

Survey of Critical Biological Resources Chaffee County, Colorado 2009



Survey of Critical Biological Resources, Chaffee County, Colorado

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EXECUTIVE SUMMARY

In 2008, Chaffee County contracted with Colorado State University and the Colorado Natural Heritage Program (CNHP) to survey for critical biological resources in Chaffee County with funding provided by Chaffee County, Great Outdoors Colorado, Colorado Division of Wildlife, and the Bureau of Land Management. A wetland and riparian survey was conducted concurrently with funding provided by the Colorado Department of Natural Resources via a U.S. Environmental Protection Agency, Region 8 Wetland Program Grant. The purpose of this project was to provide a data resource for managers, planners, and the citizens of Chaffee County for conducting proactive planning. This document should be considered a tool for managing lands that support rare, imperiled and/or sensitive plants, animals, and significant plant communities.

The goal of the project was to systematically identify the locations of rare species and significant natural plant communities. This project will provide an additional data resource for Chaffee County's Comprehensive Plan (2000). The Comprehensive Plan identified two key goals regarding natural and cultural resources and open space:

- 1) Improve County land use regulations to protect air/water quality, scenic areas, historic and cultural resources, and wildlife habitat,
- 2) Develop incentives as well as regulations to help protect river corridors, wildlife habitat, agricultural lands, and ranching.

A survey conducted concurrently with the Comprehensive Plan, resulted in an impressive 77% of survey respondents indicating that wildlife habitat should be given priority in the protection of open space. Even more, 79% said protection of river corridors and wetlands was critical. Sixty three percent of all respondents support stronger county land use regulations to accomplish these goals, and 70% supported economic incentives for ranchers to protect open space.

In May 2008, CNHP and its stakeholders identified potential areas for significant plants, animals, wetlands, and upland plant communities. Areas that were expected to contain significant elements were delineated as "Targeted Inventory Areas" (TIAs). These areas were prioritized for survey based on the relative rarity of the elements expected to be found there and the area's ability to maintain viable populations of those elements. Field surveys were conducted within the TIAs and those areas found to contain significant elements were delineated as "Potential Conservation Areas" (PCAs).

Results of the survey confirm that there are many areas with outstanding to high biological significance in Chaffee County. There are several extremely rare plants and animals that depend on these areas for survival. All together, 38 rare or imperiled plant species, 8 rare or imperiled animal species, and 29 wetland and upland plant communities of concern were documented in Chaffee County. Natural history summaries for select plants, animals, and plant communities are presented in the final section of this report. Despite a very successful and productive field season, it is likely that some elements that are present in the County were not documented, due to either lack of access, phenology (reproductive timing) of species or time constraints.

CNHP has identified 51 PCAs in Chaffee County. Of the 51 PCAs presented in this report, three are of outstanding biodiversity significance (B1), 13 are of very high significance (B2), 27 are of high significance (B3), six are of moderate biodiversity (B4), and two are of general biodiversity

significance (B5). These PCAs represent the best examples of targeted species and plant communities and their ecological processes observed on the private and public lands that were visited. There are three Potential Conservation Areas (PCA) ranked with an Outstanding Biodiversity Significance (B1) due to the rarity and/or excellent condition of a species. The Middle and South Cottonwood Creek PCA is Colorado's best breeding site for the State Endangered (G4T1QS1) Western Toad (*Bufo boreas*). The Castle Gardens and Droney Gulch PCAs are also ranked as outstanding due to the documentation of the critically imperiled (G1G2S1S2) Brandegees wild buckwheat (*Eriogonum brandegeei*), a Colorado endemic and Fendler's townsend-daisy (*Townsendia fendleri*) (G2S2), a regional endemic. The project increased the number of PCAs from 26 to 51, added 59 new element occurrences and updated 34 known occurrences. The information from the survey is already being used by several land trusts to establish conservation easements for private properties. *The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of all activity.*

Chaffee County is truly unique with an amazing richness of rare fauna and flora well worth preserving for future generations. The diversity of species and plant communities that range from alpine tundra to ancient bristlecone pine forests to badlands and hoodoos to the Arkansas River substantiate the important contribution of the County to the biodiversity of both Colorado and the World. Overall, the concentration and quality of imperiled species and habitats attest to the fact that conservation efforts in Chaffee County will have both statewide and global significance. The final report and PCAs of the survey will be provided to the stakeholders and will be available to the public on the CNHP website (www.cnhp.colostate.edu).

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	III
ACKNOWLEDGEMENTS	V
TABLE OF CONTENTS	VI
LIST OF TABLES	IX
LIST OF FIGURES	IX
LIST OF MAPS.....	IX
INTRODUCTION.....	1
RECOMMENDED CONSERVATION STRATEGIES	3
THE NATURAL HERITAGE NETWORK RANKING SYSTEM.....	7
What is Biological Diversity?.....	8
Colorado Natural Heritage Program	9
The Natural Heritage Ranking System	10
Legal Designations for Rare Species.....	12
Element Occurrences and their Ranking	14
Potential Conservation Areas	15
Off-Site Considerations.....	15
Ranking of Potential Conservation Areas	16
Protection Urgency Ranks.....	16
Management Urgency Ranks	17
WETLAND DEFINITIONS, REGULATIONS, AND CONDITION ASSESSMENT	18
Wetland Definitions	18
Wetland Regulation in Colorado	18
Wetland Mapping in Colorado.....	19
Colorado Division of Wildlife Riparian Maps	19
Wetland Functions and Ecological Services.....	20
Wetland Condition Assessment	20
PROJECT BACKGROUND.....	22
Location of the Study Area	22
Ecoregions.....	22
Hydrology	23
Geology.....	24
Soils	25
Climate.....	26
Population	26
Land Ownership.....	26

Ecological Systems	27
Colorado Plateau Pinyon-Juniper Woodland and Shrubland	28
Inter-Mountain Basins Big and Montane Sagebrush Shrubland	28
Rocky Mountain Aspen Forest and Woodland	29
Rocky Mountain Gambel Oak Mixed Montane Shrubland.....	29
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	30
Rocky Mountain Montane-Subalpine Grassland.....	31
Rocky Mountain Lower Montane-Foothill Shrubland	31
Inter-Mountain Basins Greasewood Flat.....	31
Rocky Mountain Subalpine-Montane Riparian Woodland and Shrubland	32
Flora	32
Fauna	33
Amphibians of Concern in Chaffee County.....	35
CONSERVATION ASSESSMENT	36
Potential Impacts to Biological Diversity in Chaffee County	36
Hydrological Modifications	36
Climate Change	37
Recreation.....	37
Livestock Grazing	38
Fragmentation and Edge Effects	38
Non-native Species.....	39
METHODS	40
Collect Available Information	40
Identify rare or imperiled species and significant plant associations with potential to occur in Chaffee County.....	40
Identify Targeted Inventory Areas.....	40
Contact Landowners	41
Conduct Field Surveys and Gather Data.....	41
Delineate Potential Conservation Area Boundaries.....	43
RESULTS	44
Significant Elements in Chaffee County.....	49
SITES OF BIODIVERSITY SIGNIFICANCE	54
B1: Outstanding Biodiversity Significance	
Castle Gardens PCA	58
Droney Gulch PCA.....	61
Middle and South Cottonwood Creeks PCA	65
B2: Very High Biodiversity Significance	
Arkansas River at Pine Creek PCA	69
Browns Canyon on Arkansas River PCA	74
Cougar Springs PCA.....	78
County Line PCA.....	81
Droney Gulch and Squaw Creek PCA.....	84
Harrington Gulch PCA	87
Hecla Junction PCA.....	90

King Gulch PCA.....	93
Mount Princeton	96
Pass Creek PCA	100
Ruby Mountain PCA.....	103
Tenderfoot Hill PCA.....	106
Thremile Creek PCA.....	109

B3: High Biodiversity Significance

Boss Lake Reservoir PCA	112
Buffalo Meadows PCA.....	115
Cache Creek PCA	119
Chalk Creek PCA.....	122
Chalk Creek Headwaters PCA.....	127
Chubb Park PCA.....	132
Cottonwood Pass PCA.....	135
Dry Creek at Maxwell Park PCA.....	138
Fourmile Creek at Annie Mine PCA	141
Grizzly Gulch PCA.....	144
Huron Peak PCA.....	149
La Plata Gulch PCA.....	152
Low Pass Gulch at Arkansas River PCA.....	157
Maxwell Creek PCA.....	160
Methodist Mountain PCA.....	164
Middle Clear Creek Canyon PCA.....	167
Missouri Mountain Complex PCA	173
Monarch Pass PCA	177
Mount Shavano PCA	180
Mount Yale PCA.....	183
Mounts Harvard and Columbia PCA.....	186
Red Deer and Mercury Creeks PCA.....	189
Romley PCA	194
Sawmill Gulch PCA.....	199
Sevenmile Gulch PCA	204
Spout Lake PCA	210
Upper Clear Creek Canyon PCA	214

B4: Moderate Biodiversity Significance

Collegiate Peaks View Area PCA.....	219
Limestone Ridge PCA	222
Little Cochetopa Creek PCA	225
McGee Gulch PCA	228
Poncha Hot Springs PCA.....	234
Upper Morgans Gulch PCA.....	237

B5: General Biodiversity Interest

Cleora North PCA.....	240
Maxwell Park PCA	243

NATURAL HISTORY INFORMATION FOR PLANT COMMUNITIES ASSOCIATED WITH POTENTIAL CONSERVATION AREAS IN CHAFFEE COUNTY.....	246
NATURAL HISTORY INFORMATION FOR PLANT SPECIES ASSOCIATED WITH POTENTIAL CONSERVATION AREAS IN CHAFFEE COUNTY.....	380
NATURAL HISTORY INFORMATION FOR ANIMAL SPECIES ASSOCIATED WITH POTENTIAL CONSERVATION AREAS IN CHAFFEE COUNTY.....	443
LITERATURE CITED	454

LIST OF TABLES

Table 1. Definition of Natural Heritage Imperilment Ranks.	12
Table 2. Federal and State Agency Special Designations for Rare Species.	13
Table 3. Element Occurrence Ranks and their Definitions.....	14
Table 4. Natural Heritage Program Biological Diversity Ranks and their Definitions.	16
Table 5. Natural Heritage Program Protection Urgency Ranks and their Definitions.....	17
Table 6. Natural Heritage Program Management Urgency Ranks and their Definitions	17
Table 7. List of Ecological Systems in Chaffee County.....	28
Table 8. Colorado Natural Heritage Elements Known From Chaffee County ..	49
Table 9. Potential Conservation Areas in Chaffee County.....	55

LIST OF FIGURES

Figure 1. Status map for CNHP Survey of Biological Resources.	1
Figure 2. Location of Chaffee County, CO.....	22
Figure 3. Colorado Ecoregions.	22
Figure 4. Major Watersheds in Chaffee County.	23
Figure 5. Geology in Chaffee County.....	24
Figure 6. Annual Precipitation in Chaffee CO.....	26
Figure 7. Land Ownership in Chaffee County.....	26
Figure 8. Ecological Systems in Chaffee County.	27
Figure 9. Western toad breeding locations in Chaffee CO.	35

LIST OF MAPS

Map 1 Targeted Inventory Areas in Chaffee County.....	46
Map 2 Potential Conservation Areas in Chaffee County before 2008 Survey	47
Map 3 Potential Conservation Areas in Chaffee County	48
Map 4 Castle Gardens	58
Map 5 Droney Gulch	60
Map 6 Middle and South Cottonwood Creeks.....	68

Map 7 Arkansas River at Pine Creek	73
Map 8 Browns Canyon on Arkansas River.....	77
Map 9. Cougar Springs	80
Map 10 County Line	83
Map 11 Droney Gulch and Squaw Creek	86
Map 12 Harrington Gulch	89
Map 13 Hecla Junction	91
Map 14 King Gulch	95
Map 15 Mount Princeton	99
Map 16 Pass Creek.....	102
Map 17 Ruby Mountain	105
Map 18 Tenderfoot Hill	108
Map 19 Threemile Creek	111
Map 20 Boss Lake Reservoir	114
Map 21 Buffalo Meadows	118
Map 22 Cache Creek.....	121
Map 23 Chalk Creek.....	126
Map 24 Chalk Creek Headwaters	131
Map 25 Chubb Park	134
Map 26 Cottonwood Pass	137
Map 27 Dry Creek at Maxwell Park.....	140
Map 28 Fourmile Creek at Annie Mine.....	143
Map 29 Grizzly Gulch	148
Map 30 Huron Peak	151
Map 31 La Plata Gulch.....	156
Map 32 Low Pass Gulch at Arkansas River	159
Map 33 Maxwell Creek	163
Map 34 Methodist Mountain	166
Map 35 Middle Clear Creek Canyon.....	172
Map 36 Missouri Mountain Complex.....	176
Map 37 Monarch Pass.....	179
Map 38 Mount Shavano.....	182
Map 39 Mount Yale	185
Map 40 Mounts Harvard and Columbia	188
Map 41 Red Deer and Mercury Creeks	193
Map 42 Romley.....	190
Map 43 Sawmill Gulch	203
Map 44 Sevenmile Gulch.....	209
Map 45 Spout Lake.....	213
Map 46 Upper Clear Creek Canyon.....	218
Map 47 Collegiate Peaks View Area.....	221
Map 48 Limestone Ridge.....	224
Map 49 Little Cochetopa Creek.....	228
Map 50 McGee Gulch.....	233
Map 51 Poncha Hot Springs	236
Map 52 Upper Morgans Gulch	239

Map 53 Cleora North	242
Map 54 Maxwell Park.....	245

INTRODUCTION

Chaffee County is in the heart of the Rocky Mountains within central Colorado and the Upper Arkansas River watershed. The Arkansas River is among the most popular recreation areas in the United States for river-rafting, fishing, wildlife viewing, and rock hounding. The river use alone draws more than half a million tourists and recreationists every summer and those numbers are steadily increasing. Additionally, hiking, bicycling, mountaineering, hunting and skiing draw hundreds of thousands of visitors each year (Arkansas Valley Publishing 2009).

Over the years the County's economy has seen a shift from an agriculture base towards tourism and recreation. Additionally, there has been a significant increase in the numbers of retirement and second home ownership in the past decade, with expectations that this will only increase as the baby boomers reach retirement age. Both the recreational and wildlife resources serve as major economic assets that attract tourists as well as new residents. Pro-active and informed planning decisions are necessary so that the unique natural resources, rural and agricultural character and culture of Chaffee County are preserved. Therefore, the need to retain the intrinsic values of the landscape that provide both economic assets and environmental qualities for County residents and visitors is essential. The Colorado Natural Heritage Program (CNHP) approached this project with the intent of addressing this need.

This survey of critical biological resources, including wetland and riparian areas of Chaffee County is part of the ongoing biological surveys of Colorado counties conducted by CNHP since 1992. To date, similar surveys have been conducted in all or parts of 32 Colorado counties (Figure 1). In 2008 Chaffee County and its stakeholders contracted with Colorado State

University and CNHP to identify biologically significant areas within Chaffee County.

Identification of sites containing natural heritage resources will allow conservation of these resources for future generations, and proactive planning to avoid land use conflicts in the future.

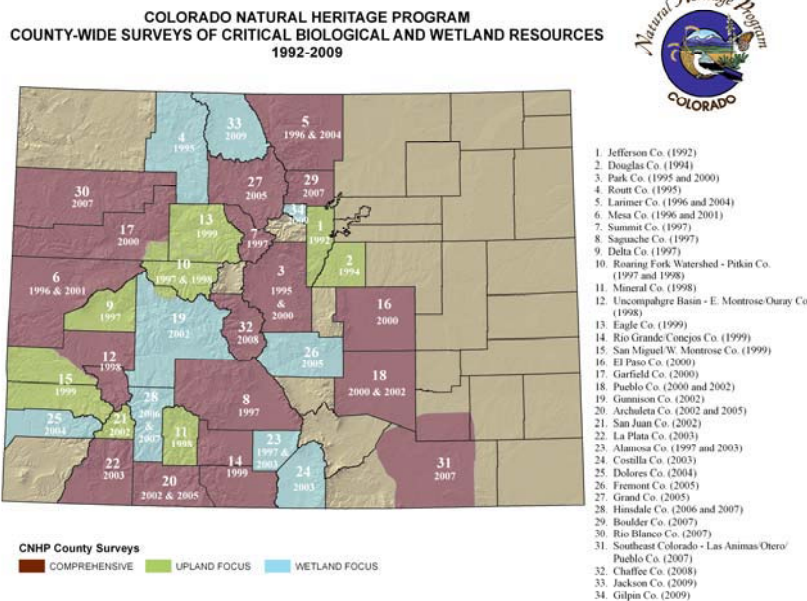


Figure 1. Status map for CNHP Survey of Biological Resources.

This *Survey of Critical Biological Resources in Chaffee County* used the methods that are employed worldwide throughout Natural Heritage Programs and Conservation Data Centers. The

primary focus was to identify the locations of the plant and animal populations and plant communities on CNHP's list of rare and imperiled elements of biodiversity, assess their conservation value, and systematically prioritize these for conservation action.

The locations of biologically significant areas were identified by:

- Examining existing biological data for rare or imperiled plant and animal species and significant plant communities (collectively called **elements**);
- Accumulating additional existing information (e.g., interviews of local experts); and
- Conducting extensive field surveys.

Locations in the county with natural heritage significance (those places where elements have been documented) are presented in this report as Potential Conservation Areas (PCAs). The goal is to identify a land area that can provide the habitat and ecological needs upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, and current and potential land uses to delineate PCA boundaries.

The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of all activity. It is hypothesized that some activities will prove degrading to the element(s) or the ecological processes on which they depend, while others will not. The boundaries represent the best professional estimate of the primary area supporting the long-term survival of the targeted species or plant communities and are presented for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection of natural heritage resources and sensitive species. Please note that these boundaries are based primarily on our understanding of the ecological systems. A thorough analysis of the human context and potential stresses was not conducted. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

CNHP uses the Heritage Ranking Methodology to prioritize conservation actions by identifying those areas that have the greatest chance of conservation success for the most imperiled elements. The sites are prioritized according to their **biodiversity significance rank**, or "B-rank," which ranges from B1 (outstanding significance) to B5 (general or statewide significance). These ranks are based on the conservation (imperilment or rarity) ranks for each element and the element occurrence ranks (viability rank) for that particular location. Therefore, the highest quality occurrences (those with the greatest likelihood of long-term survival) of the most imperiled elements are the highest priority (receive the highest B-rank). The B1-B3 sites are the highest priorities for conservation actions (due to limited resources, only the B1-B3 PCAs are presented in the report). Based on current knowledge, the sites in this report represent areas CNHP recommends for protection in order to preserve the natural heritage of Chaffee County. In addition to presenting prioritized PCAs, this report also includes a section with summaries of selected plants, animals, and plant communities that are known to be found within the PCAs.

RECOMMENDED CONSERVATION STRATEGIES

Conservation Strategies can be classified as three major types:

1. Land protection accomplished through conservation easements, land exchanges, long term leases, purchase of mineral or grazing rights, acquisition, or government regulation;
2. Management of the land influenced so that significant resources are protected; and
3. Public education about the significant ecological values of the County to engender support for land use decisions that protect these values.

The first step in facilitating any of the conservation strategies suggested above is to identify the significant elements of biodiversity and their locations in the County. This report and the accompanying GIS data provide information necessary for this first step. The next step is to use this information to conserve these elements and the areas that support them. The PCA descriptions within this report provide protection and management suggestions for most areas identified during the inventory. However, some general recommendations for conservation of biological diversity in Chaffee County are given here.

1). Develop and implement a plan for protecting the Potential Conservation Areas profiled in this report, with most attention directed toward areas with a biodiversity rank of B1, B2 and B3. The PCAs in this report provide a basic framework for implementing a comprehensive conservation program. The B1, B2 and B3 sites, because they have global biological significance, are in need of priority attention. Consider incentive-based programs such as purchasing development rights or outright purchase from willing owners of land for significant sites that are in need of protection. Support local organizations, such as land trusts, in purchasing or acquiring conservation easements for protection of biological diversity or open space. Explore opportunities to form partnerships to access state and federal funding for conservation projects, such as those offered through the Colorado Division of Wildlife or the Farm Bill. Continue to promote cooperation among local entities to preserve the County's biodiversity. Encourage County leadership to institutionalize consideration of significant biological resources in land use planning.

2). Use this report in the review of proposed activities in or near Potential Conservation Areas to determine whether or not activities adversely affect elements of biodiversity. All of the PCAs presented contain elements of biodiversity of state or global significance. Weighing the biodiversity represented by PCAs should allow planners and biologists to consider natural resource conservation when making land use decisions.

Certain land uses on or near a site may affect the element(s) present there. Range-restricted species may be especially vulnerable to habitat destruction, while wetland and riparian areas are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large change. As proposed land use changes are considered, they should be compared to the maps presented herein (also available in GIS format). If a proposed project has the potential to impact a site, planning personnel should contact persons, organizations, or agencies with the appropriate biological expertise for input in the planning process. CNHP routinely conducts site-specific environmental reviews and should be considered

a valuable resource. Also, CNHP is continually updating biodiversity data throughout the state and can provide up-to-date information in the area of concern. To contact CNHP's Environmental Review Coordinator call (970) 491-7331. Other key partners, such as the Colorado Division of Wildlife, can be a valuable resource as well, particularly in evaluating potential impacts to biological resources not tracked by CNHP (e.g., game and fish species).

3). Recognize the importance of larger, contiguous natural communities. While the PCAs identified in this report contain known locations of significant elements of natural diversity, protection of large areas in each vegetation type, especially where these are connected, may ensure that we do not lose species that have not yet been located. Work to protect large blocks of land in each of the major vegetation types in the County, and avoid fragmenting large natural areas unnecessarily with roads, trails, etc. Although large migrating animals like deer and elk are not tracked by CNHP as rare species, they are part of our natural diversity, and their needs for winter range and access to protected corridors to food and water should be taken into consideration.

Fragmentation of the landscape also affects smaller animals and plants, opening more edge habitats and introducing exotic species. Encourage cluster developments that designate large common areas for preservation of natural communities, as an alternative to scattering residences over the landscape with a house on each 35-acre parcel. Work with developers early in the planning process to educate them about the benefits of retaining natural areas. Locate trails and roads to minimize impacts on native plants and animals. See Forman and Alexander (1998) for an excellent review of the literature on the ecological effects of roads. See *Planning Trails with Wildlife in Mind* published by the State Trails Program (CDNR 1998) for suggestions regarding planning trails with minimum impacts to wildlife.

4). Increase efforts to protect biodiversity by promoting cooperation and incentives among landowners, pertinent government agencies, and non-profit conservation organizations. Involve all stakeholders in land use planning. The long-term protection of natural diversity in Chaffee County will be facilitated by the cooperation of private landowners, businesses, government agencies, and non-government organizations. Efforts to provide stronger ties among federal, state, local, and private interests involved in the protection or management of natural lands will increase the chance of success. By developing incentives that encourage biodiversity considerations in land-use planning, the likelihood of conserving biodiversity should increase. Such incentives will make planning for conservation a higher priority for private and public entities. Suggested entities include, but are not limited to, Land Trust of the Upper Arkansas <http://www.ltua.org/>, Colorado Cattleman's Agriculture Land Trust <http://www.coloradocattle.org/default.aspx>, and Colorado Natural Areas <http://parks.state.co.us/NaturalResources/CNAP/AboutCNAP/>.

5). Promote wise management of the biodiversity resources that exist within Potential Conservation Areas. Development of a site-specific conservation plan is a necessary component of the long-term protection of a PCA. Because some of the most serious impacts to Chaffee County's ecosystems are at a large scale (e.g., altered hydrology, residential encroachment, and non-native species invasion), considering each area in the context of its surroundings is critical. Several organizations and agencies are available for consultation in the development of

conservation plans, including CNHP, CDOW, Natural Resources Conservation Service, The Nature Conservancy, and various academic institutions. With the current rate of population growth in Colorado, rare and imperiled species will likely decline if not given appropriate protection or management attention. Coordinate with managers of public parks or other public lands that support sensitive biological resources. Engage local citizens, groups, and organizations (e.g., schools, 4-H clubs, Colorado Native Plant Society, Audubon) in assisting with management and monitoring projects on public lands. Make a concerted effort to involve individual landowners in conservation dialogue, as applicable.

6). Stay informed and involved in public land management decisions. Approximately 81% of Chaffee County is publicly owned. The Bureau of Land Management owns 9%, the Forest Service owns approximately 69%, and the State of Colorado collectively owns 3%. Many of the PCAs in Chaffee County are on public land and may be protected from development, but not from incompatible uses. Even ownership is not always secure, since federal and state agencies are becoming more and more involved in land exchanges. Encourage protection for the most biologically significant sites on public lands by implementing compatible management activities designated in Forest Management Plans, Grazing Management Plans, etc.

7). Continue inventories and monitoring where necessary, including inventories for species that cannot be surveyed adequately in one field season and continue inventories on lands that CNHP could not access in 2008. Not all targeted inventory areas can be surveyed in one field season due to several factors, including lack of access, phenology of species, or time constraints. Because some species are ephemeral or migratory, completing an inventory in one field season is often difficult. Despite the best efforts during one field season, it is likely that some elements were not documented during the survey. Thus, it is recommended that this report and the data included within it serve as a guide for subsequent surveys of Chaffee County. Monitoring rare elements is recommended to track trends.

