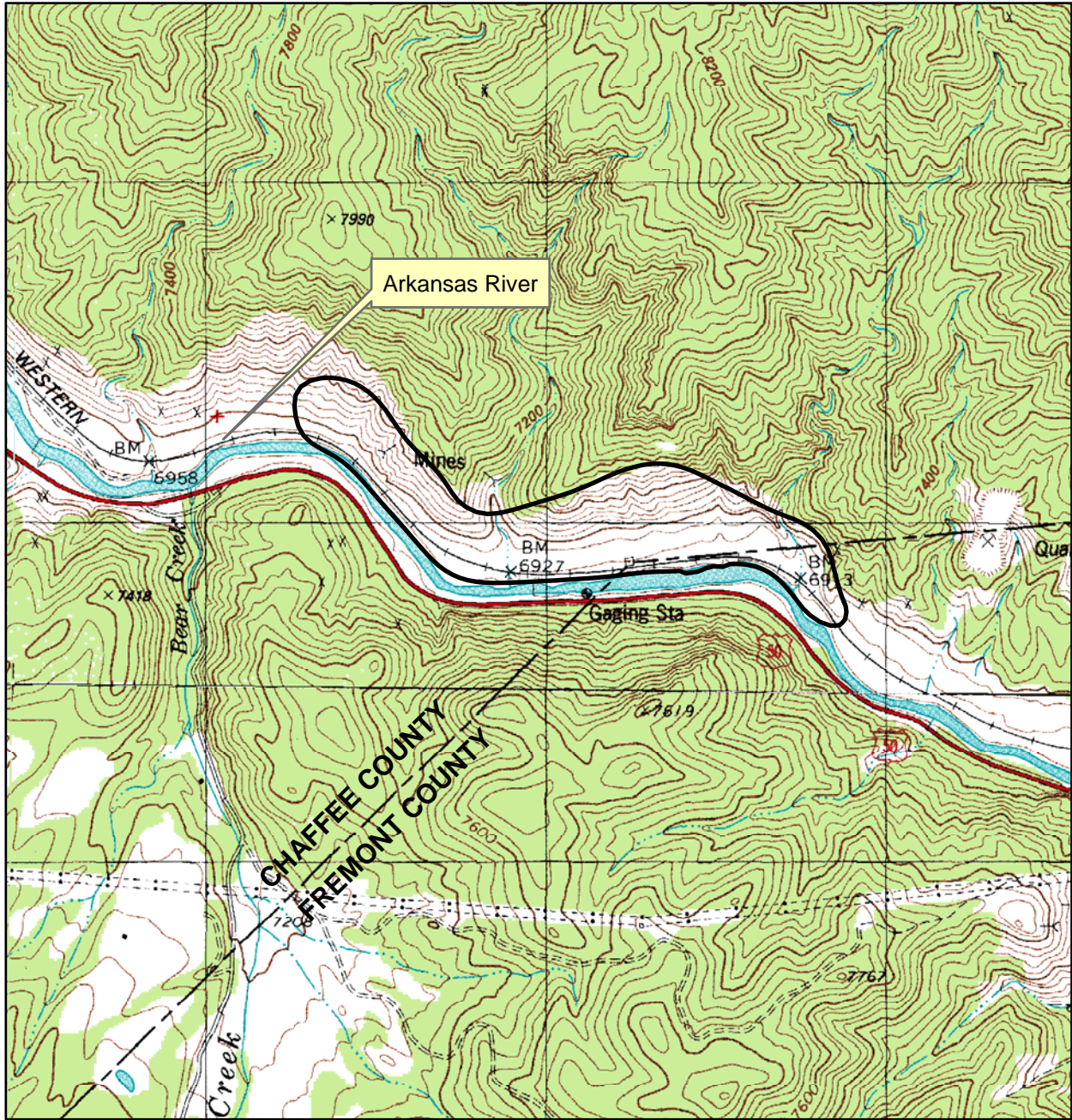
ownership. However, half of one of the rare plant occurrences is on adjacent private land.


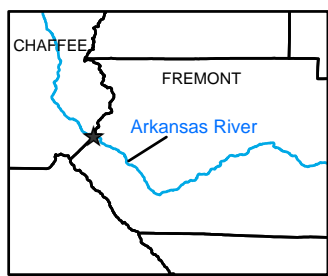
**Management Urgency Rank Comments (M3):** Evidence of threats and disturbance: weeds occupy the railroad right-of-way. Predominant land uses: historic railroad corridor.

**Version Author:** Neid, S.L.

**Version Date:** 03/07/2007





<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Salida East, 38105-E8</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	---	---

Map 4. County Line Potential Conservation Area, B2: Very High Biodiversity Significance

## Grape Creek Water Gap

**Biodiversity Rank - B2: Very High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Royal Gorge

**Size:** 316 acres (128 ha)

**Elevation:** 5,385 - 6,045 ft. (1,641 - 1,843 m)

**General Description:** This site is characterized by a series of hogbacks on the edge of a large expanse of rugged, lower montane, granitic hills. There are two low hogbacks of Niobrara shale on the east side of the area and a tall, sharp hogback of Fountain Formation (sandstone with limestone inclusions) on the west side that is immediately above Grape Creek, a perennial tributary of the Arkansas River. Rock outcrops and unvegetated granite slabs are common on the slopes of the taller western hogback, which is cut by a drainage flowing into Grape Creek. Just to the north above the water gap, there is old clay mining activity and infrastructure. Sparse pinon - juniper (*Pinus edulis* - *Juniperus monosperma*) woodland occupies the rocky slopes of the hogbacks. The lower Niobrara hogbacks also have mountain mahogany (*Cercocarpus montanus*), Bigelow sage (*Artemisia bigelovii*), and frankenia (*Frankenia jamesii*) shrubs plus sparse, mostly low-growing herbs, such as ricegrass (*Oryzopsis hymenoides*), New Mexico feathergrass (*Hesperostipa neomexicana*), spearleaf buckwheat (*Erigonum fendleriana*), three awn (*Aristida purpurea*), James' prairie clover (*Dalea jamesii*), stemless daisy (*Hymenoxys acaulis*), blue grama (*Bouteloua gracilis*), and hairy woolygrass (*Erioneuron pilosum*). The taller Fountain Formation hogback has shrubs like California brickellbush (*Brickellia californica*) and hoptree (*Ptelea trifoliata*) with diverse graminoids like little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), hairy grama (*Bouteloua hirsuta*), bush muhly (*Muhlenbergia porteri*), California oatgrass (*Danthonia californicus*), common wolfstail (*Lycurus phleoides*), and poverty threeawn (*Aristida divaricata*) plus large hedgehog cactus (*Echinocereus triglochidiatus*), dwarf Indian mallow (*Abutilon parvulum*), chickenthiel (*Mentzelia oligosperma*), and narrowleaf four o'clock (*Oxybaphus linearis*). The intervening valleys are occupied by gypsiferous grasslands. The gypsiferous grasslands are unique in character, having selenium influence and a different species composition. Graminoids are unique and include burrograss (*Scleropogon brevifolius*), ear muhly (*Muhlenbergia arenacea*), vine mesquite (*Panicum obtusum*), and Texas dropseed (*Sporobolus texanus*) in addition to more common blue grama (*Bouteloua gracilis*), green needlegrass (*Stipa viridula*), bottlebrush grass (*Elymus elymoides*), and sand dropseed (*Sporobolus cryptandrus*). Prince's plume (*Stanleya pinnata*), a selenium indicator, is abundant in some locations.

**Land Use History:** Past clay mining activity

**Biodiversity Significance Rank Comments (B2):** The site supports an excellent (A-ranked) occurrence of the globally imperiled (G2/S2) Rocky Mountain bladderpod (*Lesquerella calcicola*) and a good (B-ranked) occurrence of the state rare (G5/S2) Wright's cliff-brake (*Pellaea wrightiana*).

Natural Heritage element occurrences at the Grape Creek Water Gap PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G2	S2				A	2006-06-27
Vascular Plants	Pellaea wrightiana	Wright's cliff - brake	G5	S2				B	2006-08-30

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This boundary includes known occurrences of rare plants as well as some adjacent suitable natural habitat.

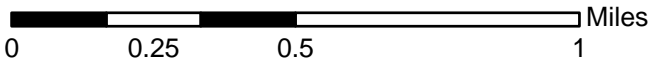
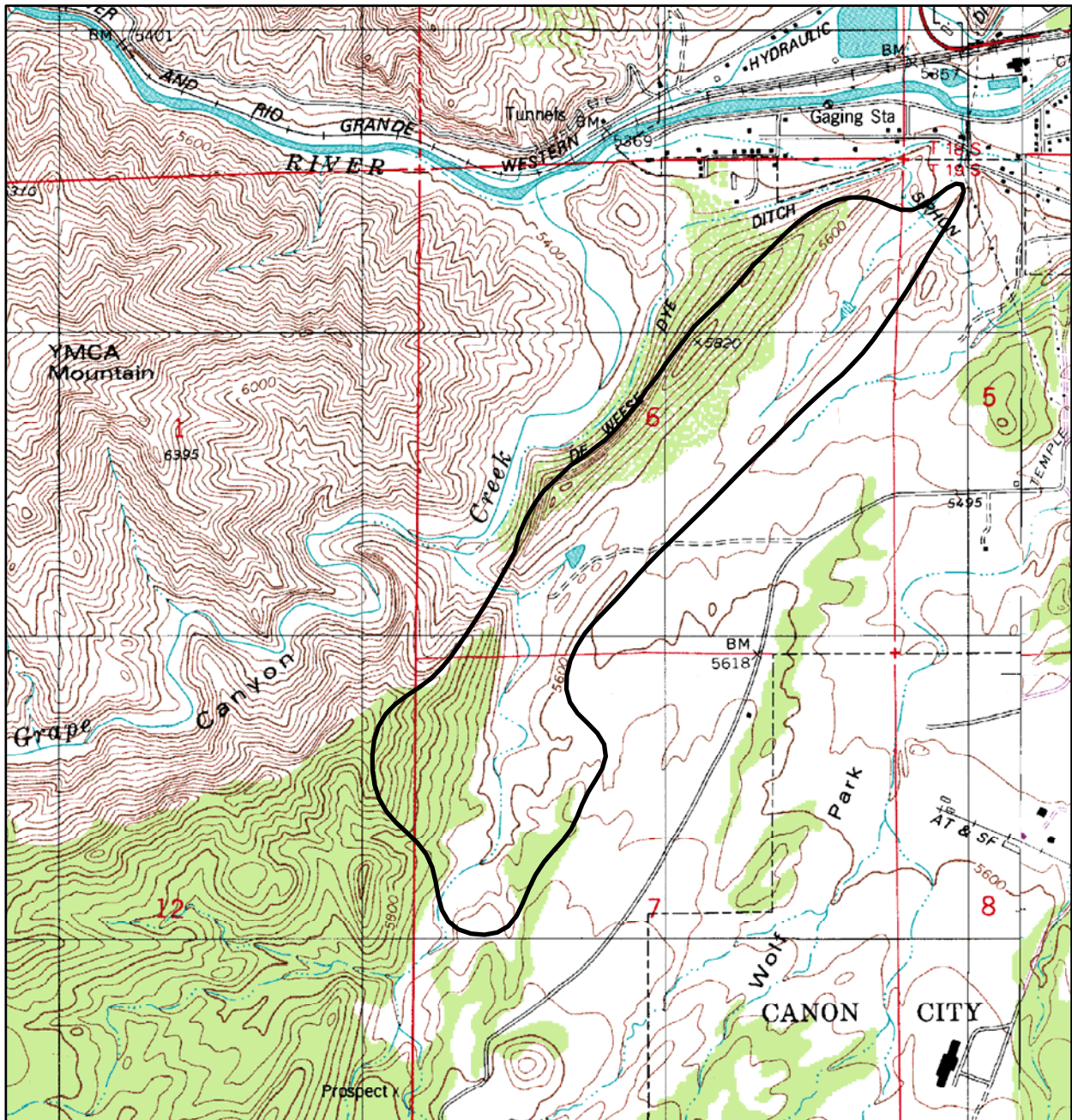
**Protection Urgency Rank Comments (P4):** The majority of the site is in BLM ownership.


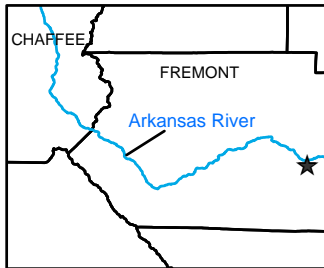
**Management Urgency Rank Comments (M4):** Evidence of threats and disturbance: historic mining activity on higher hogback to the west. Immediately to the east is a capped landfill that is now the Ecology Park, maintained by the Canon City High School ecology club. Predominant land uses: recreation. Exotic species: Russian thistle (*Salsola australis*), kochia (*Kochia scoparia*), and limited tamarisk (*Tamarix ramosissimum*), the latter occurs in the drainage above the water gap.

**Exotic Species Comments:** Exotic species present include Russian thistle (*Salsola australis*), kochia (*Kochia scoparia*), and limited tamarisk (*Tamarix ramosissimum*). The tamarisk occurs in the drainage above the water gap.

**Version Author:** Neid, S.L.

**Version Date:** 03/06/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Royal Gorge, 38105-D3</p> <p>7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey</p>	<p>Location in the Arkansas Canyon</p> 
--	---	--

Map 5. Grape Creek Water Gap Potential Conservation Area, B2: Very High Biodiversity Significance

## King Gulch

**Biodiversity Rank - B2: Very High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Salida West

**Size:** 184 acres (74 ha)

**Elevation:** 7,280 - 7,760 ft. (2,219 - 2,365 m)

**General Description:** This site is comprised of steep, largely barren slopes that have formed a bowl at the toeslope on the north face of the Sangre de Cristo range south of Salida. The rim of the bowl and slopes above it have pinon - juniper woodland and limited residential and commercial development. The bowl is exposed Dry Union Formation, which is poorly consolidated siltstone, sandstone, conglomerate, and breccia with small amounting of silty and laminated shale (Wallace et al. 1997). The steep sides of the bowl are sparsely vegetated in most areas. Within the bowl are narrow shoulders of conglomerate materials and silty soils (badlands) that descend to the valley bottom. Pinon pine (*Pinus edulis*) and mountain mahogany (*Cercocarpus montanus*) grow sporadically over diverse, but sparse understory of graminoids and forbs. Narrow, sinuous washes form in the bottom from the steep drainages above.