8). Continue to take a proactive approach to weed and exotic species control. Recognize that weeds affect both agriculture and native plant communities. Discourage the introduction and/or sale of non-native species that are known to significantly impact natural areas. These include, but are not limited to, exotic, invasive species such as tamarisk, Russian olive, yellow toadflax, purple loosestrife, and stocking of non-native fish species. Further, natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties. Enforce the use of weed-free forage on horse trails, campgrounds, and at trailheads. Encourage the use of native species for revegetation and landscaping efforts. Ideally, seed should be locally harvested. This includes any seeding done on County road right-of-ways. Refer to the Chaffee County Weeds Department for assistance on identifying and eradicating weeds <http://www.chaffeecounty.org/Page.aspx?PageID=286>. The Colorado Natural Areas Program has published a book entitled *Native Plant Revegetation Guide for Colorado* that describes appropriate species to be used for revegetation and an Integrated Weed Management Plan. These resources are available at <http://parks.state.co.us/NaturalResources/CNAP/Publications/>.

9). Encourage public education functions and publications. A significant early step in the process of conserving biodiversity is educating local citizens and other stakeholders on the value that such areas offer the public. As described in this report, Chaffee County is rich in animal and

plant diversity. Conveying the value and function of these habitats and the species that inhabit them to the public can generate greater interest in conserving lands. Conducting forums or presentations that highlight the biodiversity of Chaffee County should increase awareness of the uniqueness of the habitats within the County. Similarly, providing educational pamphlets or newsletters that explain why these areas are so valuable can increase public interest and support for biodiversity conservation. Consider developing a community conservation website to provide information on natural resource, biological diversity, and conservation opportunities in Chaffee County. Enlist the assistance of local media in public education efforts.

10). Develop and implement comprehensive program to address loss of wetlands. In conjunction with the information contained in this report, information regarding the degree and trend of loss for all wetland types (i.e., emergent marshes, riparian shrublands and forests, seeps/springs, etc.) should be sought and utilized to design and implement a comprehensive approach to the management and protection of Chaffee County wetlands. See the Colorado State Parks Best Management Practices for Wetlands <http://parks.state.co.us/NaturalResources/CNAP/Publications/> Encourage and support statewide wetland protection efforts such as the Colorado Division of Wildlife's Wetlands Program <http://wildlife.state.co.us/LandWater/WetlandsProgram/>. County governments are encouraged to support research efforts on wetlands to aid in their conservation. Countywide education on the importance of wetlands could be implemented through the County extension service or other local agencies. Encourage communication and cooperation with landowners regarding protection of wetlands in Chaffee County.

THE NATURAL HERITAGE NETWORK RANKING SYSTEM

Just as ancient artifacts and historic buildings represent our cultural heritage, a diversity of plant and animal species and their habitats represent our “natural heritage.” Colorado’s natural heritage encompasses a wide variety of ecosystems from tall grass prairie and short grass high plains to alpine cirques and rugged peaks, from canyon lands and sagebrush deserts to dense subalpine spruce-fir forests and wide-open tundra.

These widely diversified habitats are determined by water availability, temperature extremes, altitude, geologic history, and land use history. The species that inhabit each of these ecosystems have adapted to the specific set of conditions found there. Because human influence today touches every part of the Colorado environment, we are responsible for understanding our impacts and carefully planning our actions to ensure our natural heritage persists for future generations.

Some generalist species, like house finches, have flourished over the last century, having adapted to habitats altered by humans. However, many other species are specialized to survive in vulnerable Colorado habitats; among them are Bell’s twinpod (a wildflower), the greenback cutthroat trout, and the Pawnee montane skipper (a butterfly). These species have special requirements for survival that may be threatened by incompatible land management practices and competition from non-native species. Many of these species have become imperiled not only in Colorado, but also throughout their range of distribution. Some species exist in less than five populations in the entire world. The decline of these specialized species often indicates disruptions that could permanently alter entire ecosystems. Thus, recognition and protection of rare and imperiled species is crucial to preserving Colorado’s diverse natural heritage.

Colorado is inhabited by some 800 vertebrate species and subspecies, and tens of thousands of invertebrate species. In addition, the state has approximately 4,300 species of plants and more than 450 recognized plant communities that represent terrestrial and wetland ecosystems. It is this rich natural heritage that has provided the basis for Colorado’s diverse economy. Some components of this heritage have always been rare, while others have become imperiled with human-induced changes in the landscape. This decline in biological diversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that Wilson (1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biological diversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biological diversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically based approach to preserving biological diversity Dr. Robert Jenkins of The Nature Conservancy pioneered the Natural Heritage Methodology in the early 1970s.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of

imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as its biology and known threats. By ranking the relative rarity or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community realized that plant communities are equally important as individual species, this methodology has been applied to ranking and preserving rare plant communities, as well as the best examples of common communities.

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. The 85 Natural Heritage Network data centers are located in each of the 50 U.S. states, 11 Canadian provinces and territories, and many countries and territories in Latin America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

What is Biological Diversity?

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from single-celled organisms such as bacteria and protists through the multicellular kingdoms of plants and animals. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions between these levels. All levels are necessary for the continued survival of species and plant communities, and many are important for the well being of humans.

The biological diversity of an area can be described at four levels:

Genetic Diversity — the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species varies between populations within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. Once lost, this unique genetic information cannot be reclaimed.

Species Diversity — the total number and abundance of plant and animal species and subspecies in an area.

Community Diversity — the variety of plant communities within an area that represent the range of species relationships and inter-dependence. These communities may be diagnostic of or even restricted to an area.

Landscape Diversity — the type, condition, pattern, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct

ecosystems, such as a riparian corridor meandering through short grass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region.

The conservation of biological diversity should include all levels of diversity: genetic, species, community, and landscape. Each level is dependent on the other levels and inextricably linked. In addition and all too often omitted, humans and the results of their activities are also closely linked to all levels of this hierarchy and are integral parts of most landscapes. We at the Colorado Natural Heritage Program believe that a healthy natural environment and a healthy human environment go hand in hand, and that recognition of the most imperiled species is an important step in comprehensive conservation planning.

Colorado Natural Heritage Program

To place this document in context, it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP). CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in the Colorado Division of Parks and Outdoor Recreation for 14 years, the Program was relocated to the University of Colorado Museum in 1992, and then to the Warner College of Natural Resources at Colorado State University in 1994, where it has operated since.

The multi-disciplinary team of scientists, planners, and information managers at CNHP gathers comprehensive information on the rare, threatened, and endangered species and significant plant communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Data maintained in CNHP database are an integral part of on-going research at Colorado State University and reflect the observations of many scientists, institutions and our current state of knowledge. These data are acquired from various sources, with varying levels of accuracy, and are continually updated and revised. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists.

All Natural Heritage Programs house data about imperiled species and are implementing use of the Biodiversity Tracking and Conservation System (BIOTICS) developed by NatureServe. This database includes taxonomic group, global and state rarity ranks, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. BIOTICS also has an ArcView based mapping program for digitizing and mapping occurrences of rare plants, animals, and plant communities. These rare species and plant communities are referred to as “elements of natural diversity” or simply “elements.”

Concentrating on site-specific data for each element enables CNHP to evaluate the significance of each location for the conservation of biological diversity in Colorado and in the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established to guide conservation action. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

To assist in biological diversity conservation efforts, CNHP scientists strive to answer questions like the following:

- What species and ecological communities exist in the area of interest?
- Which are at greatest risk of extinction or are otherwise significant from a conservation perspective?
- What are their biological and ecological characteristics, and where are these priority species or communities found?
- What is the species' condition at these locations, and what processes or activities are sustaining or threatening them?
- Where are the most important sites to protect?
- Who owns or manages those places deemed most important to protect, and what may be threatening the biodiversity at those places?
- What actions are needed for the protection of those sites and the significant elements of biological diversity they contain?
- How can we measure our progress toward conservation goals?

CNHP has effective working relationships with several state and federal agencies, including the Colorado Department of Natural Resources, the Colorado Division of Wildlife, the Bureau of Land Management, and the U.S. Forest Service. Numerous local governments and private entities, such as consulting firms, educators, landowners, county commissioners, and non-profit organizations, also work closely with CNHP. Use of the data by many different individuals and organizations encourages a cooperative and proactive approach to conservation, thereby reducing the potential for conflict.

The Natural Heritage 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 deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population 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 imperiled 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 1.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. As noted in Table 1, ranks followed by a "B," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Table 1. Definition of Natural Heritage Imperilment Ranks.

G/S1	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.
G/S2	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.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G/S4	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.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but usually not verified for an extended period of time.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not residents.
S#N	Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ	Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SA	Accidental in the state.
SR	Reported to occur in the state but unverified.
S?	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.

Legal Designations for Rare Species

Natural Heritage imperilment ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Table 2. Federal and State Agency Special Designations for Rare Species.

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
PDL	Proposed for delisting.
XN	Nonessential experimental population.
2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as S’)	
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: Significant current or predicted downward trends in population numbers or density. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as “S”)	
BLM	Sensitive: those species found on public lands designated by a State Director that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.
4. State Status:	
The Colorado Division of Wildlife has developed categories of imperilment for non-game species (refer to the Colorado Division of Wildlife’s Chapter 10 – Nongame Wildlife of the Wildlife Commission's regulations). The categories being used and the associated CNHP codes are provided below.	
E	Endangered: those species or subspecies of native wildlife whose prospects for survival or recruitment within this state are in jeopardy, as determined by the Commission.
T	Threatened: those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or survival that they may become extinct.
SC	Special Concern: those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or are a federal listing “candidate species”) and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado.

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. Takes into account factors 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 such factors 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 3.

Table 3. Element Occurrence Ranks and their Definitions.

A	Excellent viability.
B	Good viability
C	Fair viability.
D	Poor viability.
H	Historic: known from historical record, but not verified for an extended period of time.
X	Extirpated (extinct within the state).
E	Extant: the occurrence does exist but not enough information is available to rank.
F	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 4 for a summary of these B-ranks.

Table 4. Natural Heritage Program Biological Diversity Ranks and their Definitions.

B1	<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>
B2	<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>
B3	<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>
B4	<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>
B5	<p>General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species.</p>

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 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 5 summarizes the P-ranks and their definitions.

Table 5. Natural Heritage Program Protection Urgency Ranks and their Definitions

P1	Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.
P2	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.
P3	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.
P4	No protection actions are needed in the foreseeable future.
P5	Land protection is complete and no protection actions are needed.

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 6 summarizes M-ranks and their definitions.

Table 6. Natural Heritage Program Management Urgency Ranks and their Definitions

M1	Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
M2	New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
M3	New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
M4	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.
M5	No management needs are known or anticipated in the PCA.

WETLAND DEFINITIONS, REGULATIONS, AND CONDITION ASSESSMENT

Wetland Definitions

The federal regulatory definition of a jurisdictional wetland is found in the regulations used by the U.S. Army Corps of Engineers (Corps) for the implementation of a dredge and fill permit system required by Section 404 of the Clean Water Act Amendments (Mitsch and Gosselink 2007). According to the Corps, wetlands are “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” For Corps programs, a wetland boundary must be determined according to the mandatory technical criteria described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it must have all three of the following criteria: (1) wetland plants; (2) wetland hydrology; and (3) hydric soils.

The U.S. Fish and Wildlife Service defines wetlands from an ecological point of view. *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) states that “wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.” Wetlands must have *one or more* of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly undrained hydric soil; and/or (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

CNHP adheres to the wetland definition used by the U.S. Fish and Wildlife Service, because it recognizes that some areas display many of the attributes of wetlands without exhibiting all three characteristics required to fulfill the Corps’ criteria. For example, riparian areas, which often do not meet all three of the Corps’ criteria, perform many of the same functions as other wetland types, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity, especially in the western United States (National Research Council 1995). Thus, the U.S. Fish and Wildlife Service wetland definition is more suitable to CNHP’s objective of identifying ecologically significant wetlands.

Wetland Regulation in Colorado

Wetlands in Colorado are currently regulated under the authority of the Clean Water Act. A permit issued by the Corps is required before placing fill in a wetland and before dredging, ditching, or channelizing a wetland. The Clean Water Act exempts certain filling activities, such as normal agricultural activities.

The 404(b)(1) guidelines, prepared by the Environmental Protection Agency in consultation with the Corps, are the federal environmental regulations for evaluating projects that will impact wetlands. Under these guidelines, the Corps is required to determine if alternatives exist for minimizing or eliminating impacts to wetlands. When unavoidable impacts occur, the Corps

requires mitigation of the impacts. Mitigation may involve creation or restoration of similar wetlands in order to achieve an overall goal of no net loss of wetland area.

Colorado's state government has developed no guidelines or regulations concerning the management, conservation, and protection of wetlands, but a few county and municipal governments have, including the City and County of Boulder, Summit County, and San Miguel County. Chaffee County requires development to be set back from wetlands, rivers, streams, and other aquatic resources a minimum of 100 feet (Chaffee County Comprehensive Plan 2000).

Wetland Mapping in Colorado

National Wetland Inventory Maps

The U.S. Fish and Wildlife Service has conducted inventories of the extent and types of our nation's wetlands. The Cowardin et al. (1979) classification system provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). Photo-interpretation and field reconnaissance was used to refine wetland boundaries according to the wetland classification system. The information is summarized on 1:24,000 and 1:100,000 maps.

The NWI maps provide important and accurate information regarding the location of wetlands. They can be used to gain an understanding of the general types of wetlands in the county and their distribution. The NWI maps cannot be used for federal regulatory programs that govern wetlands for two reasons. First, the U.S. Fish and Wildlife Service uses a definition for a wetland that differs slightly from Corps, the agency responsible for executing federal wetland regulations. Secondly, there is a limit to the resolution of the 1:24,000 scale maps. For example, at this scale, the width of a fine line on a map represents about 5 m (17 ft) on the ground (Mitsch and Gosselink 2007). For this reason, precise wetland boundaries must be determined on a project-by-project basis.

Colorado Division of Wildlife Riparian Maps

The following sections are summarized from DOW's Riparian web page (<http://ndis1.nrel.colostate.edu/riparian/riparian.htm>):

Since 1990, the Colorado Division of Wildlife (DOW) has been involved with mapping riparian vegetation in the state. For Chaffee County, the DOW has completed approximately 68% <http://ndis1.nrel.colostate.edu/riparian/StatusMap.html>. The riparian mapping initially started out as a cooperative project with the Pike/San Isabel National Forest and Comanche/Cimarron National Grasslands in southern Colorado. As a result, an interagency cooperative project was developed that mapped approximately 200 USGS quadrangle maps over a six year period from 1990-1996.

The DOW uses NAPP (National Aerial Photography Program) aerial infrared photographs to map riparian vegetation. These photos are flown at a height of 20,000 feet and purchased from the USGS as a 9" x 9" film positive at a nominal scale of 1:40,000. These photos are obtained in stereo to allow for 3-D viewing that aids in the mapping process. Riparian vegetation is mapped on a 7.5' Quadrangle basis at a scale of 1:24,000. Approximately ten aerial photos per quad are needed for stereo overlay. Potential riparian habitats are not delineated. Mixed communities are

delineated when obvious spectral differences in vegetation can be discerned within a common area.

Wetland Functions and Ecological Services

Wetland functions are natural processes of wetlands that continue regardless of their perceived value to humans (Novitzki et al. 1996). These include;

- storage of water;
- transformation of nutrients;
- growth of living matter; and
- diversity of wetland plants.

Ecological services are the wetland functions that are valued by society (Millennium Ecosystem Assessment 2005). For example, biogeochemical cycling (which includes retention and supply) is an ecological function whereas nutrient removal/retention is an ecological service to society. Also, overbank flooding/subsurface water storage is an ecological function whereas flood abatement/flood-flow alteration is an important ecological service.

Ecological services are typically the value people place on wetlands that is the primary factor determining whether a wetland remains intact or is converted for some other use (National Audubon Society 1993). The actual value attached to any given function or value listed above depends on the needs and perceptions of society (National Research Council 1995).

Wetland Condition Assessment

For past county wetland survey and assessment projects, CNHP utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP ecologists while incorporating some of the principles of the hydrogeomorphic (HGM) assessment method. The assessment was used to provide a rapid determination of each wetland's functional integrity. This functional assessment method used various qualitative indicators of structure, composition, and land use to represent and estimate the degree to which a function was being performed. This, as well as most functional assessments, requires the following assumptions: (1) the combination of variables adequately represents the function and (2) their combination results in an estimated "amount" of the function being performed. The result is that most functional assessments are not rapid and do not directly measure functions (Cole 2006).

Condition assessments are 'holistic' in that they consider *ecological integrity* to be an "integrating super-function" (Fennessy et al. 2004). Condition assessments or ecological integrity assessments provide insight into the integrity of a wetland's natural ecological functions that are directly related to the underlying integrity of biotic and abiotic processes. In other words, a wetland with excellent ecological integrity will perform all of its functions at full levels expected for its wetland class or type. Ecological integrity assessments are simply concerned with measuring the condition of the wetland and assume that ecological functions follow a similar trend. This assumption may not be true for all functions, especially ecological services or those functions which provide specific societal value. For example, ecological services such as flood abatement or water quality improvement may still be performed even if ecological integrity has been compromised. However, given that CNHP is attempting to identify and prioritize ecologically significant wetlands it seemed more pertinent to focus the assessment on ecological

integrity or condition of each wetland rather than specific ecological functions, services or values.

The element occurrence rank (see CNHP methodology section, Table 3) used by CNHP is a rapid assessment of the condition of on-site and adjacent biotic and abiotic processes that support and maintain the element. This method was used to assess wetland condition for this report.

Recently, NatureServe and CNHP (Faber-Langendoen et al. 2005) revised this method making it more transparent and repeatable. The Vegetation Index of Biotic Integrity (VIBI) (Lemly and Rocchio 2009; Rocchio 2007) evaluates the biotic integrity of a wetland by measuring attributes of the plant composition known to respond to human disturbance. The Ecological Integrity Assessments Scorecards (Scorecard) is a conditional assessment of wetlands that identifies biotic and abiotic metrics to measure integrity (Rocchio 2006).

PROJECT BACKGROUND

Location of the Study Area

Chaffee County encompasses just over 1,000 square miles in central Colorado (Figure 2). The Sawatch Range, including the Continental Divide, makes up its western boundary and the Mosquito Range bounds it on the northeast. The Arkansas River originates in these mountain ranges and flows through the county in a southeast direction. The county's elevation ranges from around 6,900 feet in the southeast to 14,420 feet atop Mount Harvard in the Collegiate Peaks in the northwest. Fifteen fourteeners rise in the Sawatch Range, including the three highest peaks of the Rockies, more than any other range in the contiguous 48 states. The Collegiate Peaks are the most striking and prominent physical feature in the County. The Arkansas River is the other primary physical feature of the County, flowing down the Arkansas River Valley.

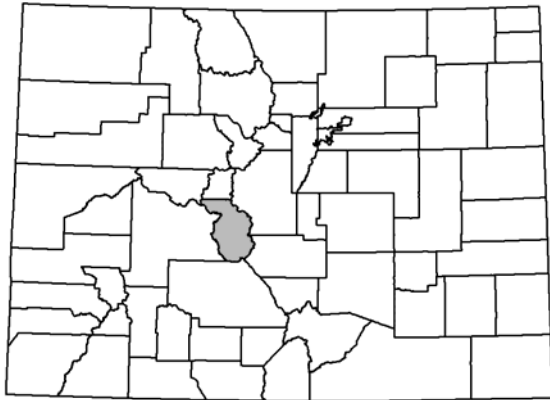


Figure 2. Location of Chaffee County, CO.

Ecoregions

Chaffee County is entirely within the Southern Rocky Mountain ecoregion (Figure 3) as defined by The Nature Conservancy (The Nature Conservancy 1997, modified from Bailey 1995). The Southern Rocky Mountain ecoregion includes the north-south trending mountain ranges with their intervening valleys and parks from southern Wyoming to northern New Mexico, and, in

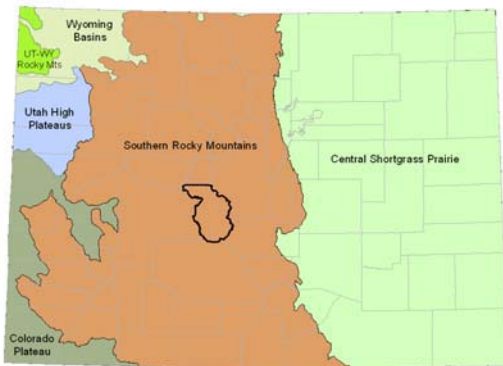


Figure 3. Colorado Ecoregions.

Colorado, more westerly mountain ranges and high plateaus. The major ecological zones are alpine, subalpine, upper montane, lower montane and foothill (Neely et al. 2001). The Southern Rocky Mountain ecoregion includes the north-south trending mountain ranges with their intervening valleys and parks from southern Wyoming to northern New Mexico, and, in Colorado, more westerly mountain ranges and high plateaus. The major ecological zones are alpine, subalpine, upper montane,

lower montane and foothill (Neely et al. 2001).

Hydrology

The Arkansas River Basin is the largest river basin in Colorado covering an area of 28,268 square miles or 27% of the surface area of the state (Colorado Water Conservation Board 2006). The headwaters of the Arkansas River begins near Leadville at an elevation of more than 14,000 feet and drops to 3,340 feet as it travels through southeast Colorado to the Colorado/Kansas state line. In Chaffee County, the main tributaries include: Clear, Pine, Cottonwood, Browns, Trout, and Ute Creeks and the South Arkansas River (Figure 4).

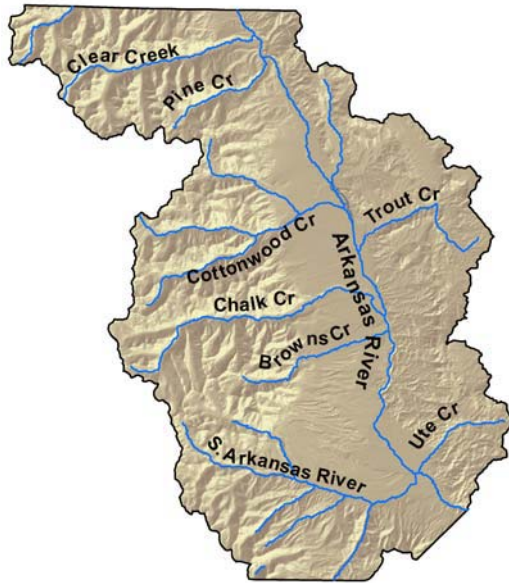


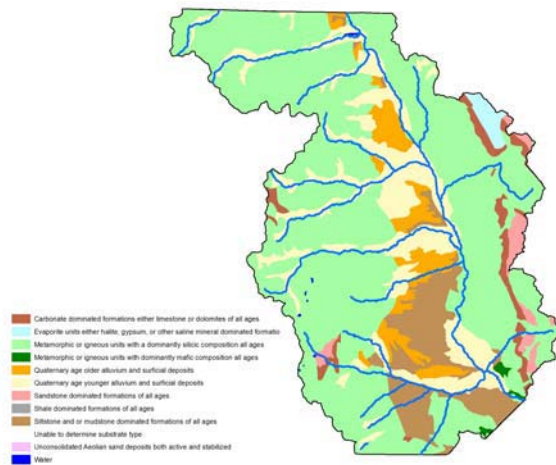
Figure 4. Major Watersheds in Chaffee County.

The Arkansas River developed following the Laramide Orogeny and subsequent creation of the Rio Grande rift in central Colorado and New Mexico. Surface runoff from the eastern side of the rift flowed towards the center of the basin, forming the Arkansas River. Originally the river flowed south and met with the Rio Grande in the San Luis Valley. Volcanic activity later blocked the river near Poncha Pass and caused the river to flow east towards the Great Plains (Colorado State Parks 2002 as cited in Topper et al. 2003). Current land use in the upper Arkansas River valley is

primarily recreation and tourism with limited agriculture and industry. Mining was historically the major industry in the valley, with silver and gold mines dominating the area in the late 1800s into the 1900s. The water quality in the Arkansas River headwaters has been affected by the mining activity severely impairing many alpine watersheds in the Leadville Area. Several reservoirs and lakes in the Upper Arkansas Basin store water from transmountain sources and local sources to meet the demand for expanded water use in the region, and thereby protecting stream depletions (Upper Arkansas Water Conservancy District 2009). These include: Twin Lakes and Turquoise Lake reservoirs that primarily hold waters transferred from the Colorado River Basin and diverted through the Busk-Ivanhoe, Boustead and Twin Lakes tunnels.. The Upper Arkansas River is one of the most popular whitewater rafting and kayaking destinations in the nation, especially the section through Browns Canyon. The FIBArk (First in Boating the Arkansas) whitewater festival in the town of Salida is a popular celebration.

Geology

(Adapted from Chronic and Williams 2002 Roadside Geology of Colorado and Karnuta 1995 Road and Riverside Geology of the Upper Arkansas Valley)



The earliest record of geology in the upper Arkansas River Valley dates back to Precambrian time (1.8 to 1.7 billion years ago). At this time Colorado consisted of a chain of oceanic islands. A large land mass, the southern edge of which is now southern Wyoming, was very close to these islands. Complex plate movement along the edge of this ancient continent drove much of the volcanic and sedimentary debris 8 to 10 miles below the Earth's surface. As this intruding magma cooled and crystallized, it formed the granodiorite of the Denny Creek Batholith. The present day Arkansas River cuts through this

5. Geology in Chaffee County.

rock in Browns Canyon, Big Horn Sheep Canyon and the Royal Gorge (Figure 5).

During the Paleozoic Era (286 million years ago) the area to become the upper Arkansas River Valley was inundated by shallow seas evidenced by accumulation of metamorphic rocks such as limestone, quartzite, and shale. Additional depositional features; ripple marks and cross bedding, also indicate a tidal flat environment.

During the Pennsylvanian Period plate intense tectonic forces resulted in the block fault mountain ranges and basin formation. The present day Upper Arkansas Valley lies in a basin between the Ancestral Front Range to the east and Uncompahgre uplift to the west. Once again a shallow sea inundated the resulting depression. During the late Pennsylvanian Period the ancestral mountains that formed the present-day Sawatch Range, southern Mosquito Range, and northern Sangre DeCristo Range were formed.

Inundation of shallow seas and mountain building continued during the Mesozoic Era (66 million years ago). At the end of the Cretaceous Period, plate tectonic actions continued mountain building in Colorado, creating the Front Range and the Sawatch Anticline. At the beginning of the Cenozoic Era (Eocene Epoch), rivers drained eastward off the western flank of the Sawatch Anticline, forming canyons and valleys across what would eventually be the upper Arkansas River Valley and the Mosquito Range, the eastern flank of the Sawatch Anticline. Volcanic activity started 35 million years ago (Oligocene Epoch) with the eruption of the Mount Aetna volcanic complex, located on the western flank of the Sawatch Anticline. Thick deposits of tuff and andesite filled the valley. Magma that was not erupted during this volcanic period was intruded into the Sawatch Anticline, uplifted and eventually exposed as large batholiths such as Mount Princeton and Mount Antero. At the end of the Oligocene Epoch, plate movement caused faults to be formed causing uplifting, tilting, and dropping of the Earth's crust. It is at this time

the separation between the Sawatch and Mosquito Range was formed. It is along these faults where several hot springs are still present e.g., Mount Princeton and Poncha hot springs. The Chalk Cliffs are a result of hot water rising along faults leaching feldspar minerals of the batholith. The powdery white rock of kaolinite, is where Chalk Cliff gets its name.

In late Miocene the upper Arkansas graben was filled with sediments being eroded off the Sawatch and Mosquito ranges. This valley fill is now called the Dry Union Formation. By late Pliocene time streams draining the east flank of the Sawatch Range and the west flank of the Mosquito Range flowed into the upper Arkansas graben, forming the ancient Arkansas River. The river began to incise its course in the Dry Union Formation. Regional uplift elevated the area an additional 6,000 feet. This uplift rejuvenated the river, causing major canyon cutting and bringing the river in contact with the resistant bedrock of Brown's Canyon.

Presently, the direction of flow of the newly formed Arkansas River is still in debate. The Arkansas and San Luis valleys are connected by a structural trough filled with volcanic and sedimentary rock of Miocene and Pliocene age. The existence of this trough indicates that the Rio Grande rift extends northward to include the upper Arkansas Valley and suggests that the ancient Arkansas River once flowed through the San Luis Valley as a tributary to the Rio Grande River. Evidence for this southward course would be discovery of the ancient channel. This ancient channel has been filled with volcanic rocks and is underneath Poncha Pass

Soils

The semi-arid climate of Chaffee County, with its low precipitation, cool nights, and moderate temperatures generally restrains vegetation growth and thereby slows the chemical and biological processes needed for good soil development. The USDA Natural Resources Service Soil Survey of Chaffee-Lake Area, County Area (1975) divides the soils of the county (not including USFS lands) into three landscape groups: 1) mountains; 2) high terraces, and 3) terraces and bottom lands. Mountain soils are on sloping and very steep fans, terraces, ridges, and slide slopes of the mountains and include rising areas of rock outcrops. They lie mainly at the higher elevations but take in most of the steep area east of the Arkansas River in Chaffee County. Vegetation ranges from sparse stands of pinyon pine at the lower elevations to lodgepole pine at the mid elevations and to alpine grasses and forbs above timberline. Soils of the High Terraces are on nearly level to steep terraces. Drainages commonly dissect the soils and some areas are now rough broken land. These soils occur mainly west of the Arkansas River, but small areas are on the narrow terraces or the east bank of the River. These high terrace soils make up 52% of the County. Vegetation is chiefly grass but many areas are irrigated for both grain crops and hay. Soils of the terraces and Bottom lands are on nearly level and gently sloping low terraces, flood plains, and swales adjacent to the Arkansas River and its major tributaries. The soils are poorly drained. They make up about 11% of the study area. The vegetation is dominantly sedges, willows, and grasses. Many areas, however have been developed as hay fields (USDA Natural Resources Service 1975).

Climate

Chaffee County is known as the “banana belt” due to its relatively mild climate, despite its mountain valley location. Typically, temperatures in Salida are only 5-10 degrees cooler than Denver throughout the year. Annual precipitation in the county is highest in the mountains of the northwest, and decreases towards the southeast (Figure 6). At Buena Vista and Salida, annual precipitation for the period of record averages 9.79 and 10.86 inches, respectively (WRCC 2008). Temperatures follow a similar elevational pattern, with generally cooler temperatures with increasing elevation. Summer temperatures typically range from lows in the 40s to highs in the 70s and 80s, with an extreme high of 105° F

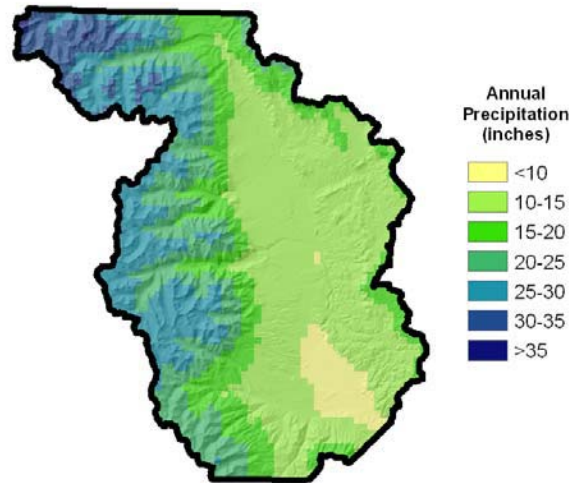


Figure 6. Annual Precipitation in Chaffee CO.

recorded at Buena Vista in 1927. Winters bring highs in the low 40s and lows in the low teens, although a temperature as low as -37° F has been recorded at Buena Vista in 1913 (WRCC 2008).

Population

At the 2000 census, the population of Chaffee County was 16,242, which ranked 28th of 64 Colorado counties. This is estimated to have increased to 16,781 in 2007, an increase of 3.3%. Nearly half of the population of the county lives in the towns of Salida and Buena Vista (US Census Bureau 2009).

Land Ownership

Over 80% of the land in Chaffee County is publicly owned (Figure 7). Of this, the USFS accounts for about 70% of the county's acreage, while BLM lands make about 8%, and are medially located at lower elevations. A number of Colorado State Land Board parcels, fish hatcheries, and one State Wildlife Area (Heckendorf SWA) account for some 3% of the area, and the remaining 19% of the county is privately owned. USFS lands include a portion of the Collegiate Peaks Wilderness Area. The large amount of public land in Chaffee County provides ample opportunities for recreation, including hunting, fishing, and off-road vehicle use.

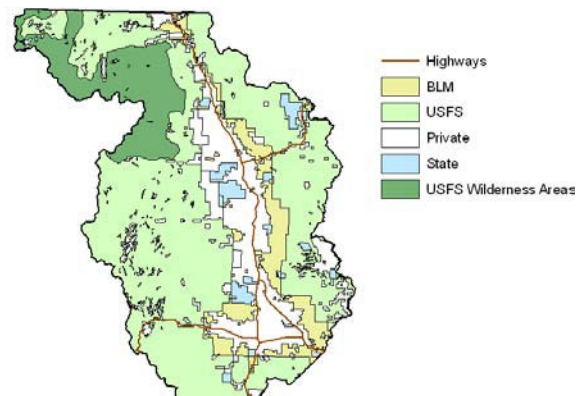


Figure 7. Land Ownership in Chaffee County.

up

Ecological Systems

The eastern and western boundaries of Chaffee County are dominated by ecological systems of higher elevations, characteristic of the Southern Rocky Mountain ecoregion (Figure 8).

Abundant alpine area is found in the western portion of the county, and with descending elevation, vegetation communities shift from tundra and alpine shrublands through subalpine spruce-fir forests, lodgepole and mixed conifer forests to pinyon-juniper woodlands and montane grasslands. The eastern portion of the county rises in elevation from montane grasslands through pinyon-juniper woodlands, ponderosa pine to mixed conifer forest. The most widespread systems in the county are pinyon-juniper woodland, lodgepole pine forest and dry tundra. Agriculture accounts for about 5% of the land area of Chaffee County. Table 7 lists all ecological system types of the county.

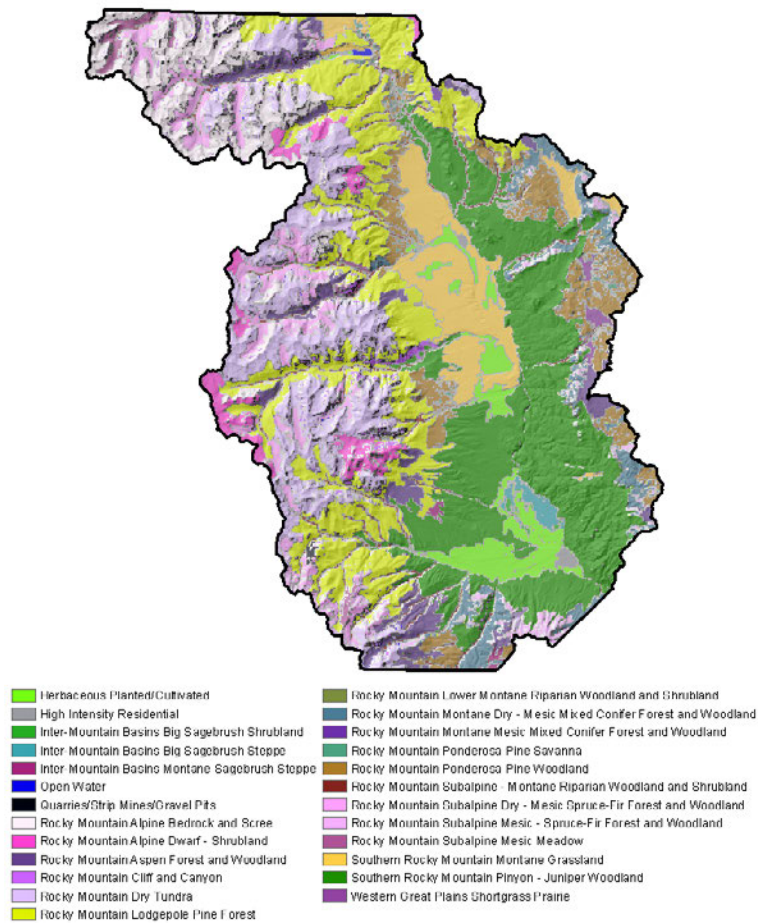


Figure 8. Ecological Systems in Chaffee County.

Table 7. List of Ecological Systems in Chaffee County.

Ecological System	Acres	Percent of County
Colorado Plateau Pinyon-Juniper Woodland & Shrubland	683,787	33.1%
Inter-Mountain Basins Big Sagebrush Shrubland	356,638	17.3%
Rocky Mountain Aspen Forest and Woodland	224,442	10.9%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	201,403	9.8%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	115,521	5.6%
Inter-Mountain Basins Montane Sagebrush Steppe	103,779	5.0%
Agriculture	102,629	5.0%
Rocky Mountain Lower Montane-Foothill Shrubland	73,084	3.5%
Inter-Mountain Basins Greasewood Flat	24,135	1.2%
Southern Rocky Mountain Montane-Subalpine Grassland	20,848	1.0%
Inter-Mountain Basins Mixed Salt Desert Scrub	18,415	0.9%
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	17,900	0.9%
Rocky Mountain Subalpine-Montane Riparian Woodland and Shrubland	14,562	0.7%
Inter-Mountain Basins Mat Saltbush Shrubland	12,629	0.6%
Rocky Mountain Subalpine Mesic Meadow	8,284	0.4%
Rocky Mountain Lodgepole Pine Forest	6,982	0.3%
Inter-Mountain Basins Shale Badland	4,471	0.2%
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	4,365	0.2%
Inter-Mountain Basins Semi-Desert Grassland	1,920	0.1%

The following are brief descriptions of the major ecological systems found in Chaffee County derived mainly from Ecological Systems Viability Specifications for Southern Rocky Mountains Ecoregion (Rondeau 2001).

Colorado Plateau Pinyon-Juniper Woodland and Shrubland

Pinyon-juniper (*Pinus edulis-Juniperus scopulorum*) woodland ecological system occupies approximately 33% in Chaffee County, primarily in the western portion of the County. The stands exhibit considerable diversity in appearance and composition. Stands may consist of all ages or one age (Mehl 1992). Dominant trees are often 400 years old (Mehl 1992). Trees 800 to 1000 years old have been recorded (Mehl 1992). Some stands may have closed canopies with single or both tree species, with little or no understory. Many stands are open with widely scattered trees of one or both species with a wide variety of understory vegetation. In Chaffee County, common herbaceous plants include: blue gramma (*Bouteloua gracilis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Fendler's bluegrass (*Poa fendleriana*), and needle and thread grass (*Stipa comata*). The pinyon-juniper woodland is a shade intolerant, climax cover type remaining on the site until disturbed by fire. When disturbed by fire it will revert to grasses and eventually return to pinyon-juniper woodland (Mehl 1992).

Inter-Mountain Basins Big and Montane Sagebrush Shrubland

Sagebrush shrubland and steppe ecological systems occupy 17% of Chaffee County. The dominant shrubs include: Wyoming and mountain big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*, *A. tridentata* ssp. *vaseyana*), with rabbitbrush (*Chrysothamnus* spp., *Ericameria nauseosa*), antelope bitterbrush (*Purshia tridentata*), and winterfat (*Krascheninnikovia lanata*).

Dominant herbaceous species include: Idaho fescue (*Festuca idahoensis*), needle and thread grass (*Stipa comata*), western wheatgrass (*Pascopyrum smithii*), elk sedge (*Carex geyeri*), and blue grama (*Bouteloua gracilis*).

Rocky Mountain Aspen Forest and Woodland

Quaking aspen (*Populus tremuloides*) forest system (11%) is found throughout the County between 8,000-10,000 feet in elevation. Aspen forest is a matrix community usually maintained by fires. It usually occurs as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands, wetlands, and coniferous forests. Aspen is usually a seral tree in climax sub-alpine fir associations at the higher elevations. In such situations it may dominate the forest community for many decades following severe disturbance, such as fire or clear-cutting, but will gradually decline as the conifers become reestablished. At lower elevations aspen can occur either as a temporary dominant seral species in a variety of climax conifer associations, or it can achieve permanent dominance as the climax forest type. The environmental conditions related to aspen's role as a seral and as a climax species remain ill-defined (Mueggler and Campbell 1986).

The aspen ecosystem is rich in number and species of animals, especially in comparison to associated coniferous forest types. This natural species diversity and richness has been both increased and influenced by the introduction of domestic livestock. Typical understory species include: Rocky Mountain maple (*Acer glabrum*), alder (*Alnus incana*), snowberry (*Symphoricarpos oreophilus*), twinberry honeysuckle (*Lonicera involucrate*), russet buffaloberry (*Shepherdia canadensis*), brome grass (*Bromus* sp.), bluegrass (*Poa* sp.), and fescue (*Festuca* sp.). The high value of the aspen type as a forage resource for livestock and as forage and cover for wildlife makes the subject of animal impacts important to understanding and management of this ecosystem (DeByle and Winokur 1985).

Rocky Mountain Gambel Oak Mixed Montane Shrubland

The Gambel oak (*Quercus gambelii*) shrubland occupies 10% of the County. This ecological system typically occupies the lower slope positions of the foothill and lower montane zones. They may occur on level to steep slopes, cliffs, escarpments, rimrock slopes, rocky outcrops, and scree slopes. Although this is a shrub-dominated system, some trees may be present. In older occurrences, or occurrences on mesic sites, some of the shrubs may acquire tree-like sizes. Adjacent communities often include woodlands or forests of Ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), Douglas fir (*Pseudotsuga menziesii*), or quaking aspen (*Populus tremuloides*) at higher elevations, and pinon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) on the lower and adjacent elevations. Shrublands of sagebrush (*Artemisia tridentata*) or grasslands of fescue (*Festuca* sp.), needle and thread grass (*Stipa* sp.), or bluebunch wheatgrass (*Pseudoroegneria spicata*) may also be present at the lower elevations.

Vegetation types in this system may occur as sparse to dense shrublands composed of moderate to tall shrubs. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. In many occurrences of this system, the canopy is dominated by the broad-leaved deciduous shrub Gambel oak, which occasionally reaches small tree size. Occurrences can range from dense thickets with little understory to relatively

mesic mixed-shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between. Scattered trees are occasionally present in stands typically include species of pine or juniper. Characteristic shrubs that may co-occur, or be singularly dominant, include serviceberries (*Amelanchier alnifolia*, *A. utahensis*), kinnikinnik (*Arctostaphylos uva-ursi*), sagebrush (*Artemisia tridentata*), mountain mahogany (*Cercocarpus montanus*), chokecherry (*Prunus virginiana*), rose (*Rosa* spp.), and snowberry (*Symphoricarpos rotundifolius*). The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover. Perennial graminoids are the most abundant species, particularly sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), three-awn grass (*Aristida* spp.), Geyer sedge (*Carex geyeri*), fescues (*Festuca* spp.), june grass (*Koeleria macrantha*), muhly grasses (*Muhlenbergia* spp.), and needle and thread grasses (*Stipa* spp.). Many forb species can occur, but none have much cover. Commonly present forbs include: yarrow (*Achillea millefolium*), wormwood (*Artemisia* spp.), geranium (*Geranium* spp.), false soloman seal (*Maianthemum stellatum*), meadow rue (*Thalictrum fendleri*), and vetch (*Vicia americana*).

Fire typically plays an important role in this system, causing die-back of the dominant shrub species in some areas, promoting stump sprouting of the dominant shrubs in other areas, and controlling the invasion of trees into the shrubland system. Natural fires typically result in a system with a mosaic of dense shrub clusters and openings dominated by herbaceous species. In some instances these associations may be seral to the adjacent *Pinus ponderosa* and *Pseudotsuga menziesii* woodlands and forests.

Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland

Approximately 6% of Chaffee County is classified as an Englemann spruce-subalpine fir (*Picea engelmannii*-*Abies lasiocarpa*) forest ecological system. Spruce-fir dominated stands occur on all but the most xeric sites above 9,000 feet and in cool, sheltered valleys at elevations as low as 8,200 feet. The relative dominance of the two canopy tree species and the understory composition vary substantially over a gradient from excessively moist to xeric sites (Peet 1981). The mesic spruce-fir type occurs on cool, sheltered, but well drained sites and is one of the most widespread forest types in the subalpine zone. In lower elevations, the spruce-fir types give way, often along abrupt fire-induced boundaries, to lodgepole pine or aspen-dominated forests.

Fire, spruce-beetle outbreaks, avalanches, and wind all play an important role in shaping the dynamics of spruce-fir forests. Fires in the subalpine forest are typically stand replacing, resulting in the extensive exposure of mineral soil and initiating the development of new forests. Fifty year return interval for high intensity surface fires and 100-400 years return interval for crown fires which cover 1,000 to 10,000 acres are noted for this ecological system (Peet 1981, Habeck and Mutch 1973). Spruce beetle (*Dendroctonus rufipennis*) outbreaks may be as significant as fire in the development of spruce-fir forests. In addition to fires and beetle kill, wind disturbance in spruce-fir forests has been well documented (Schaupp et al. 1999). Pine marten (*Martes americana*) is mostly a spruce-fir obligate that requires a healthy and sizeable occurrence of old growth forest. Therefore a viable population of pine marten has been chosen as an indicator of a healthy and viable occurrence of the spruce fir system (Rondeau 2001).

Rocky Mountain Montane-Subalpine Grassland

The montane-subalpine grassland system occurs in 1% of the County at elevations above 8,000 ft. An occurrence usually consists of a mosaic of two or three plant associations with one of the following dominant bunch grasses: *Danthonia* spp., *Festuca* spp., or *Muhlenbergia filiculmis*. The sub-dominants include *Muhlenbergia montana*, *Bouteloua gracilis*, and *Poa secunda*. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acid, and usually well-drained (Turner 1975). Frequent fires help to maintain the grassland dominants and may play an important role in restricting the invasion of trees and shrubs (Turner 1975). These large patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole, ponderosa pine, and aspen forests.

Floristic composition varies with site characteristics and grazing history (Turner 1975). Forbs tend to be more prominent at higher elevations, and shrubs at lower elevations (Turner 1975). Forbs are characteristically absent from bunch grass dominated grasslands with a long history of heavy sheep use (Turner 1975). Annual plants seldom are abundant except on recently disturbed or severely overgrazed areas (Turner 1975).

Montane grasslands were initially grazed by domestic livestock about 100 years ago and by 1900 practically all of the available high elevation lands were being grazed, and some already had been overgrazed (Turner 1975). Regulation of grazing on these lands began with establishment of the National Forests in the early 1900's. However, these and other rangelands received maximum use in meeting the demands of World War I. Present use of National Forest rangeland in the West is only about one-fourth the numbers of the former high level (Turner 1975).

Rocky Mountain Lower Montane-Foothill Shrubland

This system occupies 4% of the County. It is found in the foothills, canyon slopes and lower mountains of the County. These shrublands occur between 4,800 – 9,280 feet (1500-2900 m) elevations and are usually associated with exposed sites, rocky substrates, and dry conditions, which limit tree growth. This system is generally drier than Rocky Mountain Gambel Oak-Mixed Montane Shrubland, but may include mesic montane shrublands where Gambel oak (*Quercus gambelii*) does not occur. Scattered trees or inclusions of grassland patches or steppe may be present, but the vegetation is typically dominated by a variety of shrubs including Utah serviceberry (*Amelanchier utahensis*), mountain maghogony (*Cercocarpus montanus*), antelope bitterbush (*Purshia tridentata*), skunkbush (*Rhus trilobata*) wax current (*Ribes cereum*), snowberry (*Symphoricarpos oreophilus*), or narrow-leaf yucca (*Yucca glauca*). Grasses are represented as muhly grasses (*Muhlenbergia* spp.), blue grama (*Bouteloua gracilis*), needle and thread grass (*Hesperostipa comata*), and bluebunch wheatgrass (*Pseudoroegneria spicata*). Fires play an important role in this system as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. Mountain maghogony requires a disturbance such as fire to reproduce, either by seed sprout or root crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases sites are too xeric for tree growth.

Inter-Mountain Basins Greasewood Flat

This ecological system occurs sporadically (1.2%) in Chaffee County, for example near Hecla Junction above the Arkansas River. The Greasewood Flats ecological system typically occurs

near drainages on stream terraces and flats, on alluvial fans along streams or arroyos, or may form rings around playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most of the growing season. The Greasewood Flats ecological system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*). Four-wing saltbush (*Atriplex canescens*), shadscale saltbush (*Atriplex confertifolia*), rubber rabbitbush (*Ericameria nauseosus*), or winter fat (*Krascheninnikovia lanata*) may be present to codominant. The herbaceous layer, if present, is usually dominated by graminoids such as, salt grass (*Distichlis spicata*), three-square bulrush (*Scirpus pungens*), and blue grama (*Bouteloua gracilis*). Small patches of *Distichlis spicata* (where water remains ponded the longest), or spikerush (*Eleocharis palustris*) herbaceous types may be found within the shrubland system (NatureServe 2008).

Rocky Mountain Subalpine-Montane Riparian Woodland and Shrubland

Montane/subalpine riparian shrubland ecological system can be either a linear or small patch system, confined to specific environments occurring on floodplains or terraces of rivers and streams and shallow broad valleys. Even though the montane/subalpine riparian shrubland ecological system occupies less than 1% of Chaffee County, it provides vital habitat for brooding, foraging, nesting, and migration for the majority of birds and mammals. In Chaffee County, this system often occurs as a mosaic of multiple communities that are shrub dominated. The dominant shrubs include: alder (*Alnus incana*), red-osier dogwood (*Cornus sericea*), Drummond's, strapleaf, Geyer's, Rocky Mountain, Plane-leaf, and Wolf willows (*Salix drummondiana*, *S. eriocephala*, *S. geyeriana*, *S. moniticola*, *S. planifolia*, and *S. wolfii*). Generally the upland vegetation surrounding these riparian systems consist of either conifer or aspen forests, while adjacent riparian systems range from herbaceous dominated communities to tree dominated communities. Beaver (*Castor canadensis*) is the primary user as well as maintainer of this system. In addition to the beaver, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining this system. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant composition as well as community composition (Kittel et al. 1999).

Flora

The CU Herbarium lists 3,487 plant taxa occurring in Colorado; of these, 541 have been documented in Chaffee County. Of the thousands of species known from Colorado, 33 are ranked G1 (including rounded ranks), 80 are ranked G2, and 250 have a G3 rank. Of the plant species found in Chaffee County, 36 are rare or imperiled; one is a G1 species, ten are G2's, and twelve are G3 plants, the remaining are state rare species. These 36 plant species were the primary botany targets for data collection and survey.

The flora of Colorado reflects three phytogeographic principles: a migration corridor along the mountains oriented north-south, a barrier to east-west migration leading to distinct characters of West Slope and East Slope floras, and the Southern Rocky Mountains represent an extensive high-altitude portion of the American Cordillera and its isolation from areas with similar climate (such as boreal regions) leads to a high degree of endemism (Weber 1964).