**Key Environmental Factors:** Clay soils derived from Dry Union Formation.

**Land Use History:** There is a radio tower and requisite infrastructure at the upper edge.

**Biodiversity Significance Rank Comments (B2):** The site supports a good to excellent (AB-ranked) occurrence of the globally imperiled (G2/S1) Fendler's townsend-daisy (*Townsendia fendleri*) and a good to excellent (AB-ranked) occurrence of the globally vulnerable (G3/S3) rock-loving neoparrya (*Aletes lithophilus*).

Natural Heritage element occurrences at the King Gulch PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Townsendia fendleri</i>	Fendler's townsend - daisy	G2	S1				AB	2006-08-01
Vascular Plants	<i>Aletes lithophilus</i>	rock - loving neoparrya	G3	S3			BLM/USFS	AB	2006-08-01

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

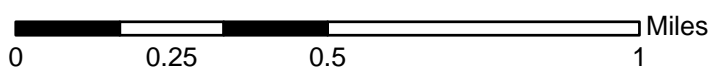
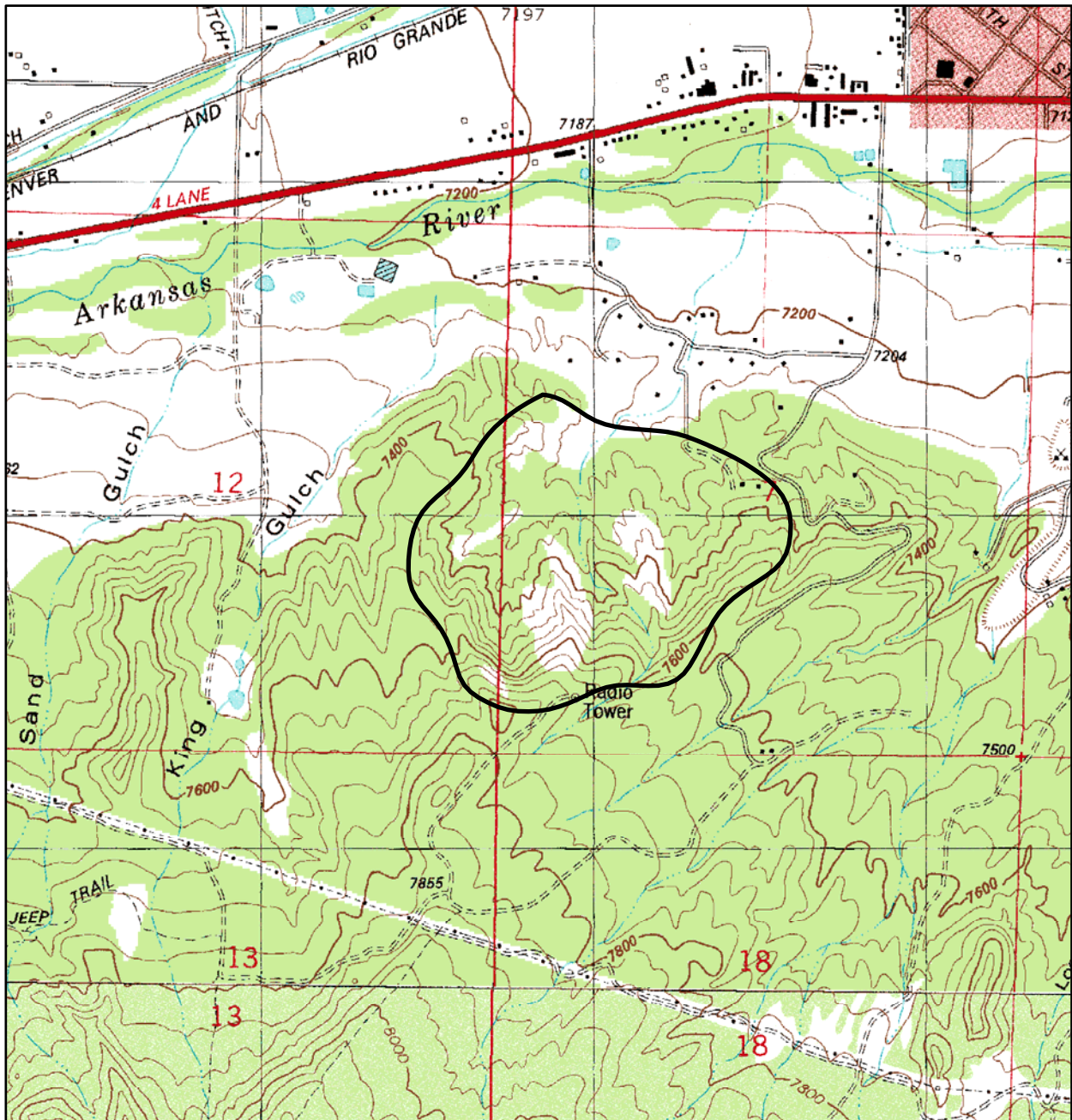
**Boundary Justification:** Boundary is drawn to protect the occurrence from direct impacts, and to provide the plants with suitable habitat where additional individuals can become established over time.


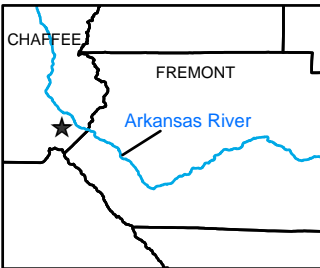
**Protection Urgency Rank Comments (P3):** Site includes public and private land. Work with BLM in Canon City to assure protection of the rare plants.

**Management Urgency Rank Comments (M4):** No management problems currently observed, but off-road vehicle use poses a significant potential threat to the steep, erodable soils. A continuation of current management and land uses at this site would prevent anthropogenic loss of the plant occurrences.

**Version Author:** Neid, S.L.

**Version Date:** 03/09/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Salida West, 38106-E1</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	---	---

Map 6. King Gulch Potential Conservation Area, B2: Very High Biodiversity Significance

## McIntyre Hills

**Biodiversity Rank - B2: Very High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Arkansas Mountain, Echo, Hillside, McIntyre Hills

**Size:** 20,654 acres (8,358 ha)      **Elevation:** 5,873 - 8,911 ft. (1,790 - 2,716 m)

**General Description:** The Arkansas River Canyon is formed by dry, open, steep, granitic slopes covered with pinon - juniper woodland. The slopes have several steep, ephemeral drainages and are dissected by several broad sand/gravel wash drainages or gulches. The river is confined by transportation corridors on both sides in the canyon; it is paralleled by Highway 50 on the south bank and the old Denver and Rio Grande Railroad on the north side. There is a mix of natural habitat, such as gravel washes and steep, granitic slopes, and unnatural habitat including railroad and highway rights-of-way. The unnatural habitat consists of rip rap slopes of variously-sized boulders (highway side) and sharp cobble (railroad side) that climb steeply away from the riverbanks. On the south side of the river there are frequent pull-outs as well as Arkansas River Headwaters Recreation Area river access and infrastructure in the narrow area between the river and the highway. On the other sides of the highway and railroad from the river are steep hills and canyonsides, some of which are now road/railroad cuts, although the majority of the habitat is natural above the transportation infrastructure. The sparse pinon - juniper woodland occurs in coarse sand and gravel soils and has a canopy of pinon pine (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*), and Rocky Mountain juniper (*Juniperus scopulorum*). Common shrubs include mock orange (*Philadelphus microphyllus*), wax currant (*Ribes cereum*), rabbitbrush (*Chrysothamnus nauseosus*), cholla (*Cylindropuntia imbricata*), snakeweed (*Gutierrezia sarothrae*), and sage species (*Artemisia ludoviciana*, *Artemisia frigida*). Herbs are largely dominated by graminoids like ricegrass (*Oryzopsis hymenoides*), Scribner's needlegrass (*Stipa scribneri*), three-awn (*Aristida purpurea*), and sand dropseed (*Sporobolus cryptandrus*).

**Key Environmental Factors:** Arid, lower montane, granitic hills and outcrops

**Biodiversity Significance Rank Comments (B2):** This site is drawn for several globally rare plant species, some of which are endemic to the Arkansas River Valley in Colorado. There is a good (B-ranked) occurrence and a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*), a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Degener beardtongue (*Penstemon degeneri*), a good (B-ranked) and a good to fair (BC-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma*



*fendleri*), and an extant occurrence of the globally vulnerable (G3?/S3?) jeweled blazingstar (*Nuttallia [=Mentzelia] speciosa*). This area represents the largest known concentration of Arkansas Canyon stickleaf individuals in the world.

Natural Heritage element occurrences at the McIntyre Hills PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	B	2006-08-31
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	C	2006-08-31
Vascular Plants	<i>Penstemon degeneri</i>	Degener beardtongue	G2	S2			BLM/ USFS	C	2003-06-29
Vascular Plants	<i>Argyrochosma fendleri</i>	Fendler cloak - fern	G3	S3				B	2006-08-31
Vascular Plants	<i>Argyrochosma fendleri</i>	Fendler cloak - fern	G3	S3				BC	2006-07-26
Vascular Plants	<i>Nuttallia speciosa</i>	jeweled blazingstar	G3?	S3?				E	1995-06-29

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This boundary largely follows the immediate watershed boundary adjacent to the river. It includes known locations of *Nuttallia densa* as well as adjacent suitable natural habitat (cliffs; outcrops; dry, sandy washes).

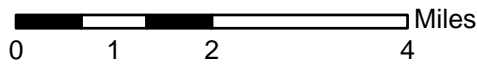
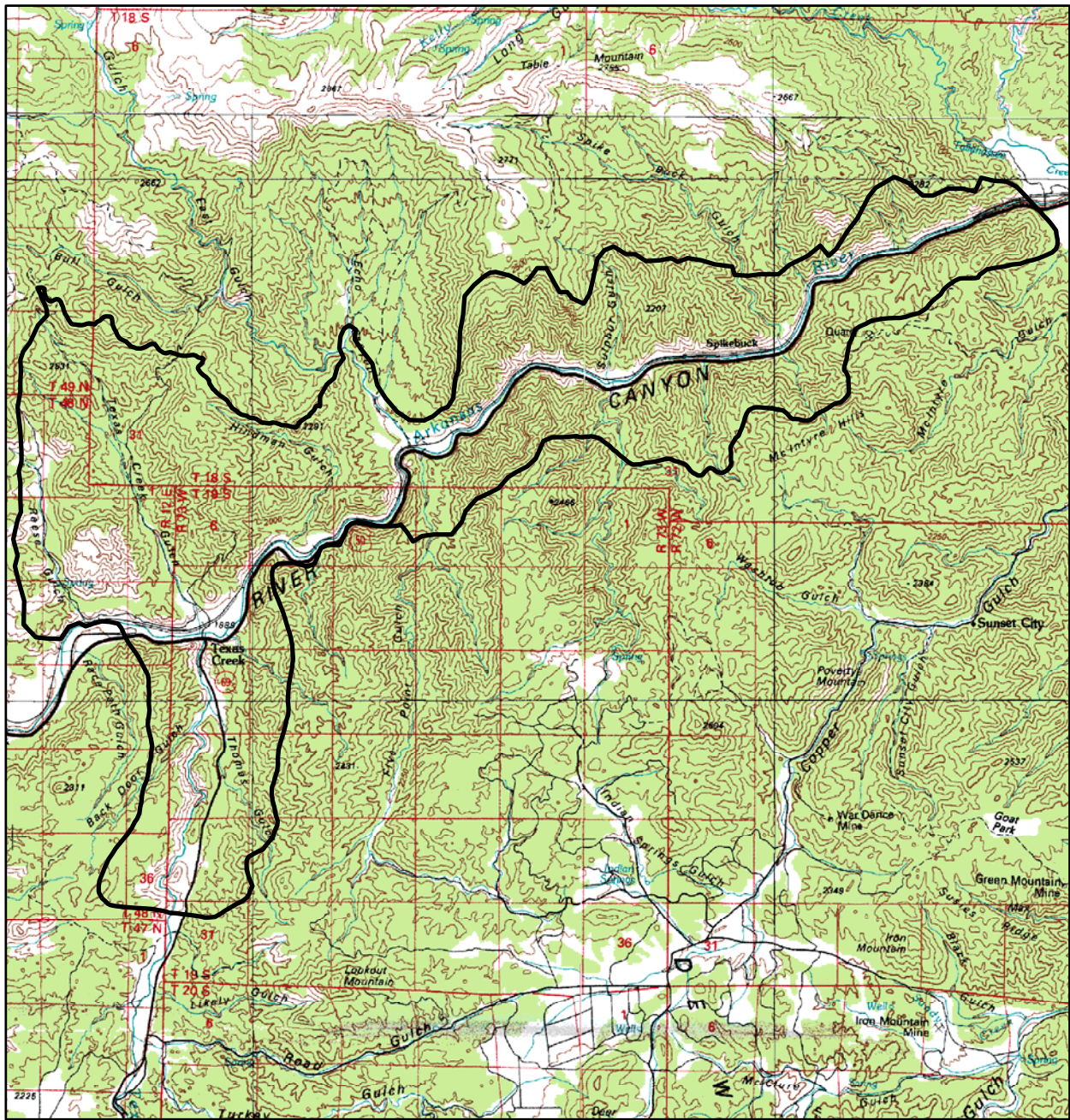
**Protection Urgency Rank Comments (P4):** This site falls almost entirely within BLM lands, much of which is designated an Area of Critical Environmental Concern (ACEC). Several of the rare plant species are on the BLM sensitive species list. However, developing a specific protection plan for this area would ensure the persistence of the plant species and aim to maintain or improve the conditions within the boundaries.