Many of the rare plant species that occur in Chaffee County are endemic to Colorado; these include:

Rock-loving Aletes	<i>Aletes (Neoparrya) lithophilus</i>
Barneby's Feverfew	<i>Bolyphyta (Parthenium) tetraeuris</i>
Gray's Peak Whitlow-grass	<i>Draba grayana</i>
Colorado Divide Whitlow-grass	<i>Draba streptobrachia</i>
Brandegee's Wild Buckwheat	<i>Eriogonum brandegeei</i>
Colorado Wild Buckwheat	<i>Eriogonum coloradense</i>
Front Range Alum-root	<i>Heuchera hallii</i>
Colorado Wood-rush	<i>Luzula subcapitata</i>
Royal Gorge Stickleaf	<i>Nuttallia (Mentzelia) densa</i>
Degener's Beardtongue	<i>Penstemon degeneri</i>

Brandegee wild buckwheat (*Eriogonum brandegeei*), a globally critically imperiled species, is known only from six verified occurrences in Fremont and Chaffee counties. It is limited to outcrops of the Dry Union Formation in Chaffee County (Anderson 2006). Rock-loving Aletes (*Aletes lithophilus*) is also found on the Dry Union Formation. The shale barrens and limestone benches and knolls of the Arkansas River Valley from Salida east to Pueblo are home to the globally imperiled Barneby's Feverfew (*Bolyphyta tetraeuris*). Degener's beardtongue (*Penstemon degeneri*) and Royal Gorge Stickleaf (*Nuttallia densa*) are found in the pinon-juniper woodlands of the Arkansas River from Salida east to Pueblo. The Gray's Peak Whitlow-grass (*Draba grayana*) and Colorado Divide Whitlow-grass (*Draba streptobrachia*) can be found on the alpine slopes of the Collegiate Peaks. Chaffee County is also home to several regional endemic species, known only from Colorado and New Mexico. These include the Colorado Larkspur (*Delphinium ramosum* var. *alpestre*) and Fendler's Townsend-daisy (*Townsendia fendleri*). Detailed information on these species may be found in the Natural History Information portion of this report.

Fauna

As with the ecological systems, the varied topography and climate in Chaffee County lead to a diversity of fauna. No vertebrates (at the species level) are endemic to the study area (Armstrong 1972, Ferris and Brown 1981, Woodling 1985, Andrews and Righter 1992, Hammerson 1999).

Extirpations of large-sized mammals are common in Chaffee County as well as throughout the West. Black-footed ferret (*Mustela nigripes*), wolf (*Canis lupus*), and grizzly bear (*Ursus arctos*) have been restricted throughout their range, and no longer occur in natural populations in Colorado (Fitzgerald et al. 1994). Two boreal forest predators, the wolverine (*Gulo gulo*) and lynx (*Lynx lynx*), were once more common in Chaffee County. In contrast, large ungulates such as mule deer (*Odocoileus hemionus*), elk (*Cervus elephus*), and moose (*Alces alces*) are all well known in the area, as are coyote (*Canis latrans*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*). Smaller carnivores, such as the American marten (*Martes americana*) and a number of weasels (*Mustela* spp.), occur throughout the mountainous regions of the county.

Numerous bat species occur in the county, using caves and mines as well as forested woodlands for roosts. Shrews (*Sorex* spp.) can be found throughout the county with rarer species such as the dwarf shrew (*Sorex nanus*) at higher elevations. Subalpine forests and alpine tundra support a number of mammalian species which have adapted to cope with harsh winters in numerous ways. Examples include the hibernating yellow-bellied marmot (*Marmota flaviventris*), the snowshoe hare (*Lepus species*), which go through a seasonal color change, mice and shrews that use runways beneath the snow, and the American pika (*Ochotona princeps*) which caches vegetation for its winter food supply. Chipmunks (*Tamias* spp.), and several species of mice (*Peromyscus* spp.) occur in areas with large rocks and well developed woodlands. Subterranean species such as pocket gophers (*Thomomys* spp.), ground squirrels (*Spermophilus* spp.), and Gunnison's prairie dog (*Cynomys gunnisoni*) can be found throughout the county especially along the Arkansas Valley floor. Wetlands riparian ecosystems support American beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*), both are dependent on river corridors for shelter and food (Fitzgerald et al. 1994).

Typical bird species found in spruce-fir, lodgepole forests, and pinyon-juniper woodlands include a large number of passerine birds. Jays, chickadees, flycatchers, thrushes, tanagers, woodpeckers, and finches are all known to breed in Chaffee County. Raptors, including Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperi*), Northern Goshawk (*Accipiter gentilis*), Red-tailed Hawk (*Buteo jamaicensis*), Golden Eagle (*Aquila chrysaetos*), and Prairie Falcon (*Falco mexicanus*) breed in the county. Owls include the Boreal Owl (*Aegolius funereus*), Northern Pygmy-Owl (*Glaucidium gnoma*), Great Horned Owl (*Bubo virginianus*), and Northern Saw-whet Owl (*Aegolius acadicus*). The high elevation tundra landscape provides habitat for the White-tailed Ptarmigan (*Lagopus leucurus*), American Pipit (*Anthus rubescens*), and Brown-capped Rosy-Finch (*Leucosticte australis*).

Fish in Chaffee County include the greenback cutthroat trout (*Oncorhynchus clarki stomias*), which can be found in stocked, recreation populations. Other fish present in the county include fathead minnow (*Pimephales promelas*), white sucker (*Catostomus commersoni*), and longnose sucker (*Catostomus catostomus*) as well as several game species such as rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*).

A limited number of amphibians can be found throughout Chaffe County. The barred tiger salamander (*Ambystoma mavortium*) and the boreal chorus frog (*Pseudacris maculata*) can be found at lower elevation. The northern leopard frog (*Lithobates pipiens*) can be found sporadically along the Arkansas River. Chaffee County is the primary location in the world for the western toad (*Anaxyrus boreas*). The Cottonwood Creek drainage supports the largest population known.

Reptiles are not common in Chaffee County, with the exception of the western terrestrial garter snake (*Thamnophis elegans*) which can be found throughout the county up to approximately 11,000 feet. The bullsnake (*Pituophis catenifer*) can be found along the Arkansas River valley floor between Salida and Buena Vista. There are a few scattered records of the plateau fence lizard (*Sceloporus tristichus*) and one historic record of the western rattlesnake (*Crotalus viridis*) near Salida (Hammerson 1999).

Amphibians of Concern in Chaffee County

Chaffee County is one of the few remaining strongholds for the state endangered western toad (*Anaxyrus boreas*), previously known as the boreal toad (*Bufo boreas*). Once common in the mountains of Colorado, southern Wyoming, and northern New Mexico, the western toad (Southern Rocky Mountain group) has declined throughout its range during the last 20 years (Corn et al. 1989, Carey 1993, Hammerson 1999, Loeffler 2001). Due to these declines, the boreal toad was listed in Colorado (1993) and in New Mexico (1976) as a state endangered species. The boreal toad was considered “warranted but precluded” for federal listing under the Endangered Species Act, but was withdrawn from the list of species being considered for protection under the Endangered Species Act in September 2005.

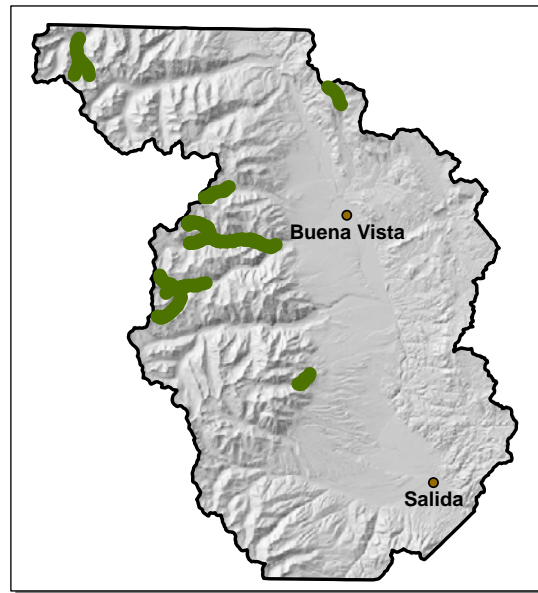


Figure 9. Western toad breeding locations in Chaffee CO.

Western toads have been documented in Chaffee County as far back as 1913 where large numbers of toads were observed under street lights and along irrigation ditches in Buena Vista (Hammerson 1999). Presently there are 18 active western toad breeding sites in Chaffee County, ranging in elevation from 9,040 feet to 12,040 feet (Lambert 2009) (Figure 9). Fourteen breeding sites are associated with the Cottonwood Creek drainage west of Buena Vista, which presently has some of the largest populations of western toads left in the state (Hammerson 1999, Jackson 2005, Lambert 2009). Seventeen of the 18 known breeding sites in Chaffee County are found on the San Isabel National Forest in the Salida and Leadville Ranger Districts. Statewide, there are about 71 breeding sites that comprise 38 separate populations, however only two of these populations, one of which is the Cottonwood Creek population, are considered viable (Jackson 2005).

Another amphibian species of concern that occurs in Chaffee County is the northern leopard frog (*Lithobates pipiens*). The CDOW classifies the northern leopard frog as a species of concern and the USFS classifies it as a sensitive species. The status and distribution of this species is not well known in this region of Colorado. There are several historical museum records for northern leopard frogs in the Buena Vista area (CNHP database 2009). In 2007 and 2008, several new populations of northern leopard frogs were documented in the Salida area (Pers. Comm. Raquel Werstbaugh, CDOW, Salida). In 2008, newly metamorphosed leopard frogs were observed crossing Highway 24 about 10 miles north of Buena Vista (CNHP database 2009). It appears that northern leopard frogs are relatively common along the Arkansas River near Salida and in the vicinity of Poncha Springs. There also is a least one population of northern leopard frogs north of Buena Vista. Two additional amphibians: the chorus frog (*Psuedacris maculata*) and the tiger salamander (*Ambystoma mavortium*), are common and widespread in Colorado. In Chaffee County these species have a limited distribution with small scattered populations mostly at lower elevations.

CONSERVATION ASSESSMENT

Potential Impacts to Biological Diversity in Chaffee County

General threats that may affect biodiversity on a large, landscape-level scale in Chaffee County are summarized below. We understand that the issues discussed below are often important parts of a healthy economy and contribute to the well being of our society. We mention these general “impacts to biodiversity” with the hope that good planning can minimize the impacts where critical habitat resides.

Hydrological Modifications

The Arkansas Basin, second only to the South Platte River, is projected to experience the largest increase in water demands (Colorado Water Conservation Board 2006). In 2000, the upper Arkansas Basin had a gross demand for 22,700 acre-feet. The estimated 2030 gross demand is 36,400 acre-feet, with an estimated shortfall of 6,600 acre-feet (Colorado Water Conservation Board 2006). Population growth in the Upper Arkansas Basin is predicted to increase 72% from 85,000 in 2000 to 146,600 in 2030 (Colorado Water Conservation Board 2006). The Arkansas Basin will face several challenges with respect to water management issues and needs over the next 30 years. First is compliance with the Arkansas River Compact of 1948 that apportions the waters of the Arkansas River between Colorado and Kansas by limiting future water developments to projects that would not deplete useable stateline flow and by dividing the benefits of the John Martin Reservoir between Colorado (60%) and Kansas (40%) (Topper et al. 2003).

Annual flooding on the Upper Arkansas River is control in part by the presence of reservoirs at its headwaters. However, the river does flood until about mid-June when flood irrigation practices begin. Flooding is a natural ecological process that can be severely altered by the construction of dams, reservoirs, major diversion projects and other water diversions such as local irrigation ditches. These water diversions and impoundments have altered the normal high peak flows that were once a part of the natural hydrological regimes of the rivers and their tributaries in Chaffee County. These periodic floods are necessary for continued viability of most riparian vegetation. For example, many plants, including cottonwood trees, reproduce primarily with flooding events (Rood and Mahoney 1993). As plant composition changes in response to alterations in the flooding regime, the composition of the aquatic and terrestrial fauna may also change.

In addition to impoundment, rivers have also been altered by stream bank stabilization projects (e.g., channelization) (Rosgen 1996), which often intend to limit or stop erosion that threatens private or public property. Most streams and rivers are dynamic and inherently move across the land. Stabilizing or channelizing stream banks forces the river to stay in one place and often leads to changes in riparian ecology and more serious destruction downstream. It is also well known that different plant communities require different geomorphologic settings. For example, point bars are required for some species of willows to regenerate, terraces are required for mature cottonwood/shrubland forests, and old oxbow reaches may eventually provide habitat for many wetland communities. By stabilizing a river, the creation of these geomorphic settings is often eliminated. Thus, the plant communities that require such fluvial processes are no longer able to

regenerate or survive. In general, the cumulative effects from dams, reservoirs, and channelization on plant communities have caused a gradual shift from diverse multi-aged riparian woodlands to mature single-aged forest canopies.

Many wetlands not directly associated with fluvial processes (e.g., seeps and springs) have been altered by irrigation practices, water diversions, and groundwater withdrawals. However, the increase of irrigated agriculture in Chaffee County since European settlement has inadvertently created many new wetlands in areas where wetland never existed, and at the same time has destroyed many existing wetlands. For example, seepage from the miles of unlined canals and earthen ditches, and much of the water applied in irrigation contributes to groundwater recharge and surface water runoff. As a result, many areas have developed wetland characteristics where none existed prior to irrigation. Conversely, many historical wetlands including seeps and springs have been lost or altered due to water “development” projects, such as water diversions or impoundments (e.g., stock ponds). Thus, as the quality and extent of historical wetlands diminished, some of the habitat loss was offset by irrigation-induced wetlands. It is debatable whether the biodiversity significance of an integrated network of river bottom wetlands, sinuous marshy stream, and extensive intact seep and spring wetlands can be equated to the dispersed pattern of irrigation –induced wetlands across an agricultural landscape. For example, the number of species supported by a man-made pond with minimal edge habitat is generally less than the number supported by an extensive intact seep and spring wetland or naturally occurring pond.

Climate Change

Data from the Intergovernmental Panel on Climate Change (IPCC) (Ray et al. 2008) clearly show that our Colorado climate will not be the same as it has been in the past ten years. Climate models project Colorado will warm by 2.5°F by 2025, relative to the 1950–99 baseline, and 4°F by 2050. The projections show summers warming more (+5°F) than winters (+3°F) and suggest that typical summer temperatures in 2050 will be as warm as or warmer than the hottest 10% of summers that occurred between 1950 and 1999; from 1957 to 2006 the average year-round temperatures in the upper Arkansas River basin have increased by 2°F (Ray et al, 2008). The IPCC primary conclusions are:

- 1) Temperatures are increasing and will continue to increase;
- 2) there is uncertainty with regard to precipitation projections;
- 3) Even with no change in precipitation, temperature increases alone will lead to a decline in runoff for most of Colorado’s river basins by the mid 21st century;
- 4) Synthesis of findings suggests a reduction in total water availability by the mid 21st century; and that
- 5) a warming climate increases the risk to Colorado’s water supply even if precipitation remains at historical levels.

Recreation

Recreation, once very local and perhaps even unnoticeable, is increasing and becoming a threat to natural ecosystems in Chaffee County. Different types of recreation (e.g., motorized versus non-motorized activities) typically have different effects on ecosystem processes. All-terrain vehicles can disrupt migration and breeding patterns, and fragment habitat for native resident

species. This activity can also threaten rare plants found in forested and non-forested areas. ATVs have also been identified as a vector for the invasion of non-native plant species.

Non-motorized recreation, mostly hiking but also some horseback riding, mountain biking and rock climbing, presents a different set of issues (Knight and Cole 1991; Miller et al. 1998). Wildlife behavior can be significantly altered by repeat visits of hikers, horseback riders, or bicyclists. Trail placement should consider the range of potential impacts on the ecosystem. Considerations include minimizing fragmentation by leaving large undisturbed areas of wildlife habitat where possible (CDNR 1998). Miller et al. (1998) found lower nest survival for ground-nesting birds adjacent to trails; they also found that ground-nesting birds were more likely to nest away from trails with a zone of influence approximating 250 feet (75 meters). Alpine areas, mountain lakes, and riparian zones are routes and destinations for many established trails. Thus, impacts to native vegetation (mainly trampling) in these areas can be high.

Livestock Grazing

Domestic livestock grazing has been a traditional livelihood in Chaffee County since the mid 1800s and has left a broad and sometimes subtle impact on the landscape. For some species, properly managed grazing can be a compatible activity. However, some range management practices can adversely affect the region's biological resources. Many riparian areas in Chaffee County are included in rangeland and grazing allotments. Especially at lower elevations in the County, livestock tend to congregate near wetland and riparian areas for shade, lush browse, and access to water. Long-term, incompatible livestock use of wetland and riparian areas can potentially erode stream banks, cause streams to downcut or spread out of an established channel causing additional erosion, lower the water table, alter channel morphology, impair plant regeneration, establish non-native species, shift community structure and composition, degrade water quality, and diminish general riparian and wetland functions (Windell et al. 1986). Depending on grazing practices and local environmental conditions, impacts can be minimal and largely reversible (slight shifts in species composition) to severe and essentially irreversible (extensive gullying and introduction of non-native forage species).

Fragmentation and Edge Effects

Edges are simply the outer boundary of an ecosystem that abruptly grades into another type of habitat, such as the edge of a Gambel oak shrubland adjacent to grassland (Forman and Gordon 1986). Edges are often created by naturally occurring processes such as floods, fires, and wind. Edges can also be created by human activities such as roads, trails, timber harvesting, agricultural practices, and rangeland management. Human induced edges are often dominated by plant and animal species that are adapted to disturbance. As the landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, these edges become increasingly abundant in areas that may have had few "natural" edges. The overall reduction of large landscapes jeopardizes the existence of specialist species, may increase non-native species, and may limit the mobility of species that require large landscapes or a diversity of landscapes for their survival (e.g., large mammals or migratory waterbirds).

Non-native Species

Invasion of non-native and aggressive species, and their replacement of native species, is one of the biggest threats to Chaffee County's natural diversity (James 1993; D'Antonio and Vitousek 1992). 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., scraped roadsides). This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Effects of non-native fishes include competition that can lead to local extinctions of native fishes and hybridization that corrupts the genetic stock of the native fishes.

Although complete eradication of non-native aggressive species is not possible, some control efforts can pay off. Regarding non-native invasive plant species, one important guideline is that when a plant is removed, something will take its place, that is, "Ecological voids do not exist" (Young 1981). Simply killing aggressive non-native plant species, unless there is a seed source for desirable replacements, will result in more unwanted species, perhaps even more noxious than those removed. Seeding of desirable plant species is usually necessary. When seeding, it is important to consider seedbed characteristics including rock cover, and the potential of the soil to support the planted species. A first step is to assess the current vegetation, in relation to the potential of the site. One approach is to experiment on a small scale to determine the potential success of a weed control/seeding project, using native plant species. Ideally, seed should be harvested locally. A mixture of native grasses and forbs is desirable, so that each species may succeed in the microhabitat for which it is best suited. In general, lower elevations of the County are more affected by non-native and aggressive plant species than higher elevations, and level valley bottoms more than steep slopes. Most of the major river corridors and many of their tributaries have been invaded by pasture grasses.

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METHODS

The methods for assessing and prioritizing conservation needs over a large area, such as a county, are necessarily diverse. CNHP follows a general method that is continuously being developed specifically for this purpose. The Survey for Critical Biological Resources in Chaffee County was conducted in several steps summarized below. Additionally, input from Chaffee County and its stakeholders were sought at all stages.

Collect Available Information

CNHP databases were updated with information regarding the known locations of species and significant plant associations within Chaffee County. A variety of information sources were searched for this information. The Colorado State University museums and herbaria were searched, as were plant and animal collections at the University of Colorado, Rocky Mountain Herbarium, and local private collections. Both general and specific literature sources were incorporated into CNHP databases, either in the form of locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage elements. Such information covers basic species and community biology including range, habitat, phenology (reproductive timing), food sources, and substrates. This information was entered into CNHP's Biodiversity Tracking and Conservation System (BIOTICS).

Identify rare or imperiled species and significant plant associations with potential to occur in Chaffee County

The information collected in the previous step was used to refine a list of potential species and natural plant communities and to refine our search areas. In general, species and plant communities that have been recorded from Chaffee County or from adjacent counties are included in this list. Over 80 rare species and significant plant communities were targeted in this survey. Given the limited amount of time and funding, a specific subset of species and communities were the priority of our inventory efforts. These elements were considered to be a priority because of their high level of biological significance (G1-G3) and/or because they are known to occur in areas that are subject to various development pressures such as hydrological alterations and residential development.

Identify Targeted Inventory Areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities (see Map 1). Previously documented locations were targeted, and additional potential areas were chosen using available information sources. Areas with potentially high natural values were selected using soil surveys, geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and numerous roadside surveys by our field scientists. Using the biological information stored in the CNHP databases, areas having the highest potential for supporting specific elements were identified. Those chosen for survey sites appeared to be in the most natural condition. In general, this means those sites that are the largest, least fragmented, and relatively free of visible disturbances such as roads, trails, fences, and quarries were identified.

The above information was used to delineate Targeted Inventory Areas (TIAs) that were believed to have relatively high probability of harboring significant natural resources. Additional TIAs were identified by Chaffee County and its stakeholders.

Roadside surveys were useful in further resolving the natural condition of these areas. The condition of shrublands is especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such aspects as weed infestation or vegetation composition. Because there were limited resources to address an overwhelming number of potential sites, surveys for all elements were prioritized by the degree of imperilment. For example, the species with Natural Heritage Program ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage Program ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented if encountered.

Contact Landowners

Obtaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using GIS land ownership coverage obtained from the Chaffee County assessor's office or stakeholders. Landowners were then either contacted by phone or in person. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were private properties surveyed without landowner permission.**

Conduct Field Surveys and Gather Data

Survey sites where access could be obtained were visited at the appropriate time as dictated by the seasonal occurrence (or phenology) of the individual elements. It was essential that surveys took place during a time when the targeted elements were detectable. For instance, plants are often not identifiable without flowers or fruit that are only present during certain times of the year. The methods used in the surveys vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Where necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant plant community was discovered, its precise location and known extent was recorded with a global positioning system (GPS) unit. Other data recorded at each occurrence include numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the size of the population or community, the condition or naturalness of the habitat, and the landscape context (its connectivity and its ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the previous section on Natural Heritage Program Methodology for more about element occurrence ranking.

Site visits and assessments were conducted on the following two levels:

1). Roadside or adjacent land assessments. Many of the sites could be viewed at a distance from a public road or from adjacent public land. While on the ground the field scientist can see, even from a distance, many features not apparent on maps and aerial photos. The road assessments determined the extent of human and livestock impacts on the survey area, which included ditching, adventive plant species, plant species indicative of intensive livestock use, stream bank destabilization, major hydrologic alterations, excessive cover of non-native plant species, or new construction. Sites with one or more of these characteristics were generally excluded as potential conservation areas and no extensive data were gathered at these areas. If roadside assessments of private lands yielded the potential presence of an element occurrence, landowner contact was initiated, and if permission was given, an on-site assessment was performed.

2). On-site assessments. On-site assessment was the preferred method, as it is the only assessment technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common associations. On-site assessments are also the most resource intensive because of the effort required to contact landowners. In several cases where on-site assessments were desired, they could not be conducted because either field personnel were denied access to the property by the landowner, or CNHP was unable to contact the landowner during the time frame of this study.

During on-site assessments, the following information was collected for the PCAs in this report:

General Field Information

- A list of all plant associations in the survey area, including the percent cover by that community. In almost all cases, plant associations were immediately placed within either the International National Vegetation Classification (Anderson et al. 1998; Comer et al. 2003) and the Comprehensive Statewide Wetlands Classification (Carsey et al. 2003). Plant synonym follows Kartesz (1999).
- Vegetation data for each major plant association in the wetland were collected using visual ocular estimates of species cover in a representative portion of the plant association, including non-native species.
- A sketch of the site layout, with distribution of plant community types indicated (this was generally done on the 7.5-min. USGS topographic map, but occasionally for clarity a separate map was drawn on the site survey form).

UTM coordinates from Garmin GPS 12 Personal Navigator.

Elevation (from 7.5-min. USGS topographic maps and GPS).

Current and historic land use (e.g., grazing, logging, recreational use) when apparent.

Notes on geology and geomorphology.

Reference photos of the site.

Indicators of disturbance such as logging, grazing, flooding, etc.

Natural Heritage Information

- A list of elements present or expected at the site
- Element occurrence (EO) ranks or information that will lead to EO Rank

- Proposed conservation area boundaries

General Wetland Information

- Water source
- Hydroperiod
- Water chemistry (pH and conductivity)
- General soils description (these are based on either a detailed description of a soil profile in the field (e.g., horizons, texture, color, cobble size, percent mottling) or from information from the county soil surveys.

Delineate Potential Conservation Area Boundaries

The objective for this survey was to delineate and prioritize specific areas for conservation efforts. The purpose of the PCA is 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 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; and
- land necessary for management or monitoring activities.

RESULTS

Results of the 2008 survey of Chaffee County confirmed that there are many areas with high biological significance. Several extremely rare plants depend on these areas for survival. A total of 38 rare or imperiled plants, 8 rare or imperiled animals, and 29 plant communities of concern were documented from 2008 field work (Table 8). A total of 59 new element occurrences were documented as well as 34 element occurrences that were updated.

One hundred and twenty six Targeted Inventory Areas (TIAs) were delineated within Chaffee County (Map1), of which 60 (48%) were visited during the summer of 2008. With the assistance of the stakeholders and Chaffee County, CNHP was very successful in obtaining permission from landowners to conduct these surveys and were denied access to only one property.