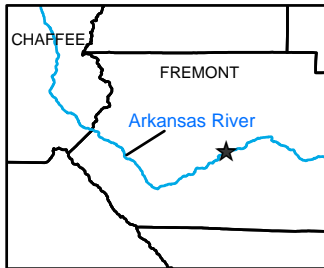
**Management Urgency Rank Comments (M3):** Management issues for the plant species include grazing, highway maintenance or widening, recreation, and exotic species. The plants are seemingly unpalatable to cattle, but individuals are subject to trampling by livestock or by recreation. Highway maintenance activities, such as herbicide spraying, directly impact individuals. Invasive, exotic species shade otherwise open, sandy habitat.

**Exotic Species Comments:** The highway and railroad corridors have significant infestations of invasive, exotic weeds including Jim Hill mustard (*Sisymbrium altissimum*), cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium canadensis*), and some diffuse knapweed (*Centaurea diffusa*).

**Version Author:** Neid, S.L.

**Version Date:** 03/09/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Canon City, 38105-A1</p> <p>30x60 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 7. McIntyre Hills Potential Conservation Area, B2: Very High Biodiversity Significance

## Tenderfoot Hill

**Biodiversity Rank - B2: Very High Biodiversity Significance**  
**Protection Urgency Rank - P4: No Threat or Special Opportunity**  
**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Salida East

**Size:** 577 acres (234 ha)

**Elevation:** 7,200 - 7,987 ft. (2,195 - 2,434 m)

**General Description:** The site is characterized by lower montane hills comprised of crumbly volcanic bedrock above the Arkansas River valley north of Salida. The unique volcanic bedrock (Oligocene andesite, basalt, and biotite latite) is only known from this vicinity (Wallace et al. 1997). Vegetation is a mosaic of pinon pine (*Pinus edulis*) woodland and open grassland dotted with sparsely-vegetated rock outcrops and small barrens. There are steep slope crests and high slopes at the local heights of land. Lower elevations and south-facing slopes are generally midgrass grasslands dominated by needle-and-thread (*Hesperostipa comata*) or in localized areas by New Mexico feathergrass (*Hesperostipa neomexicana*). Scattered shrubs, such as mountain mahogany (*Cercocarpus montanus*), rabbitbrush (*Chrysothamnus nauseosus*), and occasionally saltbush (*Atriplex canescens*) occur on rockier areas. The localized barrens areas are often sparsely vegetated with annuals.

**Key Environmental Factors:** Volcanic bedrock

**Biodiversity Significance Rank Comments (B2):** The site supports a good (B-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*) and a good (B-ranked) occurrence of the globally vulnerable (G3/S3) rock-loving neoparrya (*Aletes lithophilus [=Neoparrya lithophila]*).

Natural Heritage element occurrences at the Tenderfoot Hill PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	B	2006-08-02
Vascular Plants	<i>Aletes lithophilus</i>	rock - loving neoparrya	G3	S3			BLM/ USFS	B	2006-08-02

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes suitable habitat in the surrounding area for the rare plants found at the site.

**Protection Urgency Rank Comments (P4):** The locations of the rare species are, at

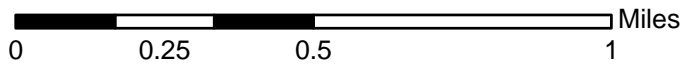
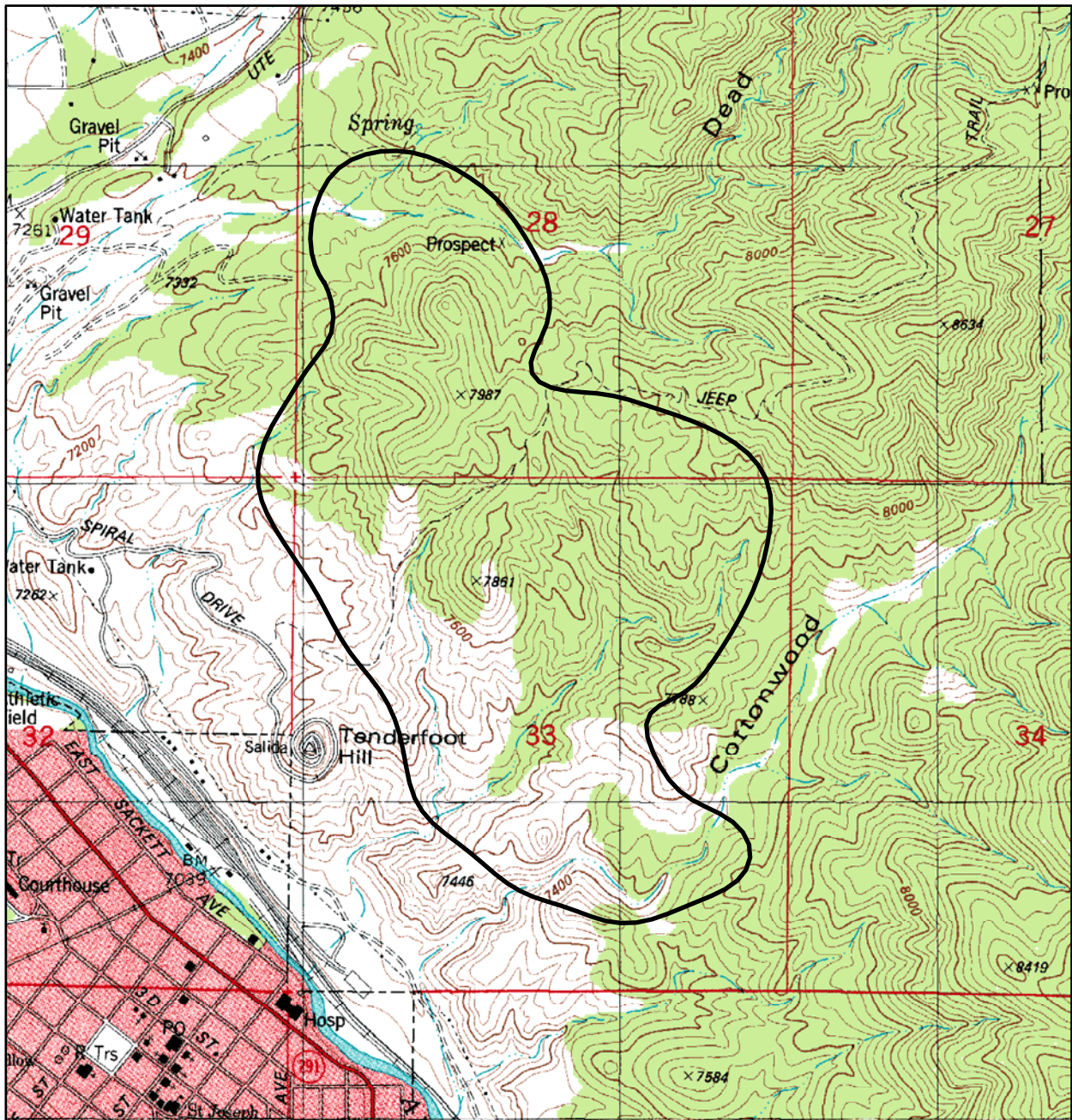
present, relatively inaccessible. However, avoiding increased recreational use in the rare plant locations would lessen potential impacts.