CNHP identified a total of 75 element occurrences (Table 8) that are contained within 51 Potential Conservation Areas (PCAs) in Chaffee County (Table 9). Before the project there were only 26 PCAs identified in Chaffee County (Map 2). Of the PCAs presented in the report (Map 3);

- 3 are of outstanding biodiversity significance (B1),
- 13 are of very high biodiversity significance (B2),
- 27 are of high biodiversity significance (B3),
- 6 are of moderate biodiversity significance (B4), and
- 2 are of general biodiversity significance (B5).

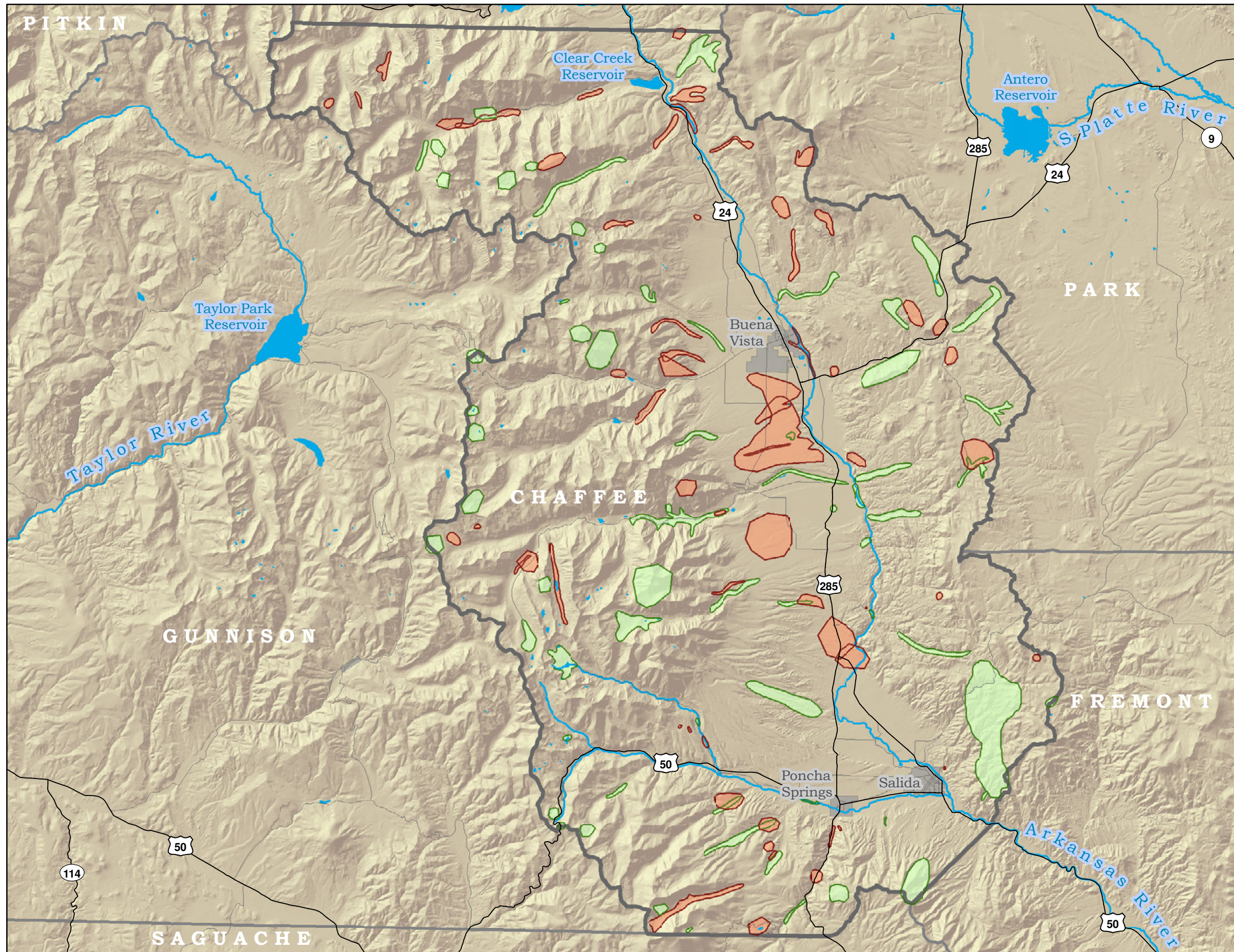
Two of the B1 sites, Castle Gardens and Droney Gulch are based on populations of the globally imperiled Brandegee wild buckwheat (*Eriogonum brandegeei*) and Fendler's townsend-daisy (*Townsendia fendleri*). Brandegee wild buckwheat, a Colorado endemic, is known only from six verified occurrences in Fremont and Chaffee counties. It is limited to outcrops of the Dry Union Formation in Chaffee County (Anderson 2006). Fendler's townsend-daisy is a regional endemic found in Colorado (Chaffee, Fremont, and Pueblo counties) and New Mexico. The third B1 PCA, Middle and South Cottonwood Creeks, is the best known breeding site in Colorado for the western or boreal toad (*Bufo boreas boreas*), as well as several good occurrences of globally imperiled riparian plant communities.

Several of the B2 sites, e.g., Tenderfoot Hill and King Gulch support good occurrences of other globally imperiled species. These include rock-loving aletes (*Aletes lithophilus*) and Arkansas Canyon stickleaf (*Nuttallia densa*). Of special note is the Poncha Hot Springs PCA that supports one of Colorado's best known occurrences of the state rare (G4S2) giant helleborine (*Epipactis gigantea*) that continues to thrive despite major hydrological modifications to the springs.

The wetland and riparian portion of the survey resulted in a wide diversity of riparian and wetland ecosystems. Some of the outstanding high elevation riparian habitat in the Sawatch Range includes La Plata Gulch, upper east and west Sayre's Gulch and the headwaters of the North Fork of Chalk Creek and Little Cochetopa Creek. Both PCAs support expansive and diverse mosaics of excellent quality willow carrs, wet meadows and open water ponds. Additional examples of outstanding montane riparian habitat in the Sawatch Range includes the riparian woodlands that line the upper reaches of Red Deer and Mercury Creeks and the

woodlands, shrublands and herbaceous wetlands along the lower reaches of Chalk Creek (below Chalk Lake and above the hot springs) and Clear Creek (above Clear Creek reservoir); and in the Mosquito Range the beaver complex and willow carrs that dominate Sawmill Gulch and the upper reaches of Fourmile creek. Habitat along Sevenmile Creek, in the foothills of the Mosquito Range, provides excellent examples riparian shrublands and woodlands that occur in an arid, mid-elevation desert climate.

Overall, the results confirm that Chaffee County's dramatic and varied topography has created distinctly different climate regimes in the upper Arkansas River Watershed which, in combination with complex geology, has resulted in a wide diversity of ecosystems. From the alpine tundra to the bristlecone pine forests that form a "ring" along the Sawatch Range, to the Mosquito Range and its Arkansas Hills, down to the Arkansas River valley Chaffee County is indeed a very unique and valuable place for Colorado and the world.



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Targeted Inventory Areas

- Visited
- Not Visited

Base Data

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

10m DEM Produced by the USGS

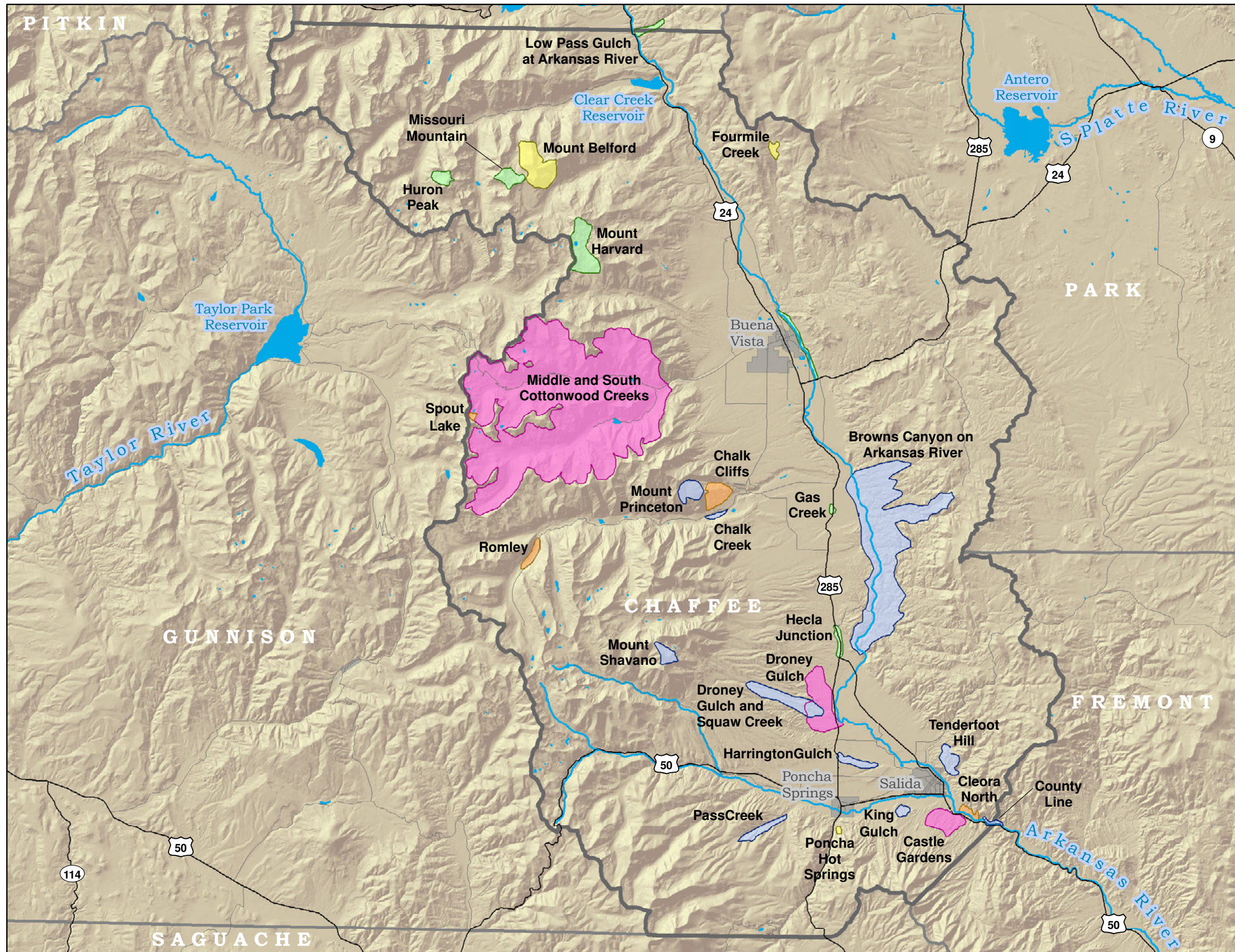
Location in Colorado



Targeted Inventory Areas are believed to have a relatively high probability of harboring significant biological resources.



Map 1. Targeted Inventory Areas in Chaffee County.



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**Potential Conservation Areas
 Before 2008 Survey**

by Biodiversity Significance Rank

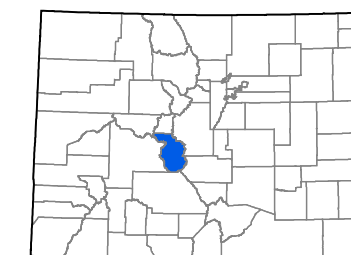
- B1: Outstanding Biodiversity Significance
- B2: Very High Biodiversity Significance
- B3: High Biodiversity Significance
- B4: Moderate Biodiversity Significance
- B5: General Biodiversity Interest

Base Data

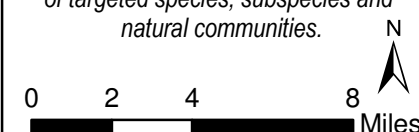
- Project Area
- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
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10m DEM Produced by the USGS

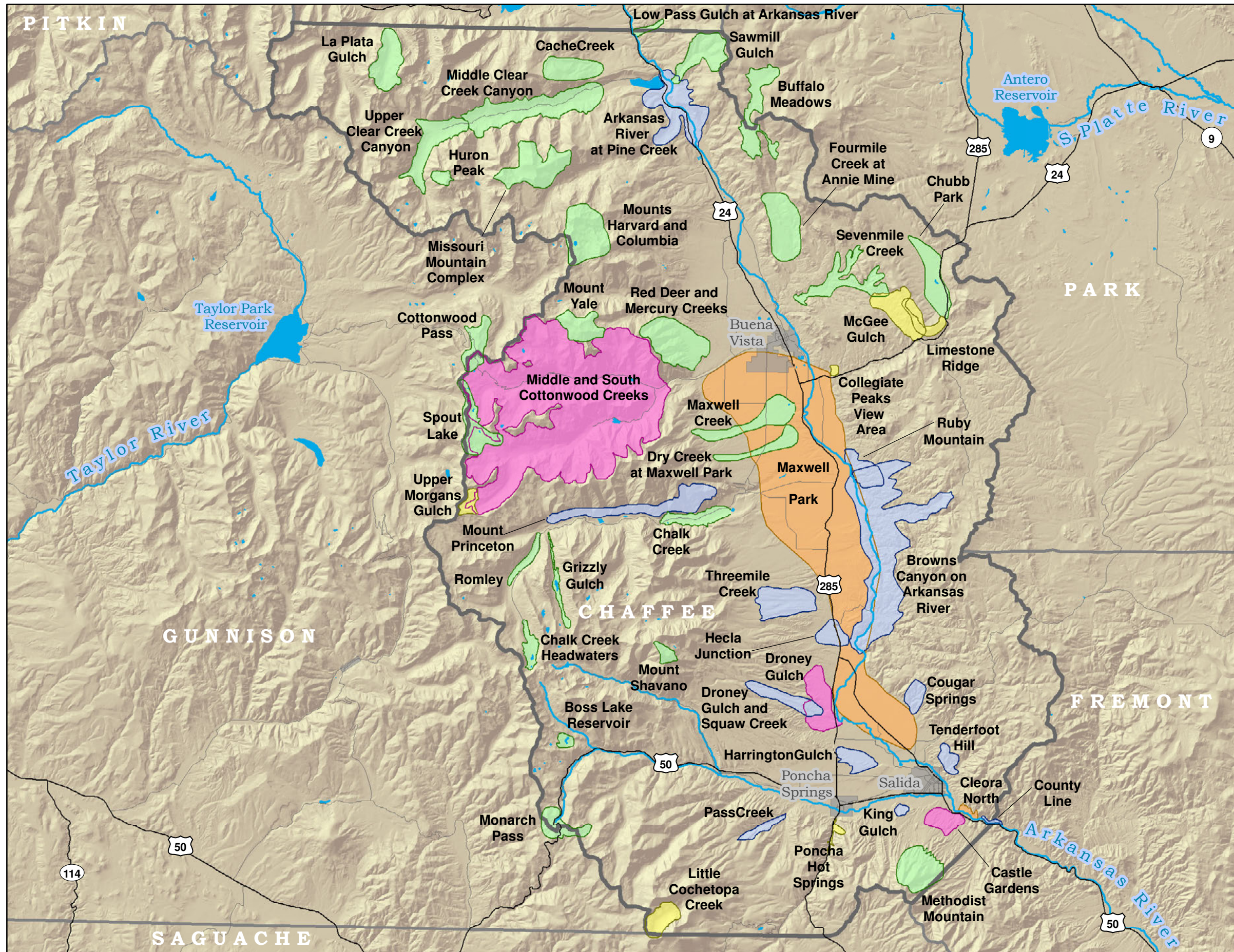
Location in Colorado



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



Map 2. Potential Conservation Areas in Chaffee County before 2008 Survey.



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Potential Conservation Areas by Biodiversity Significance Rank

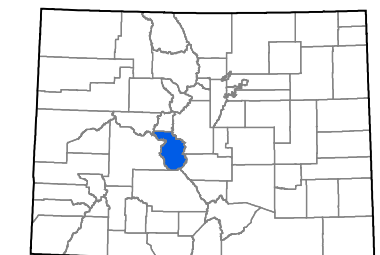
- B1: Outstanding Biodiversity Significance
- B2: Very High Biodiversity Significance
- B3: High Biodiversity Significance
- B4: Moderate Biodiversity Significance
- B5: General Biodiversity Interest

Base Data

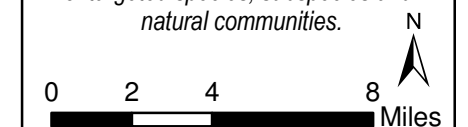
- Project Area
- Counties
- Municipalities
- Lakes, Reservoirs
- Rivers, Streams, Creeks
- Highways
- Major Roads

10m DEM Produced by the USGS

Location in Colorado



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



Map 3. Potential Conservation Areas in Chaffee County.

Significant Elements in Chaffee County

Table 8 presents CNHP elements of biological significance known to occur in a Potential Conservation Areas (PCAs) in this report. This is not a comprehensive list of all elements of biological significance known to occur in Chaffee County, but rather only includes those elements associated with PCAs that are significant enough to be archived in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS). For a key to Federal and State Status Codes, please refer to the table of Federal and State Agency special designations for rare species, within the section of the report entitled "The Natural Heritage Network and Ranking System".

Table 8. Colorado Natural Heritage Elements Known From Chaffee County (as of 4/10/2009). Detailed description of bolded elements can be found in the Natural History section of the document.

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive
Amphibians					
<i>Bufo boreas</i>	Western Toad - Southern Rocky Mountains	G4T1Q	S1T1		
Birds					
<i>Aegolius funereus</i>	Boreal Owl	G5	S2		USFS
<i>Cypseloides niger</i>	Black Swift	G4	S3B		USFS
Insects					
<i>Lycaeides idas sublivens</i>	Dark Blue	G5T3T4	S2S3S3		
<i>Ochrotrichia susanae</i>	Susan's Purse-making Caddisfly	G2	S2		USFS
<i>Oeneis bore</i>	White-veined Arctic	G5	S3		
Mammals					
<i>Corynorhinus (Plecotus) townsendii pallescens</i>	Pale Lump-nosed Bat	G4T4	S2T4		BLM/ USFS
<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	G5	S5	C	USFS
Vascular Plants					
<i>Aletes lithophilus (Neoparrya) lithophila</i>	Rock-loving Aletes	G3	S3		BLM/ USFS
<i>Argyroschisma fendleri</i>	Fendler Cloak-fern	G3	S3		
<i>Askellia (Crepis) nana</i>	Dwarf Alpine Hawk's-beard	G5	S2		
<i>Boechera (Arabis) crandallii</i>	Crandall's Rockcress	G2	S2		BLM
<i>Bolyphyta (Parthenium) tetraeuris</i>	Barneby's Feverfew	G3	S3		

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive
<i>Botrychium echo</i>	Reflected Moonwort	G3	S3		
<i>Botrychium simplex</i>	Least Grape-fern	G5	S1		
<i>Braya glabella</i> ssp. <i>glabella</i>	Smooth Rockcress	G5TNR	S1		USFS
<i>Braya humilis</i>	Low Braya	G5	S2		
<i>Carex concinna</i>	Beautiful Sedge	G4G5	S1		BLM
<i>Carex diandra</i>	Lesser Panicked Sedge	G5	S1		USFS
<i>Delphinium ramosum</i> var. <i>alpestre</i> (<i>Delphinium alpestre</i>)	Colorado Larkspur	G2	S2		
<i>Draba crassa</i>	Thick-leaf Whitlow-grass	G3	S3		
<i>Draba exunguiculata</i>	Clawless Draba	G2	S2		USFS
<i>Draba fladnizensis</i>	White Arctic Whitlow-grass	G4	S2S3		
<i>Draba grayana</i>	Gray's Peak Whitlow-grass	G2	S2		USFS
<i>Draba oligosperma</i>	Few-seed Whitlow-grass	G5	S2		
<i>Draba porsildii</i>	Porsild's Whitlow-grass	G3G4	S1		
<i>Draba streptobrachia</i>	Colorado Divide Whitlow-grass	G3	S3		
<i>Draba ventosa</i>	Wind River Whitlow-grass	G3	S1		
<i>Epipactis gigantea</i>	Giant Helleborine	G4	S2		USFS
<i>Erigeron lanatus</i>	Woolly Fleabane	G3G4	S1		
<i>Eriogonum brandegeei</i>	Brandegee's Wild Buckwheat	G1G2	S1S2		BLM/USFS
<i>Eriogonum coloradense</i>	Colorado Wild Buckwheat	G2	S2		BLM
<i>Eriophorum gracile</i>	Slender Cotton-grass	G5	S2		BLM/USFS
<i>Heuchera hallii</i>	Front Range Alum-root	G3	S3		
<i>Listera borealis</i>	Northern Twayblade	G4	S2		BLM
<i>Luzula subcapitata</i>	Colorado Wood-rush	G3?	S3?		
<i>Machaeranthera coloradoensis</i>	Colorado Tansy-aster	G2	S2		USFS
<i>Nama dichotomum</i>	Livemore Fiddleleaf	G4	S1		

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive
<i>Nuttallia (Mentzelia) densa</i>	Royal Gorge Stickleaf	G2	S2		BLM
<i>Nuttallia (Mentzelia) speciosa</i>	Jeweled Blazingstar	G3?	S3?		
<i>Penstemon degeneri</i>	Degener's Beardtongue	G2	S2		BLM/ USFS
<i>Ranunculus gelidus</i> ssp. <i>grayi</i> (<i>Ranunculus karelinii</i>)	Arctic Buttercup	G4G5	S2		USFS
<i>Sisyrinchium pallidum</i>	Pale Blue-eye-grass	G2G3	S2		BLM
<i>Townsendia fendleri</i>	Fendler's Townsend-daisy	G2	S2		
<i>Townsendia rothrockii</i>	Rothrock Townsend-daisy	G2G3	S2S3		
<i>Utricularia minor</i>	Lesser Bladderwort	G5	S2		USFS
Plant Communities					
<i>Alnus incana - Salix drummondiana</i> Shrubland	Alder-Drummond's willow shrubland	G3	S3		
<i>Betula nana</i> / Mesic Forbs - Mesic Graminoids Shrubland	Bog birch/mesic forbs-graminoids shrubland	G3G4	S3		
<i>Betula occidentalis / Maianthemum stellatum</i> Shrubland	River birch/false lily of the valley shrubland	G4?	S2		
<i>Betula occidentalis</i> / Mesic Graminoids Shrubland	River birch/ mesic graminoids	G3	S2		
<i>Carex simulata</i> Herbaceous Vegetation	Analogue sedge herbaceous vegetation	G4	S3		
<i>Eleocharis rostellata</i> Herbaceous Vegetation	Beaked spikerush herbaceous vegetation	G3	S2		
<i>Picea pungens / Alnus incana</i> Woodland	Colorado blue spruce-alder woodland	G3	S3		
<i>Picea pungens/ Equisetum arvense</i> Woodland	Colorado blue spruce-horsetail woodland	G3	S2?		
<i>Pinus aristata / Trifolium dasyphyllum</i> Woodland	Bristlecone pine/alpine clover woodland	G2	S2		

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive
<i>Pinus ponderosa</i> / <i>Alnus incana</i> Woodland	Ponderosa pine/ alder woodland	G2	S2		
<i>Populus angustifolia</i> - <i>Juniperus scopulorum</i> Woodland	Narrowleaf cottonwood-Rocky Mountain juniper woodland	G2G3	S2S3		
<i>Populus angustifolia</i> – <i>Pseudotsuga menziesii</i> Woodland	Narrowleaf cottonwood/ Douglas fir woodland	G3	S2		
<i>Populus angustifolia</i> / <i>Alnus incana</i> Woodland	Narrowleaf cottonwood-alder woodland	G3	S3		
<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	Narrowleaf cottonwood/river birch woodland	G3	S3		
<i>Populus angustifolia</i> / <i>Salix (monticola,</i> <i>drummondiana,</i> <i>lucida)</i> Woodland	Narrowleaf cottonwood/willow s woodland	G3	S3		
<i>Populus tremuloides</i> / <i>Acer glabrum</i> Forest	Aspen/ Rocky Mountain maple forest	G1G2	S2		
<i>Populus tremuloides</i> / <i>Alnus incana</i> Forest	Aspen/alder forest	G3	S3		
<i>Populus tremuloides</i> / <i>Salix drummondiana</i> Forest	Aspen/Drummond willow forest	G3G4	SU		
<i>Pseudotsuga menziesii</i> / <i>Betula occidentalis</i> Woodland	Douglas fir/river birch woodland	G3?	S3		
<i>Salix drummondiana</i> / <i>Calamagrostis</i> <i>canadensis</i> Shrubland	Drummond willow/blue-joint reedgrass shrubland	G3	S3		
<i>Salix geyeriana</i> - <i>Salix</i> <i>monticola</i> / Mesic Forbs Shrubland	Geyer willow- Rocky Mountain willow/mesic forbs shrubland	G3	S3		
<i>Salix geyeriana</i> / <i>Carex</i> <i>aquatilis</i> Shrubland	Geyer willow/water sedge shrubland	G3	S3		
<i>Salix geyeriana</i> / Mesic Forbs Shrubland	Geyer willow /mesic forbs shrubland	G3	S3		

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive
<i>Salix geyeriana</i> / Mesic Graminoids Shrubland	Geyer willow/ mesic graminoids shrubland	G3?	S3		
<i>Salix monticola</i> / <i>Carex aquatilis</i> Shrubland	Rocky Mountain willow/water sedge shrubland	G3	S3		
<i>Salix monticola</i> / <i>Carex utriculata</i> Shrubland	Rocky Mountain willow/beaked sedge shrubland	G3	S3		
<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	Planeleaf willow/water sedge shrubland	G5	S4		
<i>Salix planifolia</i> / <i>Deschampsia caespitosa</i> Shrubland	Planeleaf willow/tufted hairgrass shrubland	G2G3	S3		
<i>Salix wolfii</i> / Mesic Forbs Shrubland	Wolf willow/mesic forbs shrubland	G3	S3		

SITES OF BIODIVERSITY SIGNIFICANCE

The 51 most important sites in Chaffee County are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Table 9, Map 3).

Each Potential Conservation Area (PCA) is described in a standard PCA profile report that reflects data fields in CNHP's Biodiversity Tracking and Conservation System (BIOTICS). The contents of the profile report are outlined and explained below:

PCA Profile Explanation

Biodiversity Rank: B#

The overall significance of the PCA in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see *Natural Heritage Ranking System* section for more details.

Protection Urgency Rank: P#

A summary of major land ownership issues that may affect the long-term viability of the PCA and the element(s).

Management Urgency Rank: M#

A summary of major management issues that may affect the long-term viability of the PCA and the element(s).

USGS 7.5-minute Quadrangle name(s): A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.

Size: Expressed in acres.

***Elevation:** Expressed in feet.

General Description: A brief narrative of the topography, hydrology, vegetation, and current use of the potential conservation area.

***Key Environmental Factors:** A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.

***Climate Description:** Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, temperature and precipitation patterns is included.

***Land Use History:** General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.

***Cultural Features:** Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.

Biodiversity Significance Rank Comments: A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the PCA, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 1 for explanations of ranks and Table 2 for legal designations.

Boundary Justification: Justification for the location of the proposed PCA boundary delineated in this report, which includes all known occurrences of Natural Heritage resources and, in some cases, adjacent lands required for their protection.

***Protection Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

***Management Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

***Land Use Comments:** Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.

***Natural Hazard Comments:** If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.

***Exotic Species Comments:** A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance, and their potential effect on the viability of the targeted elements within the PCA.

***Offsite Considerations:** Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.

***Information Needs:** A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

* Optional fields, may or may not be included in Potential Conservation Area descriptions.

Table 9. Potential Conservation Areas in Chaffee County.

Potential Conservation Area	Biodiversity Rank
Castle Gardens	B1: Outstanding Biodiversity Significance
Droney Gulch	B1: Outstanding Biodiversity Significance
Middle and South Cottonwood Creeks	B1: Outstanding Biodiversity Significance
Arkansas River at Pine Creek	B2: Very High Biodiversity Significance
Browns Canyon on Arkansas River	B2: Very High Biodiversity Significance
Cougar Springs	B2: Very High Biodiversity Significance
County Line	B2: Very High Biodiversity Significance
Droney Gulch and Squaw Creek	B2: Very High Biodiversity Significance
Harrington Gulch	B2: Very High Biodiversity Significance
Hecla Junction	B2: Very High Biodiversity Significance
King Gulch	B2: Very High Biodiversity Significance
Mount Princeton	B2: Very High Biodiversity Significance
Pass Creek	B2: Very High Biodiversity Significance

Potential Conservation Area	Biodiversity Rank
Ruby Mountain	B2: Very High Biodiversity Significance
Tenderfoot Hill	B2: Very High Biodiversity Significance
Threemile Creek	B2: Very High Biodiversity Significance
Boss Lake Reservoir	B3: High Biodiversity Significance
Buffalo Meadows	B3: Moderate Biodiversity Significance
Cache Creek	B3: High Biodiversity Significance
Chalk Creek	B3: High Biodiversity Significance
Chalk Creek Headwaters	B3: High Biodiversity Significance
Chubb Park	B3: Moderate Biodiversity Significance
Cottonwood Pass	B3: High Biodiversity Significance
Dry Creek at Maxwell Park	B3: High Biodiversity Significance
Fourmile Creek at Annie Mine	B3: High Biodiversity Significance
Grizzly Gulch	B3: High Biodiversity Significance
Huron Peak	B3: High Biodiversity Significance
La Plata Gulch	B3: High Biodiversity Significance
Low Pass Gulch at Arkansas River	B3: High Biodiversity Significance
Maxwell Creek	B3: High Biodiversity Significance
Methodist Mountain	B3: High Biodiversity Significance
Middle Clear Creek Canyon	B3: High Biodiversity Significance
Missouri Mountain Complex	B3: High Biodiversity Significance
Monarch Pass	B3: High Biodiversity Significance
Mount Shavano	B3: High Biodiversity Significance

Potential Conservation Area	Biodiversity Rank
Mount Yale	B3: High Biodiversity Significance
Mounts Harvard and Columbia	B3: High Biodiversity Significance
Red Deer –Mercury Creeks	B3: High Biodiversity Significance
Romley	B3: High Biodiversity Interest
Sawmill Gulch	B3: High Biodiversity Significance
Sevenmile Gulch	B3: High Biodiversity Significance
Spout Lake	B3: High Biodiversity Significance
Upper Clear Creek Canyon	B3: High Biodiversity Significance
Collegiate Peaks View Area	B4: High Biodiversity Significance
Limestone Ridge	B4: High Biodiversity Significance
Little Cochetopa Creek	B4: High Biodiversity Significance
McGee Gulch	B4: Moderate Biodiversity Significance
Poncha Hot Springs	B4: Moderate Biodiversity Significance
Upper Morgans Gulch	B4: Moderate Biodiversity Significance
Cleora North	B5: General Biodiversity Interest
Maxwell Park	B5: Moderate Biodiversity 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.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B1): Castle Gardens supports an excellent to good (AB-ranked) occurrence of the globally critically (G1G2/S1S2) Brandegee wild buckwheat (*Eriogonum brandegeei*), 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 to date. There is also a good (B-ranked) occurrence of Fendler's townsend daisy (*Townsendia fendleri*), a globally imperiled (G2/S2) plant.

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
Vascular Plants	<i>Townsendia fendleri</i>	Fendler's townsend - daisy	G2	S2				B	2008-06-03

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

Boundary Justification: The boundary includes the populations of Brandegee wild buckwheat (*Eriogonum brandegeei*) and Fendler's townsend daisy (*Townsendia fendleri*) that occur throughout the barren slopes and adjacent pinon pine woodlands, and area for potential expansion of the plants. It also includes a buffer against direct disturbance. However, the natural processes are not completely contained in the boundary, and off-site activities within the larger area have the potential to impact the rare plant populations.

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

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

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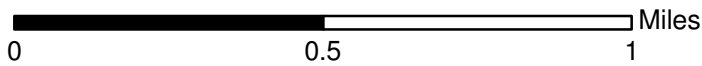
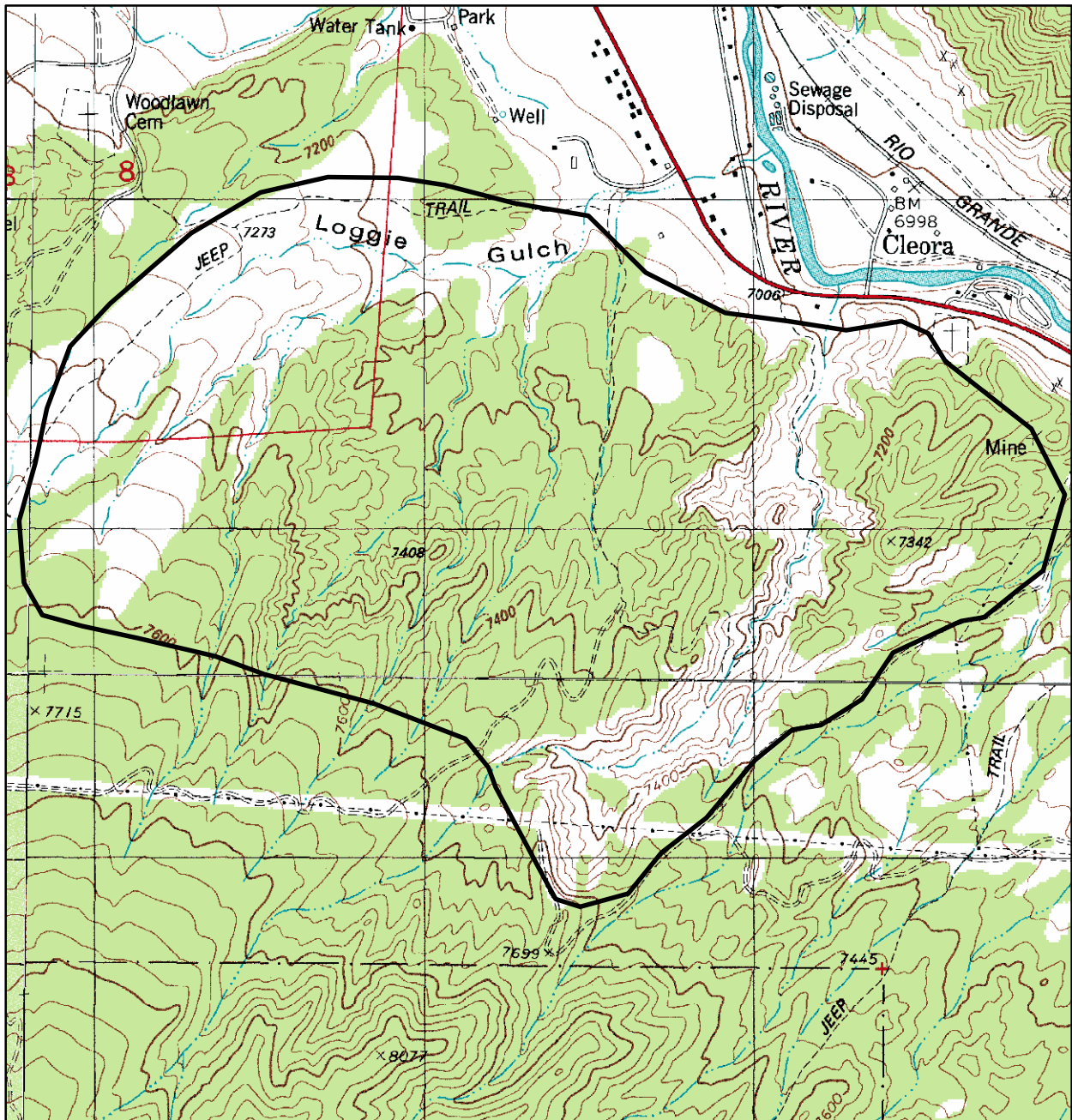
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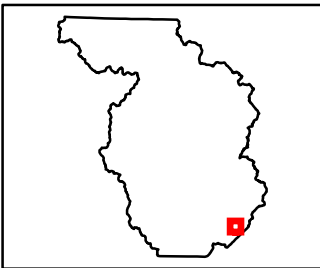
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Version Author: Culver, D.R.

Version Date: 03/12/2009



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 02/13/2009</p>	<p>Legend</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 Chaffee County</p> 
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Castle Gardens Potential Conservation Area, B1: Outstanding Biodiversity Significance

Droney Gulch

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

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

Size: 2,265 acres (917 ha)

Elevation: 7,620 - 8,000 ft. (2,323 - 2,438 m)

General Description: The Droney Gulch site consists of sparsely vegetated light-brown hills of lacustrine alluvium of the Dry Union Formation (Tweto 1979). These Pliocene and Miocene deposits form soils ranging from silt-loams to sands. These stark, barren slopes support one of the best known occurrences of the globally rare Brandegee wild buckwheat (*Eriogonum brandegeei*). At the base of the slopes there are sparse stands of the pinon pine / mountain mahogany / Indian ricegrass (*Pinus edulis* / *Cercocarpus montanus* / *Oryzopsis hymenoides*) woodland plant association. Associated species are Utah juniper (*Juniperus osteosperma*), James buckwheat (*Eriogonum jamesii*), narrow-leaved yucca (*Yucca angustissima*), gray horsebrush (*Tetradymia canescens*), and rubber rabbitbrush (*Chrysothamnus nauseosus*). Surrounding uplands are dominated by denser stands of pinon pine and Utah juniper. Toe slopes below the site are dominated by bluegrama (*Bouteloua gracilis*), pinon pine, winterfat (*Krascheninnikovia lanata*), and four-wing saltbush (*Atriplex canescens*).

Key Environmental Factors: The Brandegee wild buckwheat is probably a long-lived perennial with episodic recruitment which is likely related to moisture and temperature. It occurs on steep, eroding slopes with fine-textured soils derived from the Dry Union Formation.

Biodiversity Significance Rank Comments (B1): One of the most outstanding occurrences (A-ranked) of the globally critically imperiled (G1G2/S1S2) Brandegee wild buckwheat (*Eriogonum brandegeei*) occurs within this site. It also contains an excellent to good (AB-ranked) occurrence of the globally imperiled (G2/S1) Fendler's townsend-daisy (*Townsendia fendleri*). The Brandegee wild buckwheat at Droney Gulch represents one of the largest and least disturbed known occurrences in the world of this species (O'Kane 1985). Only a few occurrences have been documented, all of which are in Fremont and Chaffee counties in Colorado and nowhere else in the world. This site and one other with Brandegee wild buckwheat, the Garden Park Fossil locality in Fremont County, are registered as a State Natural Areas.

Natural Heritage element occurrences at the Droney 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>Eriogonum brandegeei</i>	Brandegee wild buckwheat	G1G2	S1S2			BLM/USFS	A	2001-07-24
Vascular Plants	<i>Townsendia fendleri</i>	Fendler's townsend - daisy	G2	S2				AB	2006-08-10

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

Boundary Justification: The boundary includes the populations of Brandegee wild buckwheat (*Eriogonum brandegeei*) and Fendler's townsend daisy (*Townsendia fendleri*) that occur throughout the barren slopes and adjacent pinon pine woodlands, and area for potential expansion of the plants. It also includes a buffer against direct disturbance. However, the natural processes are not completely contained in the boundary, and off-site activities within the larger area have the potential to impact the rare plant populations.

Protection Urgency Rank Comments (P5): This site has become a designated State Natural Area. Additionally, the portions of the occurrences that are on Bureau of Land Management land are within an Area of Critical Environmental Concern (ACEC). As such, any impact of management activities to rare plant populations should be taken into consideration.

Management Urgency Rank Comments (M3): The barren nature of the slopes and the highly erodible soils make off-road vehicle use and horseback riding desirable recreational uses, and consequently pose a major threat to the area. The steep, soft, barren slopes are generally not impacted by grazing that occurs in the area. Increased residential development and the potential for mineral exploration and extraction should be considered for the protection of this outstanding occurrence of the Brandegee wild buckwheat and other species. Some tree stumps indicate past timber cutting.

Exotic Species Comments: Leafy spurge (*Euphorbia esula*), Jim Hill mustard (*Sisymbrium altissimum*), Russian thistle (*Salsola iberica*), lambsquarters (*Chenopodium album*), yellow sweetclover (*Melilotus officianale*) and cheatgrass (*Bromus tectorum*) occur but are currently sparse in the area (Anderson et al. 2001). Targeting management efforts to control the spread of these weeds may reduce their threat to the ecological systems.

Off-Site Considerations: Some recent cattle grazing has occurred west of a cattle guard and the fence, and north of County Road 251. Several trailers and a new house lie along the north side of County Road 251, east of the ACEC boundary, and a new house has been built in the area. The lands surrounding the private tracts are largely owned by BLM or the State of Colorado.

Information Needs: The potential for minerals in the area should be determined. The Arkansas River Canyon separates the Garden Park occurrence from the Chaffee County populations. Research could be conducted to examine the substrate preference of the Brandegee wild buckwheat and whether there are genetic differences between the two separated populations. Additional information is needed on the biology and the life history of the Brandegee wild buckwheat to help guide management decisions such as; in which season is precipitation utilized most by Brandegee wild buckwheat? What are the total annual and seasonal precipitation amounts for this site? With which plants does it compete? Long-term monitoring should be initiated to help us better understand the population biology of this species. For example, research should be conducted to determine the effects of herbivory by cows, sheep, mice and deer. Could below- ground root-grazing be a problem?

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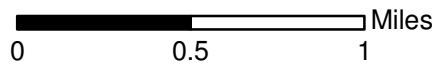
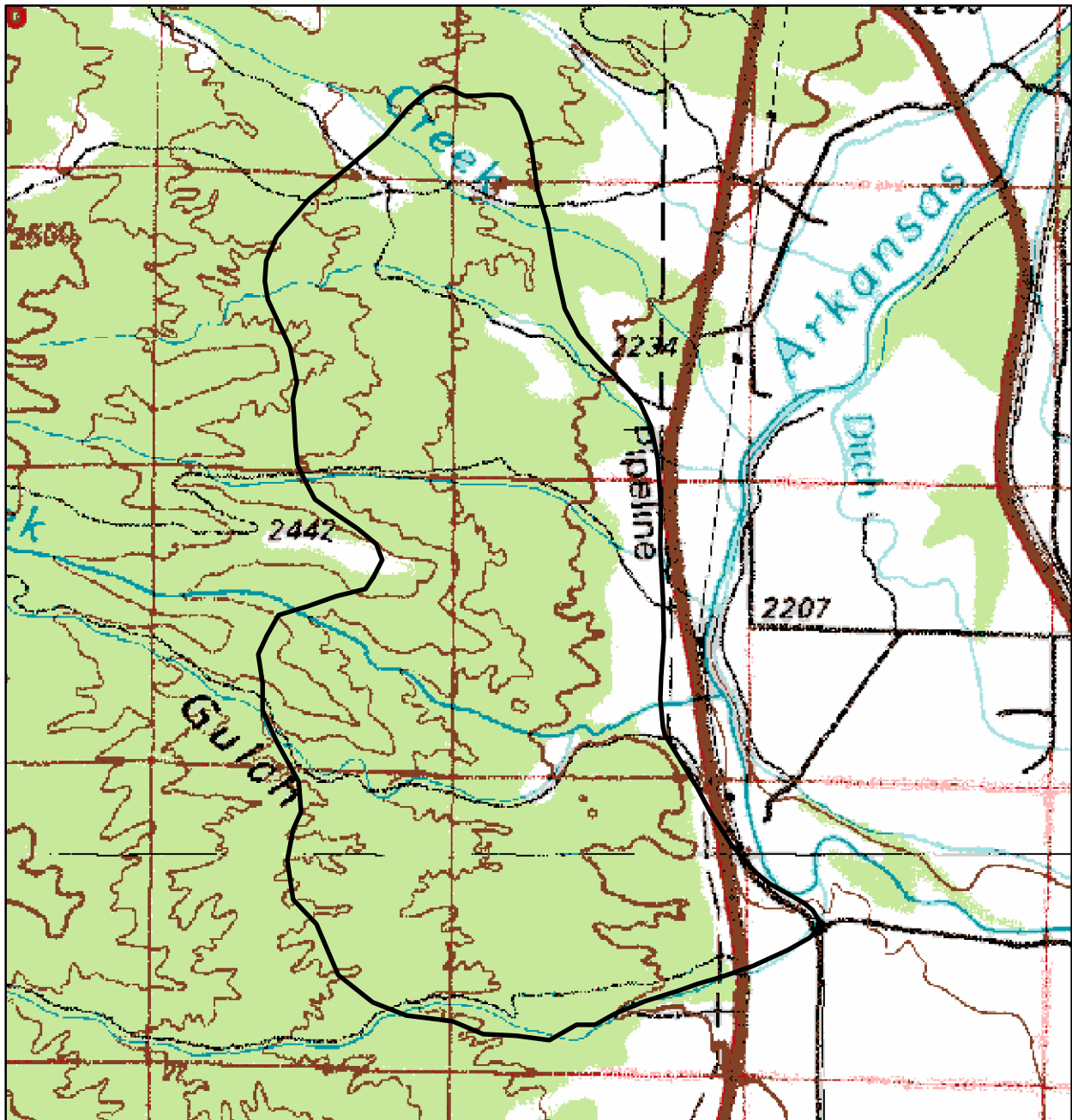
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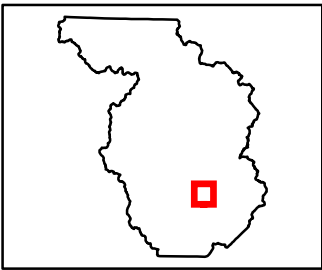
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Version Author: Neid, S.L.

Version Date: 03/30/2007



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Droney Gulch Potential Conservation Area, B1: Outstanding Biodiversity Significance

Middle and South Cottonwood Creeks

Biodiversity Rank - B1: Outstanding 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: Saint Elmo, Mount Yale, Tincup, Cumberland Pass, Buena Vista West

Size: 37,580 acres (15,208 ha) **Elevation:** 8,760 - 12,402 ft. (2,670 - 3,780 m)

General Description: This site includes about 10 breeding sites for the boreal toad each year. The habitat includes high elevation riparian with cottonwood and willow communities, alpine and subalpine meadows, spruce / fir and aspen forests. Montane riparian forest communities include *Populus angustifolia* / *Alnus incana* woodlands and *Populus tremuloides* / *Acer glabrum* forest. Subalpine riparian shrubland communities include *Betula nana* / mesic forb - mesic graminoid shrubland. Boreal Owls (*Aegolius funereus*) have also been documented in the site.

Climate Description: The area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Land Use History: High to medium use recreation (camping, ORV use, fishing, hunting) and historic mining and logging operations.

Biodiversity Significance Rank Comments (B1): The site supports excellent (A-ranked) occurrences of a globally critically imperiled subspecies (G4T1Q/S1), boreal toad (*Bufo boreas* pop. 1). As of 2005, this is one of two viable sites for boreal toads and the best known occurrence in Colorado. It also supports high quality examples of several globally rare riparian communities.

Natural Heritage element occurrences at the Middle and South Cottonwood Creeks PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		A	2008-09-24
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		A	2008-99-99
Birds	Aegolius funereus	Boreal Owl	G5	S2			USFS	E	2007-05-21
Natural Communities	Populus tremuloides / Acer glabrum Forest	Montane Riparian Forests	G1G2	S2				A	2008-08-28
Natural Communities	Populus angustifolia / Alnus incana Woodland	Montane Riparian Forest	G3	S3				B	2008-08-28
Natural Communities	Salix drummondiana / Calamagrostis canadensis Shrubland	Lower Montane Willow Carrs	G3	S3				B	2008-08-28
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	1998-06-27

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

Boundary Justification: The site boundary was created by dissolving the Middle and South Cottonwood Creeks drainages from 12 digit hydrological units then clipping it to the digital elevation model at 3,780 meters. This elevation range allowed two hypothesized dispersal corridors, the Ptarmigan Lake area where boreal toads have been observed at high elevation on both sides of watershed divide as well as the confluence where historic toad records exist below. Using PIT tags, dispersal between the Middle and South Cottonwood Creeks drainages has been documented. Boreal toad success in these drainages is closely tied to water quality, water level in breeding ponds, winter refugia, beaver activity, and invertebrate populations. Also, little is known about the boreal toad life cycle away from the breeding pond. Thus, much of the watershed is included in the site to encompass possible dispersal corridors and certainly water quality issues. The boundaries also

include the immediate ecological processes and watersheds need to support the riparian plant communities.

Protection Urgency Rank Comments (P3): Much of the property is owned by the San Isabel National Forest, however small parcels with private cabins and recreation based businesses exist.

Management Urgency Rank Comments (M3): High use recreation impacts may need to be addressed due to habitat degradation in areas with road side camping and/or ORV use close to breeding sites.

Off-Site Considerations: Hydrological processes originating outside of the planning boundary, including water quality, quantity, flow and timing must be managed to maintain site viability.

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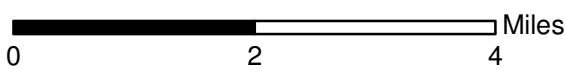
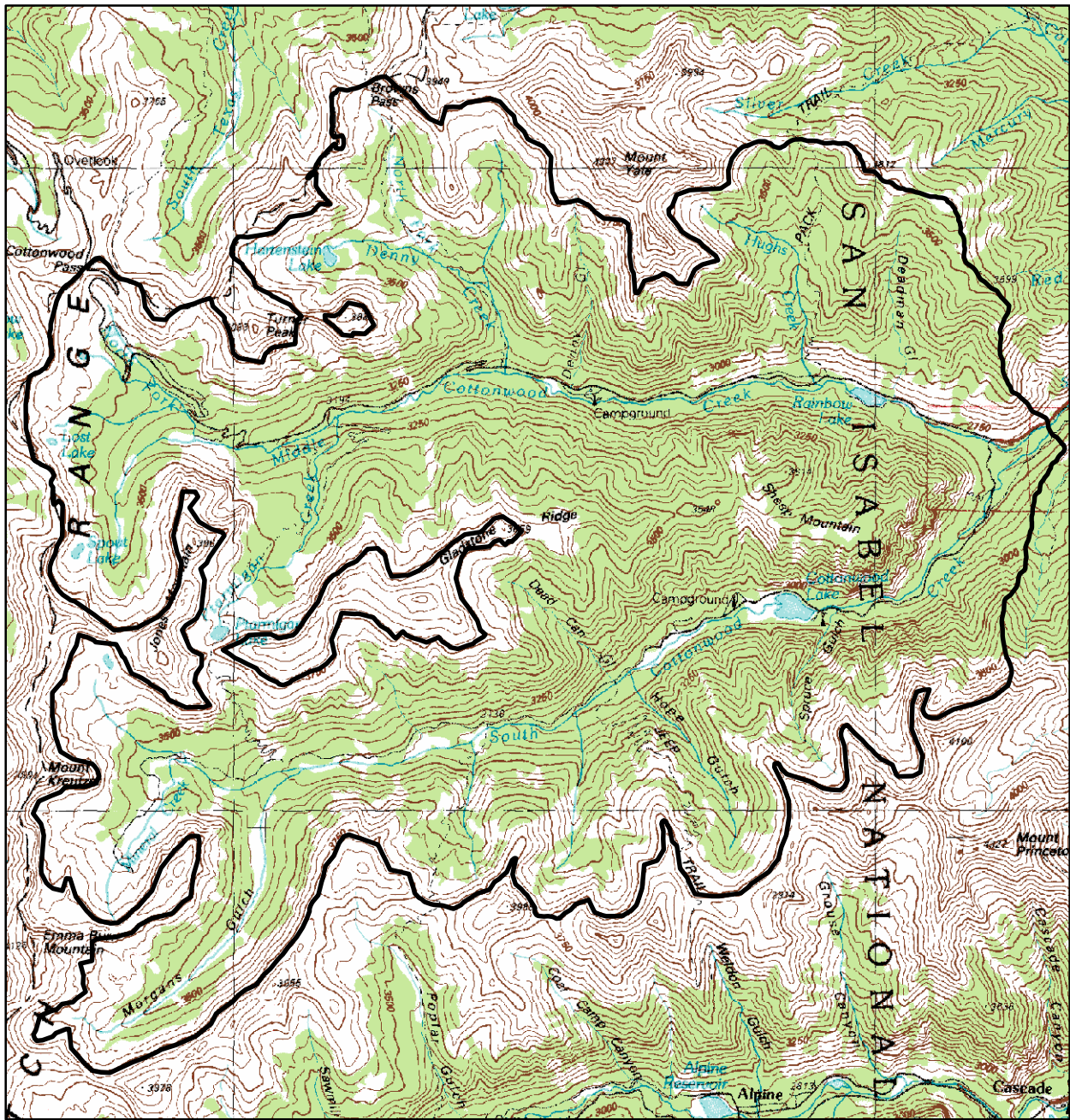
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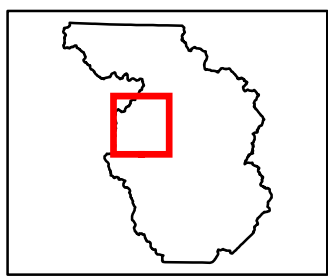
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Version Author: Gaughan, C.R.