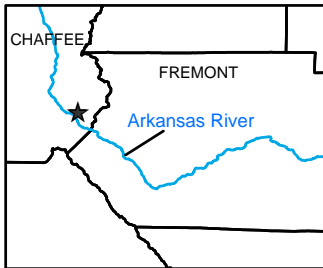
**Management Urgency Rank Comments (M3):** Currently there are limited areas of non-native weed infestations that occupy the Arkansas Canyon stickleaf habitat. There are additional weed infestations within the site, especially along riparian corridors and in limited areas along some trails.

**Exotic Species Comments:** There are weed infestations along riparian corridors and in limited areas along some trails.

**Version Author:** Neid, S.L.

**Version Date:** 03/09/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Salida East, 38105-E8</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	---	---

Map 8. Tenderfoot Hill Potential Conservation Area, B2: Very High Biodiversity Significance

## Box Canyon at Wellsville

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Wellsville

**Size:** 316 acres (128 ha)

**General Description:** The site is a narrow canyon with cliffs and rocky (boulders to scree) slopes. Mountain mahogany (*Cercocarpus montanus*) and cholla (*Cylindropuntia imbricaria*) shrubland and scattered pinon pine (*Pinus edulis*) dominate the area.

**Biodiversity Significance Rank Comments (B3):** Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*) is restricted to the Arkansas River drainage in Fremont County, Colorado. This site contains a good to fair (BC-ranked) example of this globally imperiled (G2/S2) plant species.

Natural Heritage element occurrences at the Box Canyon at Wellsville PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	BC	2006-07-13

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

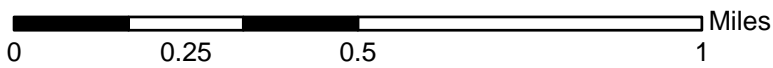
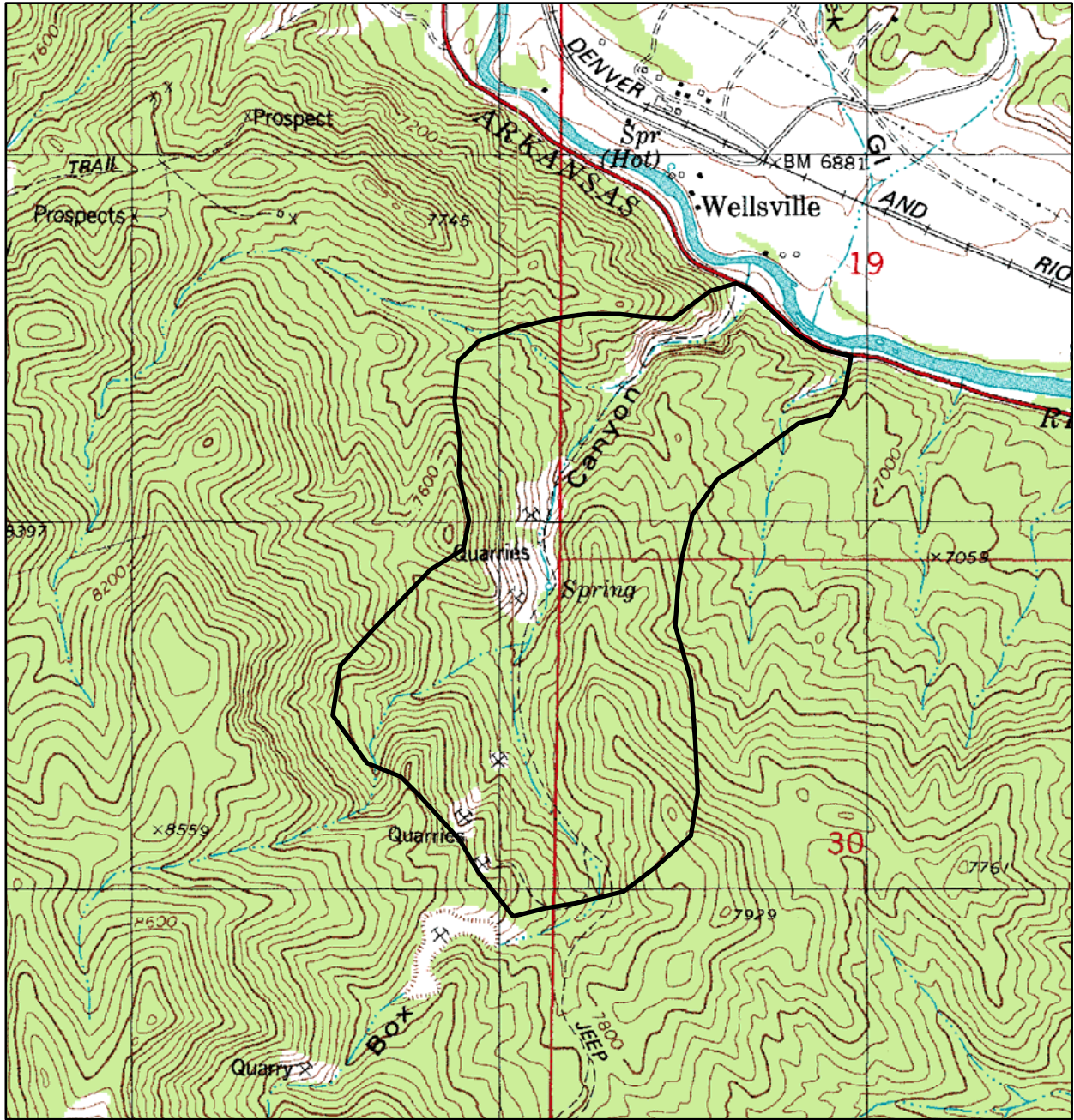
**Boundary Justification:** Boundary includes rock outcrops that support a rare plant species. Plants are more or less naturally protected given the very steep terrain.


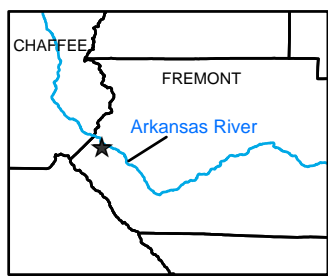
**Protection Urgency Rank Comments (P3):** Approximately half of the site is owned by the BLM with private inholdings.

**Management Urgency Rank Comments (M3):** There are infestations of weeds along the steep road going up this canyon including cheatgrass (*Bromus tectorum*) and knapweed (*Centaurea diffusa*).

**Version Author:** Spackman, S.C.

**Version Date:** 04/01/1997



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/09/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Wellsville, 38105-D8</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 9. Box Canyon at Wellsville Potential Conservation Area, B3: High Biodiversity Significance



## Bumback Gulch Parkdale

**Biodiversity Rank - B3: High Biodiversity Significance**  
**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**  
**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Royal Gorge

**Size:** 512 acres (207 ha)

**General Description:** This site largely follows the roads along Eight Mile Park west of the Royal Gorge. The park is dominated by grasslands that abut hillsides characterized by weathered granitic (Precambrian granodiorite) outcrops and pinon - juniper (*Pinus edulis* - *Juniperus monosperma*) woodlands. Mountain mahogany (*Cercocarpus montanus*) and cholla (*Cylindropuntia imbricata*) are common shrubs and indian ricegrass (*Oryzopsis hymenoides*) are common.