Version Date: 11/02/2005



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Middle and South Cottonwood Creeks Potential Conservation Area, B1: Outstanding Biodiversity Significance

Arkansas River at Pine Creek

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: Harvard Lakes, Granite, South Peak, Mount Harvard

Size: 3,872 acres (1,567 ha)

Elevation: 8,590 - 10,200 ft. (2,618 - 3,109 m)

General Description: The site is located on the banks of the Arkansas River approximately nine miles upstream of the city of Buena Vista in the upper Arkansas River Watershed. Here, the Arkansas River is a fourth order, north-south trending stream that drains a moderately wide, gently sloping valley. The upper Arkansas Valley is flanked by the Sawatch Mountains to the west and by the Mosquito Mountains to the east. These steep mountain ranges rise dramatically from the valley floor, creating a "double" rain-shadow effect in the valley. Geology on the valley floor at the upstream end is Pleistocene age glacial drift of the Pinedale and Bull Lake glaciations; mid reaches are gravels and alluviums of the Pinedale and Bull Lake glaciations; and lower reaches are Quaternary age younger alluvium that are landslide deposits that includes talus, rock glacier and thick colluvial deposits (Tweto 1979). Upland and riparian soils are typically well-drained and riparian soils characteristically have a thin organic layer. Upland habitat is characterized by drought tolerant plant communities including sage (*Artemisia tridentata*) shrublands, pinon - juniper (*Pinus edulis* - *Juniperus scopulorum*) woodlands with Douglas-fir (*Pseudotsuga menziesii*) scattered across the hillslopes. Upland and riparian habitat on the left bank are fragmented by a dirt road and a railroad grade and on the right bank by a highway. On the left bank, at the base of the hillslopes, a groundwater discharge zone creates a narrow but extensive zone of wetland vegetation. The narrow riparian zone is seasonally flooded but this is a controlled river and the hydrologic regime does not approximate the natural amplitude or periodicity of a natural hydrologic cycle. Additionally, the river has been channelized by a highway and by a historic railroad grade with consequent impacts to channel form and function and to the condition and extent of riparian habitat. Riparian habitat forms a narrow band of lush vegetation that winds through this arid landscape. In these stream reaches it is dominated by woodlands interspersed with shrublands and patches of herbaceous cover. Riparian habitat on the upper 2.5 miles of this site is characterized by an association of ponderosa pine (*Pinus ponderosa*) and thinleaf alder (*Alnus incana*). The upper canopy is clearly dominated by ponderosa pine but other tree species are also present including Douglas-fir and narrowleaf cottonwood (*Populus angustifolia*). Thinleaf alder dominates the shrub layer but is confined to a narrow band lining the stream channel. Other common shrub species include coyote

willow (*Salix exigua*), mountain willow (*Salix monticola*), Wood's rose (*Rosa woodsii*), wax currant (*Ribes cereum*) and shrubby cinquefoil (*Dasiphora floribunda*). The herbaceous layer is sparse except for the very narrow zone of inundated habitat adjacent to the river. Common herbaceous species here include arctic rush (*Juncus balticus*), slender scouring rush (*Equisetum variegatum*) and star solomonplume (*Maianthemum stellatum*). The lower 0.5 miles is characterized by an association of narrowleaf cottonwood and Douglas- fir interspersed with patches of willow and herbaceous cover. Other tree species include blue spruce (*Picea pungens*) and ponderosa pine. Thinleaf alder and coyote willow co-dominate the shrub canopy but other shrubs also occur including mountain willow, Drummond's willow (*Salix drummondiana*), Rocky Mountain maple (*Acer glabrum*), chokecherry (*Prunus virginiana*) and Wood's rose (*Rosa woodsii*).

Key Environmental Factors: The primary ecological process essential for the maintenance of these riparian woodland systems is hydrology and specifically surface flow with annual and episodic flooding (Rondeau 2001). Seasonal flooding allows ponderosa pine access to the water table, and enables regeneration and establishment of narrowleaf cottonwood; additionally, Douglas-fir establishment is favored by well-drained colluvial soils and the moist cool air of narrow canyons (NatureServe 2009).

Biodiversity Significance Rank Comments (B2): This site supports a good (B-ranked) occurrence of a globally imperiled (G2/S2) *Pinus ponderosa* / *Alnus incana* woodland. Lower montane woodland ecological systems occupy less than 1% of the Southern Rocky Mountains ecoregion (Rondeau 2001) and the *Pinus ponderosa* / *Alnus incana* association has been known only from the Front Range of Colorado (NatureServe 2009). There is also a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Populus tremuloides* / *Alnus incana* montane riparian forest, a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Picea pungens* / *Alnus incana* montane riparian forest and a fair (C-ranked) occurrence of a globally vulnerable (G3/S2) *Populus angustifolia* - *Pseudotsuga menziesii* montane riparian forest.

Natural Heritage element occurrences at the Arkansas River at Pine Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Pinus ponderosa / Alnus incana Woodland	Ponderosa Pine / Thin Leaf Alder	G2	S2				B	2008-07-25
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				B	2008-07-30
Natural Communities	Populus angustifolia - Pseudotsuga menziesii Woodland	Montane Riparian Forest	G3	S2				C	2008-07-25
Natural Communities	Populus tremuloides / Alnus incana Forest	Montane Riparian Forests	G3	S3				B	2008-07-30

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

Boundary Justification: The boundary encompasses the occurrences and the immediate watershed enabling the hydrologic and ecologic processes that support the long-term viability of the riparian communities.

Protection Urgency Rank Comments (P3): Land ownership is private and public. Public lands include both State Land and USFS land. Private landowners are conservation-minded.

Management Urgency Rank Comments (M3): Threats are primarily from diversions on the Arkansas River that alter the natural hydrologic regime, reducing the potential for long-term system viability.

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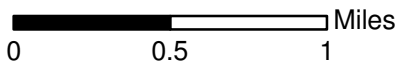
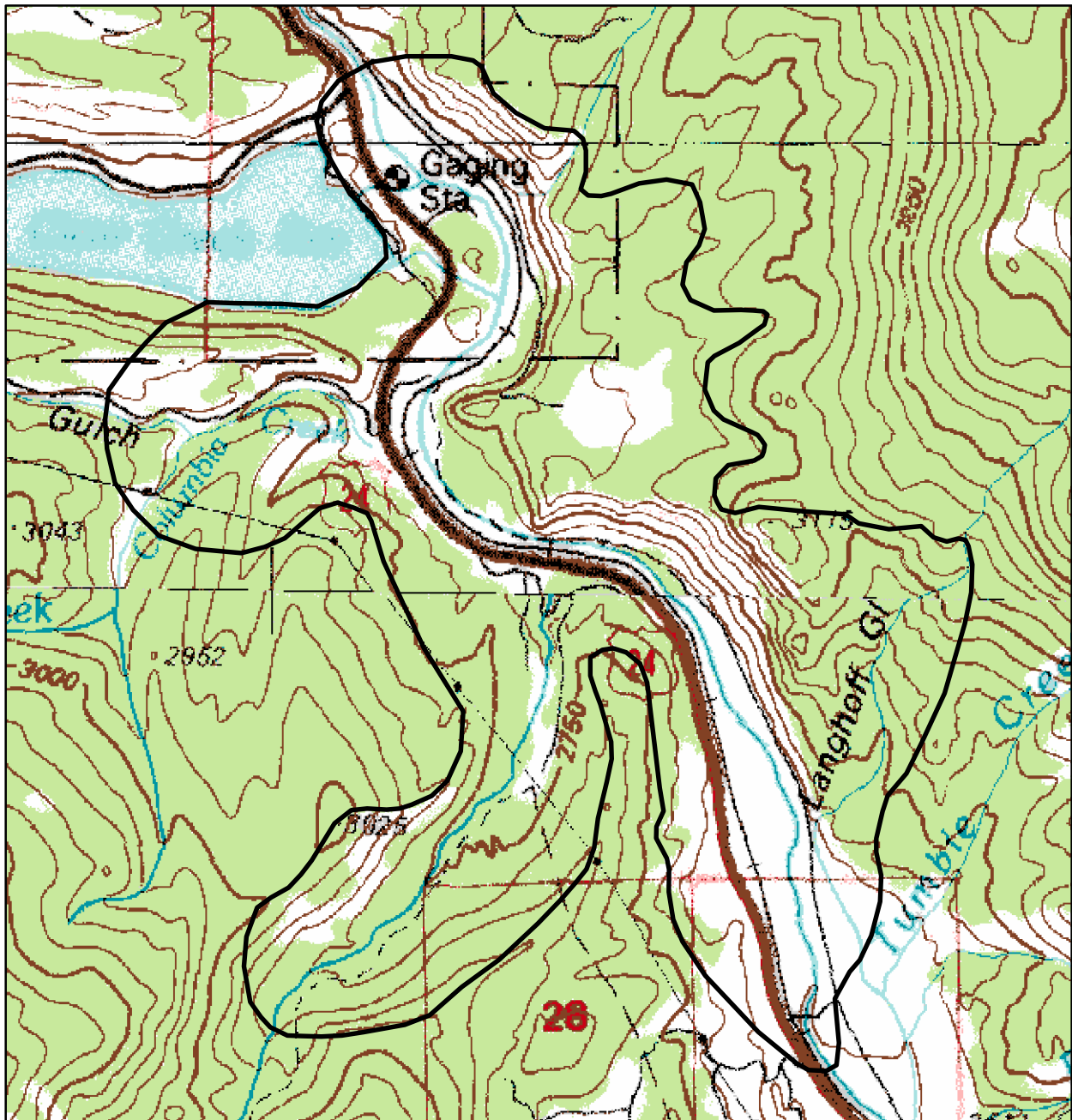
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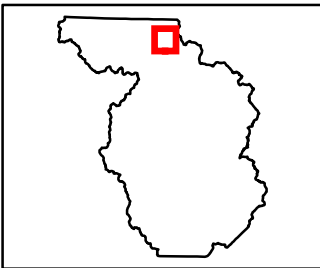
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Version Author: Malone, D.G.

Version Date: 04/07/2009



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Arkansas River at Pine Creek Potential Conservation Area, B2: Very High Biodiversity Significance

Browns Canyon on Arkansas River

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: Buena Vista East, Nathrop, Salida West, Cameron Mountain

Size: 11,581 acres (4,687 ha) **Elevation:** 7,320 - 8,200 ft. (2,231 - 2,499 m)

General Description: The site is located between Nathrop and Hecla Junction along the Arkansas River. Browns Canyon is the most heavily used section of the upper Arkansas River. Browns Canyon is a northwest extension of the Arkansas Valley, which lies on the western flank of the Mosquito Range. Rocks that comprise Browns Canyon make up a batholith of Precambrian granodiorite that is 1.6 billion years old (Karnuta 1995). Side streams have cut steep gulches through the pinkish granite and metamorphic rock of the area. Pinon - juniper forest dominates the arid lands in Browns Canyon along the Arkansas River. The vegetation changes dramatically as elevation increases, giving way to Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), and stands of aspen (*Populus tremuloides*) for which Aspen Ridge is named. The area is an important wintering ground for deer and elk. Twenty bighorn sheep were reintroduced into Browns Canyon in 1980, with an additional 20 in both 1982 and 1985. It is estimated that there is currently a herd of 135 bighorns whose range includes Browns Canyon and portions of Aspen Ridge. Other mammals found within the area include mountain lions, black bears, bobcats, foxes, coyotes, pine martens and many smaller animals. Eight species of raptors have been sighted in the area, including Golden Eagle, Prairie Falcons, and Great-horned Owl (CDOW 2009). The riparian area is dominated by narrowleaf cottonwood (*Populus angustifolia*), river birch (*Betula occidentalis*) and scattered Rocky Mountain juniper (*Juniperus scopulorum*).

Climate Description: The area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Land Use History: Hecla Junction in the southern portion of the site was once one of the major fluorspar mining districts in the United States (Karnuta 1995).

Biodiversity Significance Rank Comments (B2): This site supports two excellent (A-ranked) occurrences of a globally imperiled (G2G3/S2S3) montane riparian forest (*Populus angustifolia* - *Juniperus scopulorum*) as well as good (B-ranked) and fair

(C-ranked) occurrences of a state rare (G4?/S2) foothills riparian shrubland (*Betula occidentalis* / *Maianthemum stellatum*).

Natural Heritage element occurrences at the Browns Canyon on Arkansas River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				A	2008-08-21
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				A	1995-08-29
Natural Communities	Betula occidentalis / Maianthemum stellatum Shrubland	Foothills Riparian Shrubland	G4?	S2				B	1995-07-18
Natural Communities	Betula occidentalis / Maianthemum stellatum Shrubland	Foothills Riparian Shrubland	G4?	S2				B	2008-08-21
Natural Communities	Betula occidentalis / Maianthemum stellatum Shrubland	Foothills Riparian Shrubland	G4?	S2				BC	2008-08-07

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

Boundary Justification: The boundary is drawn to encompass the local watershed and adjacent side canyons, allowing for the operation of normal hydrological and ecological processes. The boundary includes high quality riparian areas on narrow tributary to Brown's Canyon, as well as the canyon itself. Topographic ridgelines were used as immediate watershed protection.

Protection Urgency Rank Comments (P4): Site is owned by the Bureau of Land Management and Forest Service.

Management Urgency Rank Comments (M4): The site is a BLM Area of Critical Concern and the western portion is being considered for wilderness designation.

Information Needs: Site needs visit to confirm boundaries.

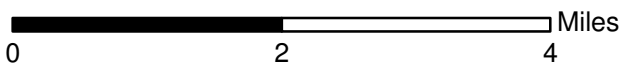
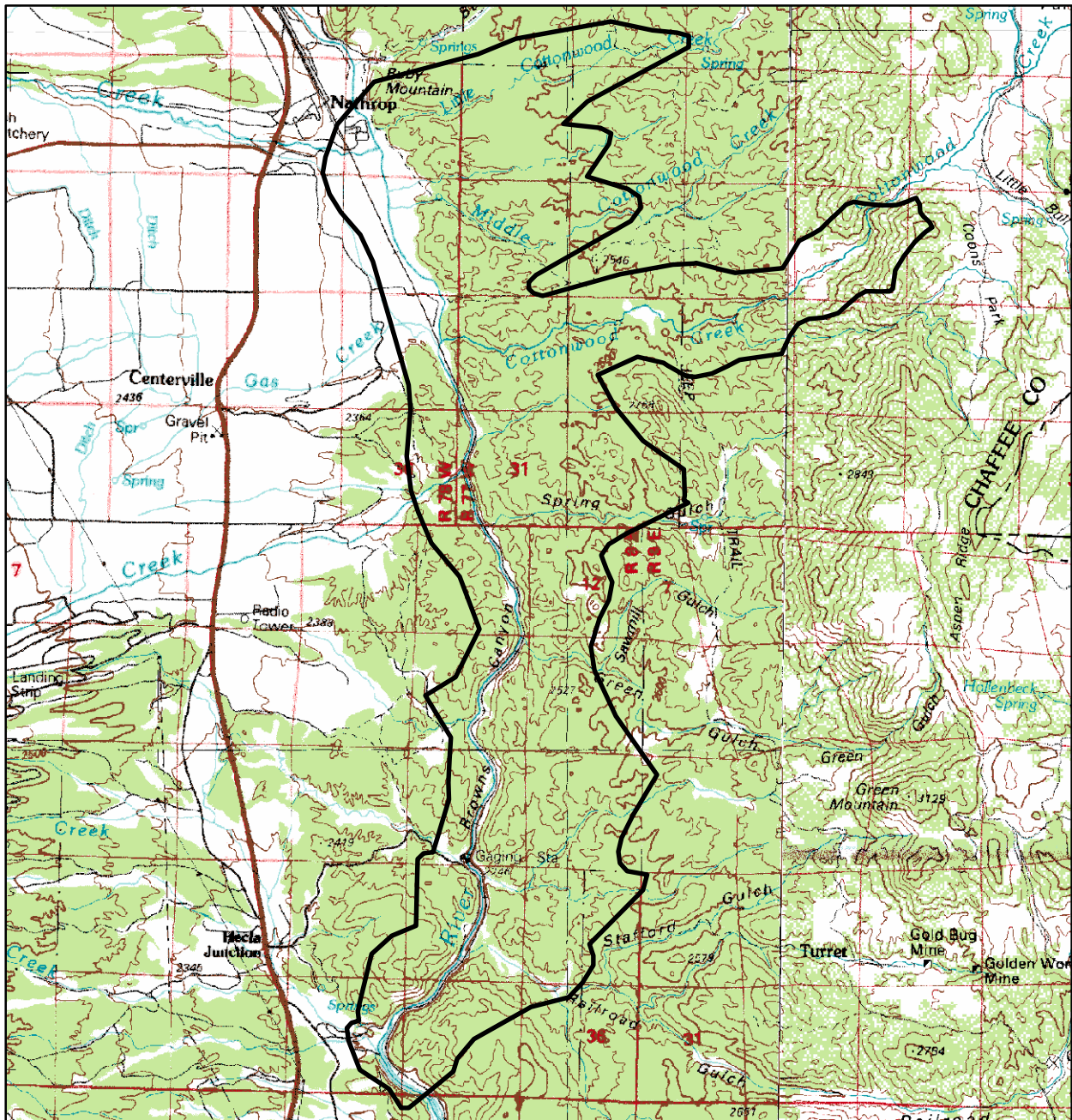
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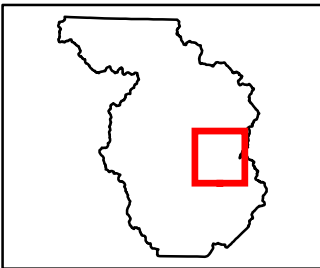
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Karnuta, T. 1995. Road and Riverside Geology of the Upper Arkansas Valley. Geotechnics. Salida, CO.

Version Author: Kittel, G.M.

Version Date: 05/02/1997



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 04/22/2009</p>	<p>Legend</p> <p> PCA Boundary</p> <p>Pikes Peak, 38105-E1 Gunnison, 38106-E1</p> <p>30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey</p>	<p>Location in Chaffee County</p> 
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Browns Canyon on Arkansas River Potential Conservation Area, B2: Very High Biodiversity Significance

Cougar Springs

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: Salida West

Size: 708 acres (287 ha)

Elevation: 7,400 - 8,350 ft. (2,256 - 2,545 m)

General Description: Cougar Springs is located above Sand Park within the Arkansas Hills. There are scattered stabilized sand dunes throughout the site. The area is sparsely vegetated with scattered pinon pine (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*), blue gilia (*Aliciella pinnatifida*), golden aster (*Heterotheca villosa*), fringed sage (*Artemisia frigida*), mountain mahogany (*Cercocarpus montanus*), prickly pear cactus (*Opuntia polyacantha*), needle-and-thread grass (*Hesperostipa comata*), narrow leaf yucca (*Yucca glauca*), buckwheat (*Eriogonum jamesii*), and rice grass (*Achnatherum hymenoides*). The uplands consist of pinon pine (*Pinus edulis*) woodland with Douglas fir (*Pseudotsuga menzeisii*) forest on the north facing slopes and drainages.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of the globally imperiled (G2/S2) Fendler's townsend-daisy (*Townsendia fendleri*).

Natural Heritage element occurrences at the Cougar Springs 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	Townsendia fendleri	Fendler's townsend - daisy	G2	S2				B	2008-09-05

** 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 capture the rare plants and the sand dunes. A buffer against direct disturbances also provides potential habitat for future recruitment.

Protection Urgency Rank Comments (P4): The site is located on both BLM and

private lands. Currently there are no threats due to limited access.

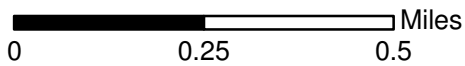
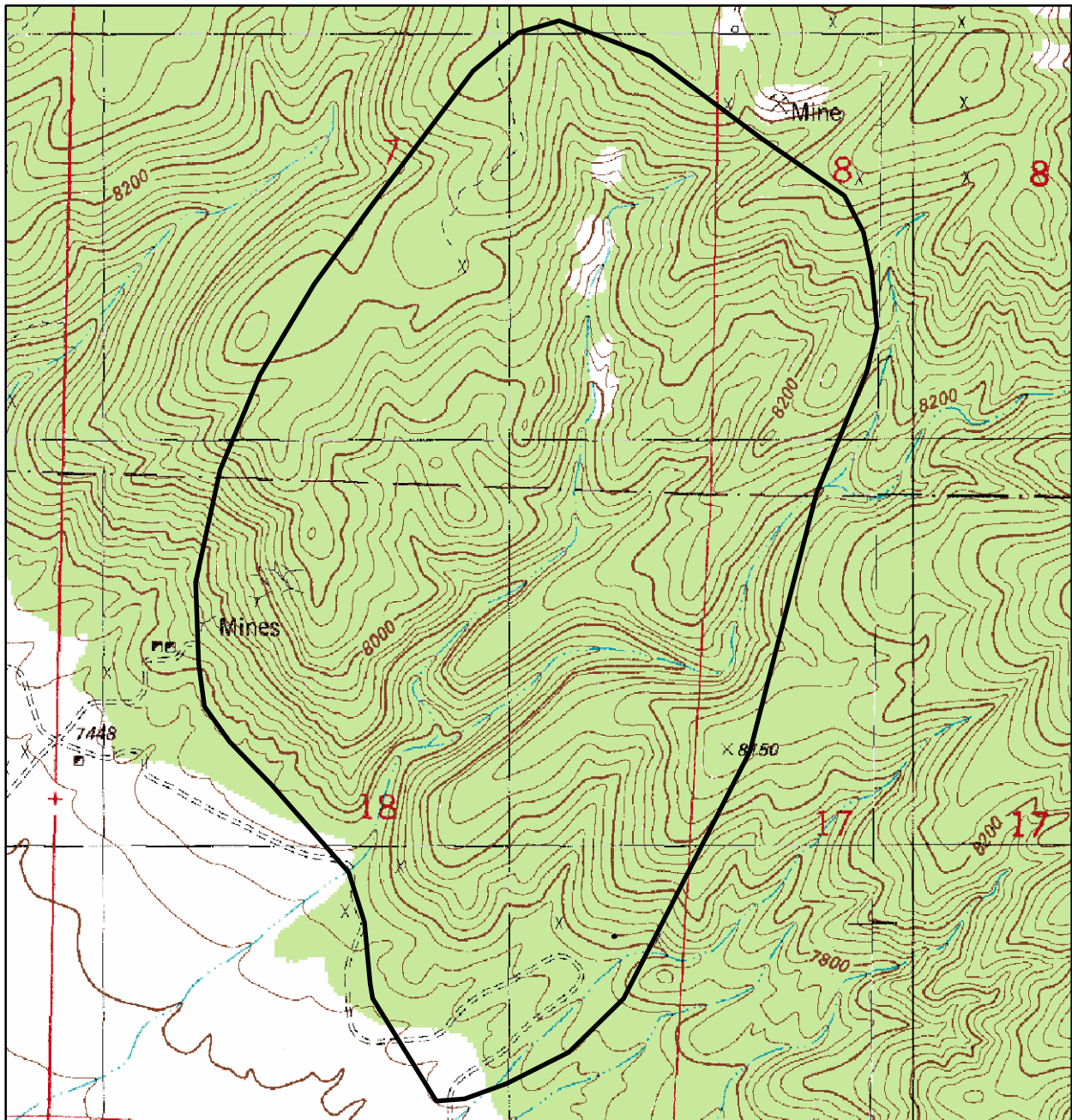
Management Urgency Rank Comments (M4): The site is not threatened presently by OHV use due to its difficult access and the required crossing of private lands.