**Key Environmental Factors:** Granitic scree on steep hillsides.

**Biodiversity Significance Rank Comments (B3):** The site supports two fair (C-ranked) occurrences of a globally rare (G2/S2) plant species, Arkansas Canyon stickleaf (*Nuttallia [=Mentzelia] densa*). Arkansas Canyon stickleaf is a Colorado endemic restricted to the Arkansas River drainage.

Natural Heritage element occurrences at the Bumback Gulch Parkdale PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Nuttallia densa	Arkansas Canyon stickleaf	G2	S2			BLM	C	1989-07-21
Vascular Plants	Nuttallia densa	Arkansas Canyon stickleaf	G2	S2			BLM	C	1995-08-04

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This boundary includes known occurrences of rare plants as well as adjacent suitable natural habitat (cliffs; outcrops; dry, sandy washes, Arkansas River valley).

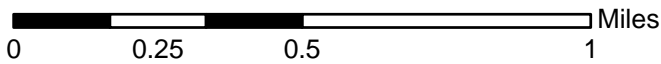
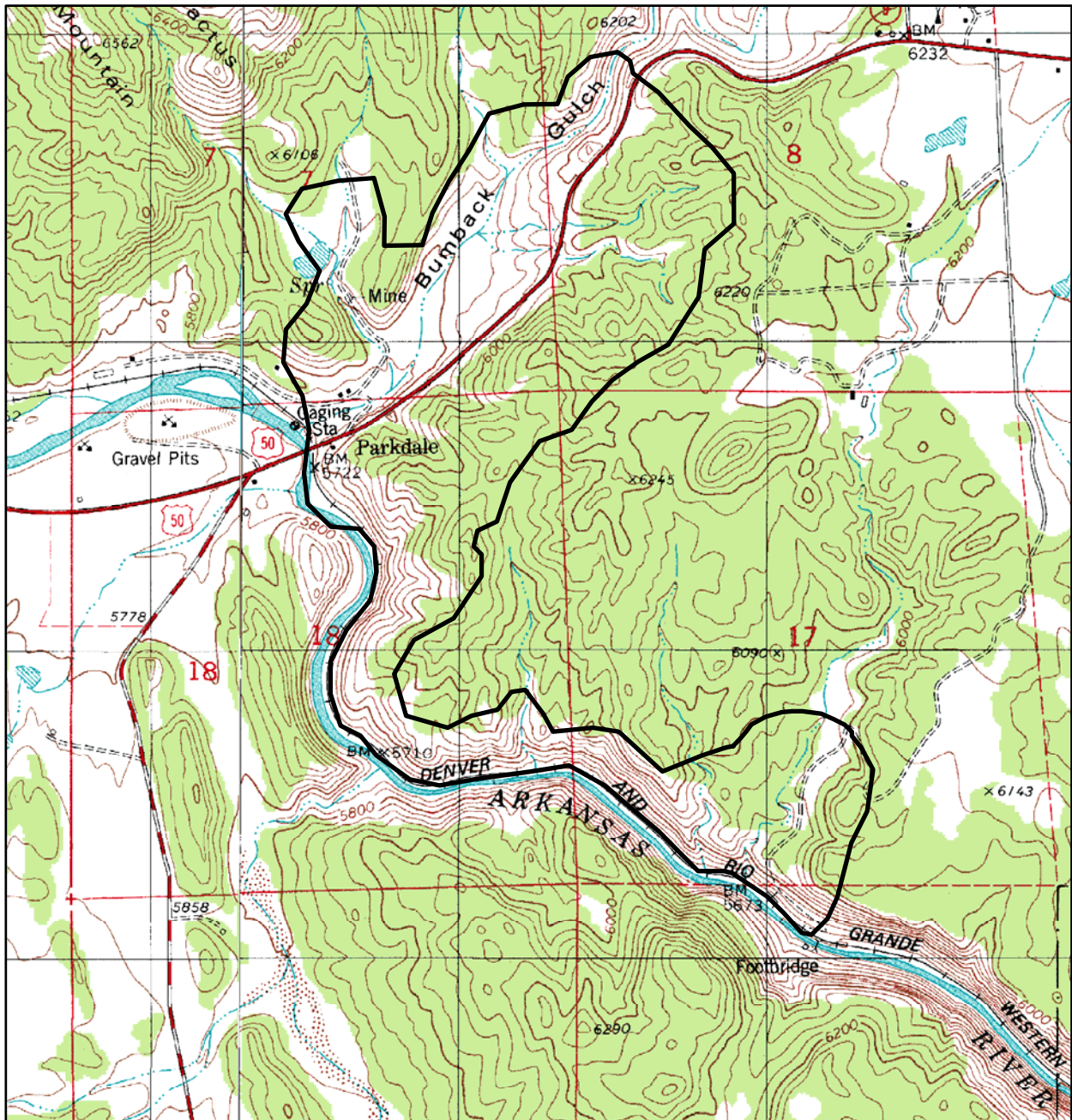
**Protection Urgency Rank Comments (P3):** The area is a mixture of private and BLM lands.


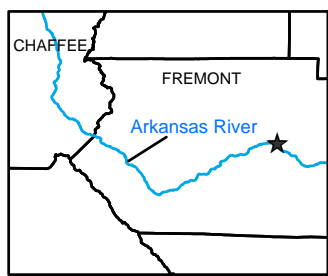
**Management Urgency Rank Comments (M3):** The rare plant species grows on cliffs that provide some natural protection. This species is fairly resistant to disturbance.

The plants are known from roadside habitat; restricting pesticide use (both herbicides and insecticides) will lessen impact to both plants and their pollinators.

**Version Author:** Neid, S.L.

**Version Date:** 03/07/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Royal Gorge, 38105-D3</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	---	---

Map 10. Bumback Gulch Parkdale Potential Conservation Area, B3: High Biodiversity Significance

## Vallie

**Biodiversity Rank - B3: High Biodiversity Significance**  
**Protection Urgency Rank - P4: No Threat or Special Opportunity**  
**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Howard

**Size:** 22 acres (9 ha)

**Elevation:** 6,580 - 6,770 ft. (2,006 - 2,064 m)

**General Description:** This site is within a swath of rugged foothills on the north-facing toeslope of the Sangre de Cristo range. The Arkansas River has a broader floodplain in this vicinity with small towns and irrigated hay meadows in the valley. The surrounding hills are comprised of pinon - juniper (*Pinus edulis*, *Juniperus monosperma*) woodland with some shrub cover from mountain mahogany (*Cercocarpus montanus*), Gambel oak (*Quercus gambelii*), skunkbush (*Rhus trilobata*) and rabbitbrush (*Chrysothamnus nauseosus*). Herbaceous species include many forbs including Arkansas Canyon stickleaf (*Nuttallia densa*). The plants occupy coarse, gravelly soils in crevices and on small ledges on very steep slopes and cliffs comprised of Minturn and Belden Formation (sedimentary shales, limestones, and sandstones) bedrock above Highway 50. They also occupy the roadbed rip rap between the highway and the Arkansas River.

**Biodiversity Significance Rank Comments (B3):** The site supports a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Arkansas Canyon stickleaf (*Nuttallia* [=*Mentzelia*] *densa*). Arkansas Canyon stickleaf is a Colorado endemic restricted to the Arkansas River drainage.

Natural Heritage element occurrences at the Vallie PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Nuttallia densa</i>	Arkansas Canyon stickleaf	G2	S2			BLM	C	2006-08-31

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This site is drawn for natural cliff and slope habitat along a roadside occurrence of *Nuttallia densa*. As the roadside individuals likely dropped from the cliffs above, the boundary extends to the top of the hills, which comprise additional suitable natural habitat. It does not include a portion of the plant occurrence (one plant found) that is at the edge of a parking lot in the Arkansas Headwaters Recreation Area pullout at Vallie Bridge.

**Protection Urgency Rank Comments (P4):** Much of the site is on BLM lands and the

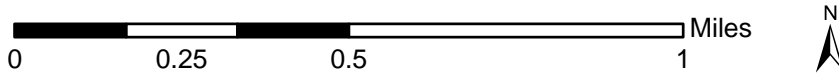
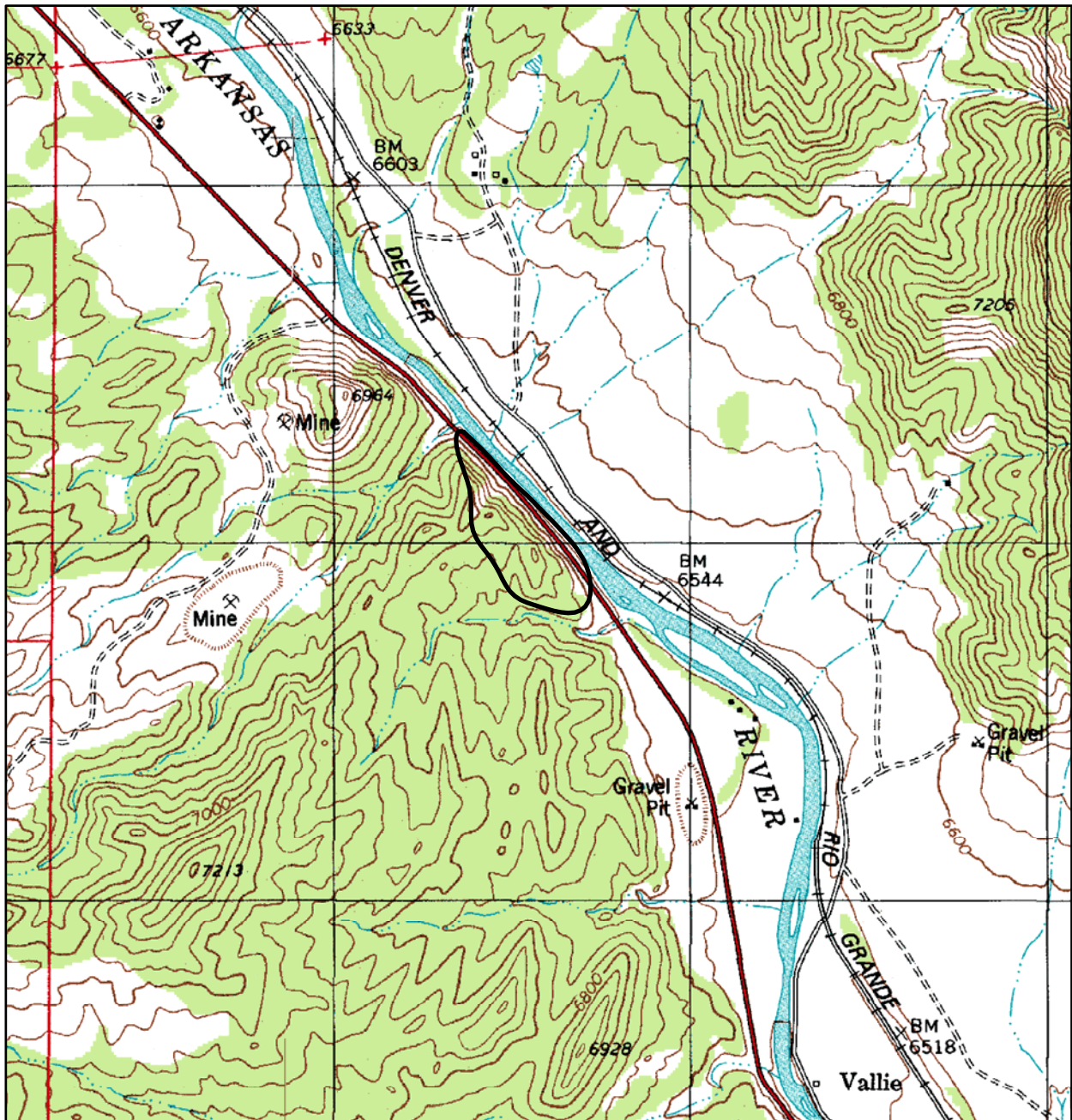
Arkansas Canyon stickleaf is on the BLM sensitive species list.


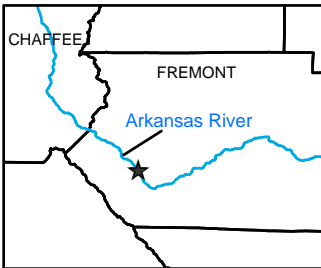
**Management Urgency Rank Comments (M3):** Evidence of threats and disturbance: there are individuals that have established adjacent to the highway (dropped from natural habitat above) that would be susceptible to any roadside pesticide applications--herbicides or insecticides. Exotic species along roadside: Russian thistle (*Kochia scoparia*), mullein (*Verbascum thapsus*), smooth brome (*Bromus inermis*), and Canada thistle (*Cirsium canadensis*).

**Exotic Species Comments:** Exotic species along roadside: *Kochia scoparia*, *Verbascum thapsus*, *Bromus inermis* and *Cirsium canadensis*.

**Version Author:** Neid, S.L.

**Version Date:** 03/13/2007



<p>Colorado Natural Heritage Program          Colorado State University          254 General Services Building          8002 Campus Delivery          Fort Collins, CO 80523-8002</p> <p>Ph (970) 491-1309          Fax (970) 491-3349  <a href="http://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a></p> <p>Map Date: 04/02/2007</p>	<p><b>Legend</b></p> <p> PCA Boundary</p> <p>Howard, 38105-D7</p> <p>7.5 Minute Digital Raster          Graphic produced by the          U.S. Geological Survey</p>	<p>Location in the          Arkansas Canyon</p> 
--	--	---

Map 11. Vallie Potential Conservation Area, B3: High Biodiversity Significance

**Appendix D is not available.**