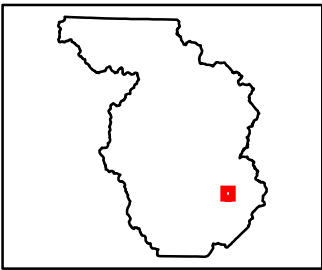
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Version Author: Culver, D.R.

Version Date: 01/20/2009



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Cougar Springs 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 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): There is an historic railroad corridor and weeds occupy the railroad right-of-way.

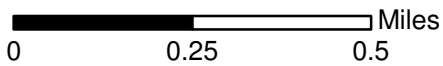
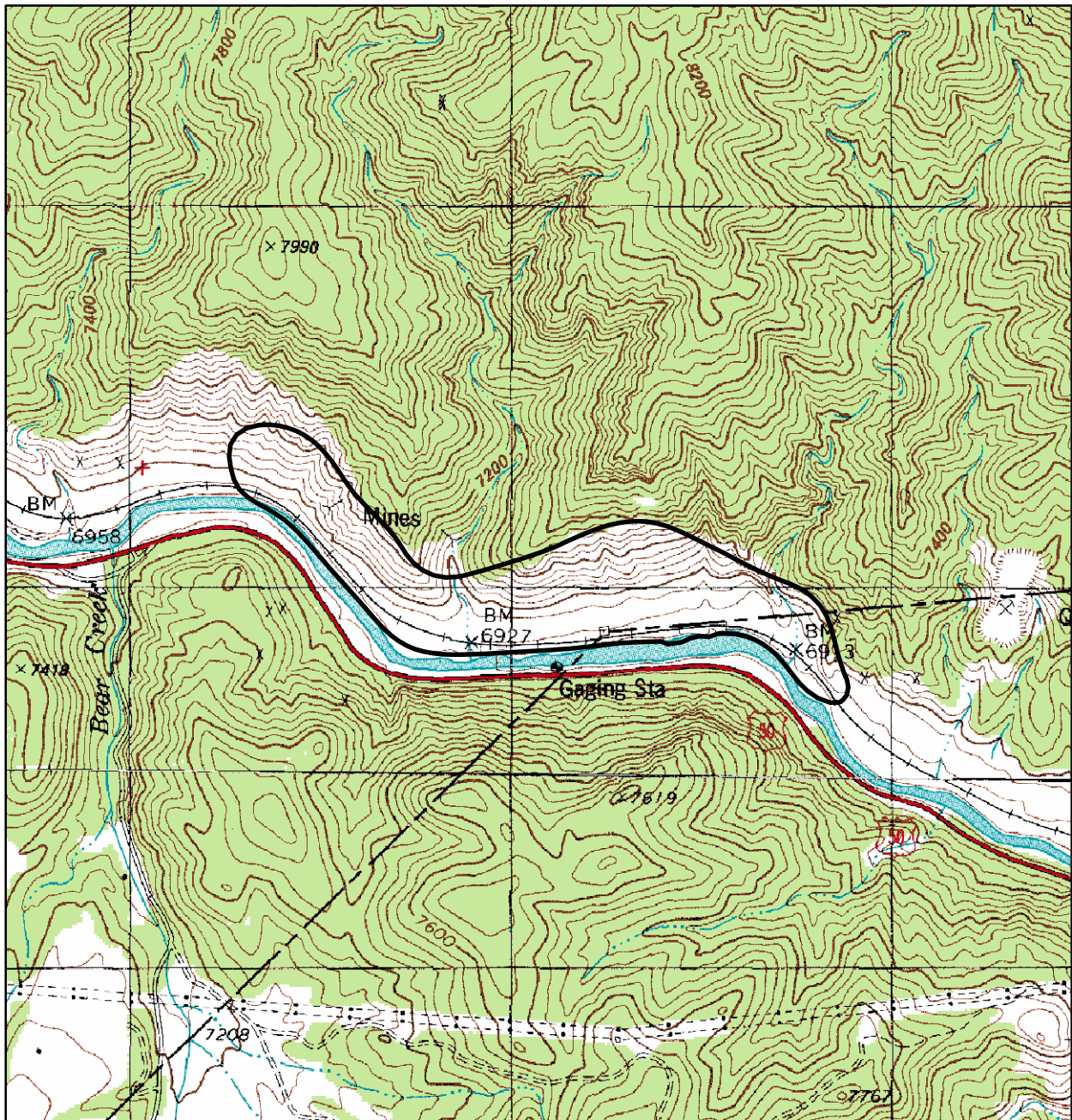
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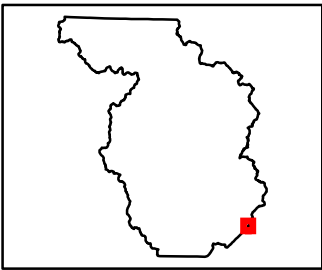
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Neid, S.L. 2007. Final Report: Rare Plant Survey of Select Bureau of Land Management Lands in the Arkansas River Canyon, Chaffee and Fremont Counties, Colorado. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Neid, S.L.

Version Date: 03/07/2007



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

Droney Gulch and Squaw Creeks

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 West, Maysville

Size: 1,380 acres (559 ha)

Elevation: 7,400 - 9,000 ft. (2,256 - 2,743 m)

General Description: Droney Gulch and Squaw Creeks are second-order ephemeral streams that flow through narrow, steep to moderately sloped valleys in sparsely vegetated light-brown hills of the Dry Union Formation (Tweto 1979). Dry Union Formation is comprised of Pliocene and Miocene Lacustrine alluvium deposits that form soils ranging from silt-loams to sands. It tends to form stark, steep, barren or sparsely vegetated slopes. The riparian community occurs on the immediate floodplain and narrow, entrenched creek channel. The understory is comprised of dense graminoids, sparse forbs, and intermittent shrubs beneath an overstory of mature, tall trees dominated by narrowleaf cottonwood (*Populus angustifolia*), Douglas-fir (*Pseudotsuga menziesii*), and Rocky Mountain juniper (*Juniperus scopulorum*). Upland communities consists of pinon - juniper (*Pinus edulis* - *Juniperus scopulorum*) woodlands with ponderosa pine (*Pinus ponderosa*) and mountain mahogany (*Cercocarpus montanus*) on south-facing slopes and Douglas-fir and ponderosa pine on north-facing slopes. These rocky slopes yield to many creeks and gulches. The drainages have created topography that undulates from steep slopes to low gravelly to sandy gulch valleys.

Key Environmental Factors: Lower montane elevation; ephemeral stream channel

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of a globally imperiled (G2G3/S2S3) montane riparian forest (*Populus angustifolia* - *Juniperus scopulorum*).

Natural Heritage element occurrences at the Droney Gulch and Squaw Creeks PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3				B	1995-09-12

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

Boundary Justification: This boundary roughly includes a 1,000 foot buffer around the riparian corridor.

Protection Urgency Rank Comments (P4): This site is largely within a State Natural Area.

Management Urgency Rank Comments (M3): There is light grazing and a road paralleling the creek plus four wheel drive access to the base of Mt. Shavano. There is significant non-native weed cover, including Canada thistle (*Cirsium canadensis*), redtop (*Agrostis stolonifera*), and Kentucky bluegrass (*Poa pratensis*).

Land Use Comments: Grazing, hunting, recreational use

Exotic Species Comments: There is significant non-native weed cover, such as Canada thistle (*Cirsium canadensis*), redtop (*Agrostis stolonifera*), and Kentucky bluegrass (*Poa pratensis*).

References

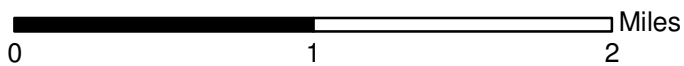
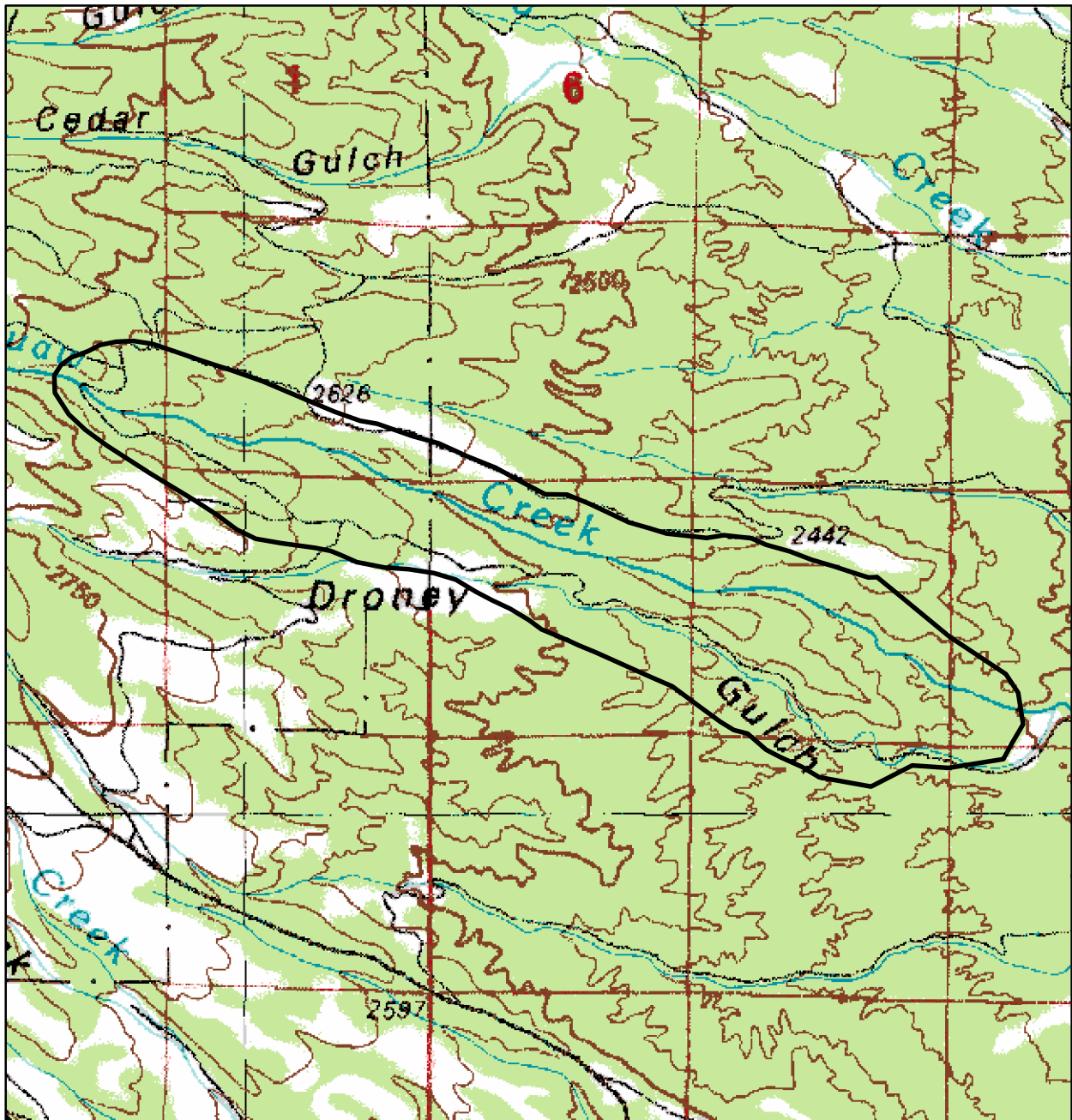
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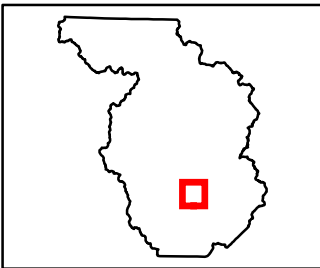
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Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

Version Author: Neid, S.L.

Version Date: 03/10/2007



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Droney Gulch and Squaw Creek Potential Conservation Area, B2: Very High Biodiversity Significance

Harrington Gulch

Biodiversity Rank - B2: Very High Biodiversity Significance

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

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

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

Size: 950 acres (384 ha)

Elevation: 7,200 - 7,600 ft. (2,195 - 2,316 m)

General Description: The Harrington Gulch site is located north of Salida and east of Highway 285 in Adobe Park. Adobe Park was one of the first areas in Chaffee County to be settled in 1868. The site consists of sparsely vegetated hills of the Dry Union Formation (Tweto 1979). The soils are light-colored (buff), fine, and highly erodible. Vegetation is dominated by pinon pine (*Pinus edulis*), mountain mahogany (*Cercocarpus montanus*), one-seeded juniper (*Juniperus monosperma*), blue grama (*Bouteloua gracilis*), prickly pear (*Opuntia polyacantha*), and Indian rice grass (*Oryzopsis hymenoides*).

Key Environmental Factors: The Brandegeee wild buckwheat (*Eriogonum brandegeei*) and Arkansas River feverfew (*Bolophyta tetraeuris*) are likely long-lived perennials with episodic recruitment which is likely related to moisture and temperature. It occurs on steep, eroding slopes with fine-textured soils.

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): The biodiversity rank is based on a good (B-ranked) occurrence of a globally critically imperiled (G1G2/S1S2) plant species, Brandegeee wild buckwheat (*Eriogonum brandegeei*). Other significant plant occurrences in the site include a fair (C-ranked) example of the globally imperiled (G2/S2) Fendler's townsend-daisy (*Townsendia fendleri*) and a fair (C-ranked) example of the globally vulnerable (G3/S3) Barney's fever-few (*Bolophyta tetraeuris*).

Natural Heritage element occurrences at the Harrington 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	Eriogonum brandegeei	Brandegee wild buckwheat	G1G2	S1S2			BLM/USFS	B	1991-08-08
Vascular Plants	Townsendia fendleri	Fendler's townsend - daisy	G2	S2				C	2008-06-03
Vascular Plants	Bolophyta tetraeuris	Barneby's fever - few	G3	S3				C	1991-08-08

** 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 occurrences from direct impacts from surface disturbances. A buffer is included to provide the plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P3): Land is privately owned. In 2008, CNHP was unable to obtain permission from landowners to survey.

Management Urgency Rank Comments (M2): Slopes with the rare plants are not disturbed but the surrounding area is grazed. Bottoms/toe slopes are weedy. Increased erosion is possible if building on top of the mesa occurs. Wood cutting of pinon pine (*Pinus edulis*) and ORV use are threats.

Information Needs: CNHP was not able to obtain private landowner access to update occurrences for *Eriogonum brandegeei* or *Bolophyta tetraeuris*. The *Townsendia fendleri* was documented on road right of way adjacent private lands.

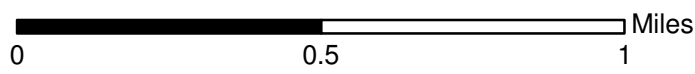
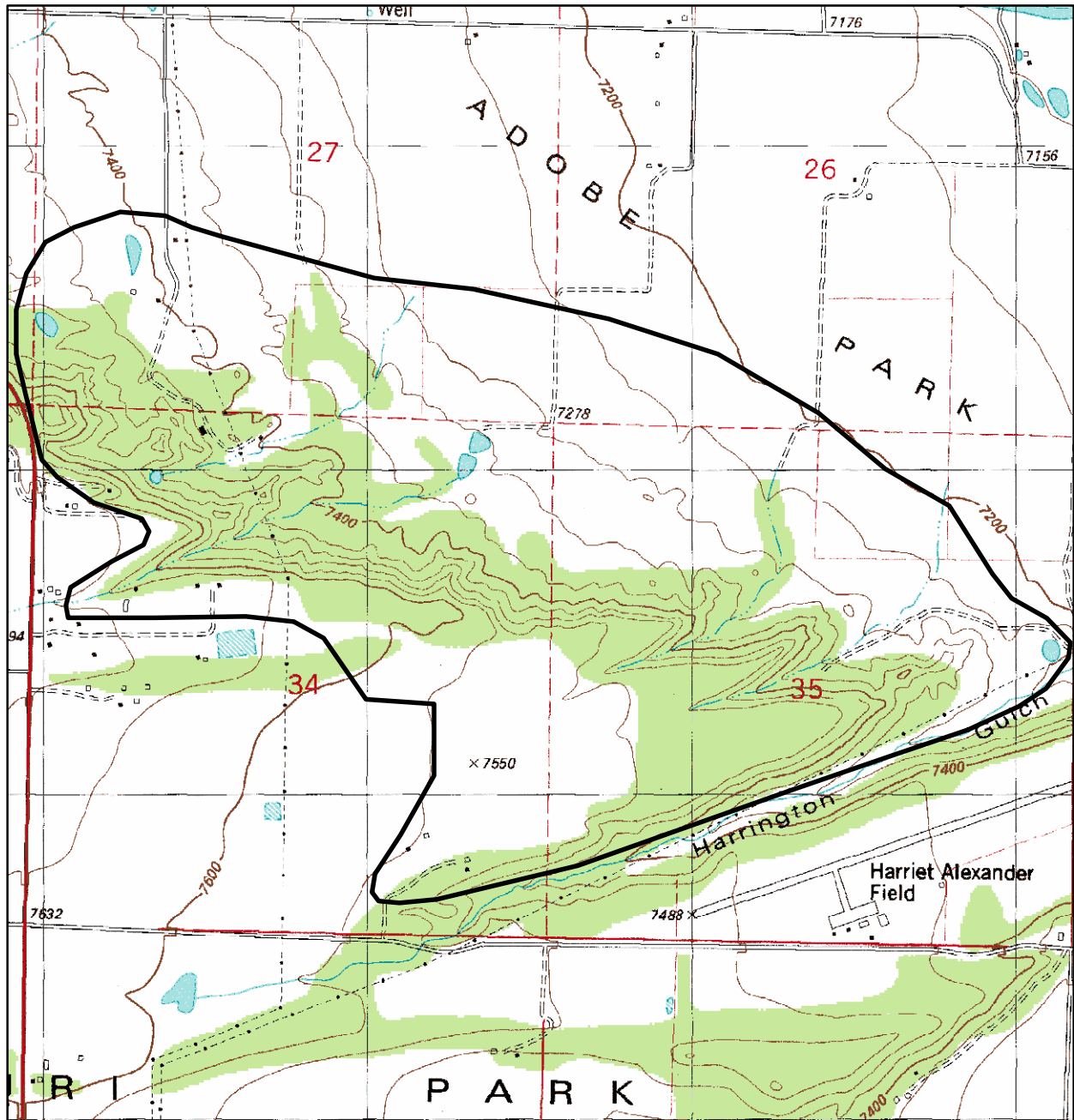
References


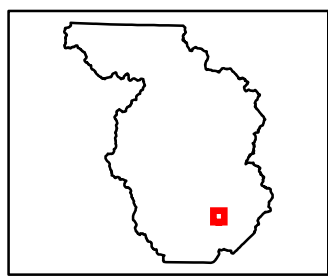
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Version Author: Culver, D.R.

Version Date: 01/13/2009



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Harrington Gulch Potential Conservation Area, B2: Very High Biodiversity Significance

Hecla Junction

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity 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: Nathrop

Size: 897 acres (363 ha)

Elevation: 7,400 - 8,000 ft. (2,256 - 2,438 m)

General Description: The Hecla Junction site is located in the Arkansas Valley, east of Browns Canyon. It consists of small, rolling hills that are sparsely vegetated with pinon pine (*Pinus edulis*) and one-seeded juniper (*Juniperus monosperma*) with mountain mahogany (*Cercocarpus montanus*) and grasses (*Bouteloua gracilis* and *Oryzopsis hymenoides*). The light brown soils are derived from the Dry Union Formation (Tweto 1979). Highway 285 bisects the site and Highway 291 forms the southern border. The site supports the rare Brandegeee wild buckwheat (*Eriogonum brandegeei*) and Fendler's townsend's daisy (*Townsendia fendleri*). Both plants are indicators of the Dry Union Formation. This Formation is composed from sediments from massive deposits of brown silt, sand and gravel deposited in alluvial fans of the Pliocene age (Karnuta 1995).

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): This site contains one of the nine known occurrences of the globally rare (G1G2/S1S2) Brandegeee wild buckwheat (*Eriogonum brandegeei*), a Colorado endemic restricted to Chaffee and Fremont counties. The population here is in fair (C-ranked) condition. A good (B-ranked) occurrence of the globally rare (G2/S2) Fendler's townsend-daisy (*Townsendia fendleri*) is also within this site. *Townsendia fendleri* is known only from Colorado and New Mexico.

Natural Heritage element occurrences at the Hecla Junction 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	Eriogonum brandegeei	Brandegee wild buckwheat	G1G2	S1S2			BLM/ USFS	C	2008-06-11
Vascular Plants	Townsendia fendleri	Fendler's townsend - daisy	G2	S2				AB	2008-06-11

** 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 occurrences from direct impacts, and to provide the plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P2): Site includes both private and public ownership.

Management Urgency Rank Comments (M4): The site is bisected by a highway and the highway department should be aware of this site to avoid weed spraying and road improvement projects that may harm rare plant populations. ORV's may need to be excluded.

References

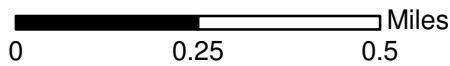
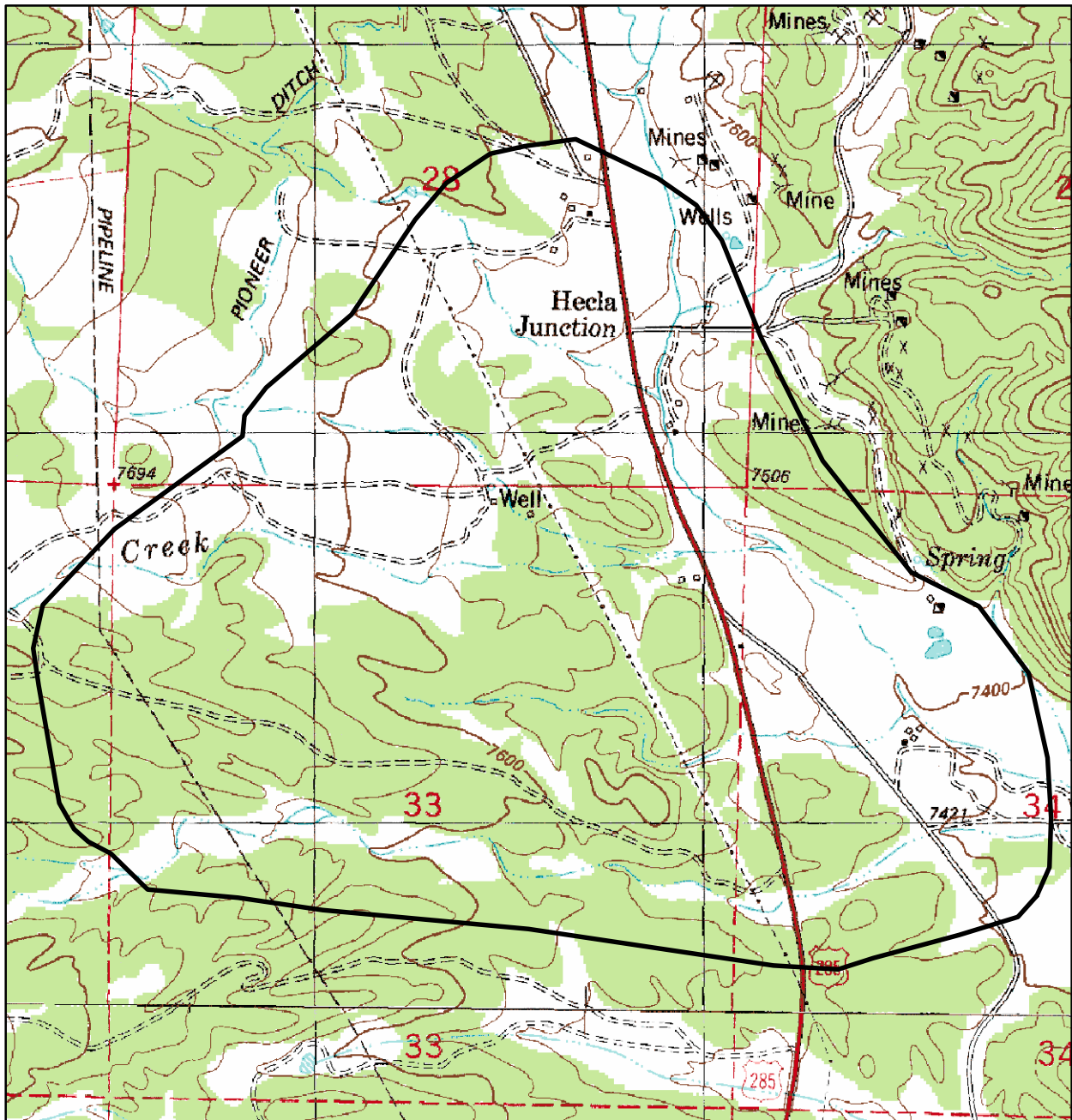
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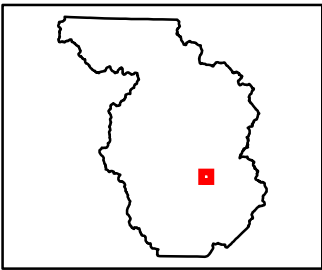
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Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

Version Author: Culver, D.R.

Version Date: 02/09/2009



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Hecla Junction 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.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

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/S2) 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	Townsendia fendleri	Fendler's townsend - daisy	G2	S2				AB	2006-08-01
Vascular Plants	Aletes lithophilus	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. However, off-road vehicle use poses a significant potential threat to the steep, erodible soils. A continuation of current management and land uses at this site would prevent anthropogenic-induced loss of the plant occurrences.

References

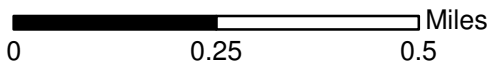
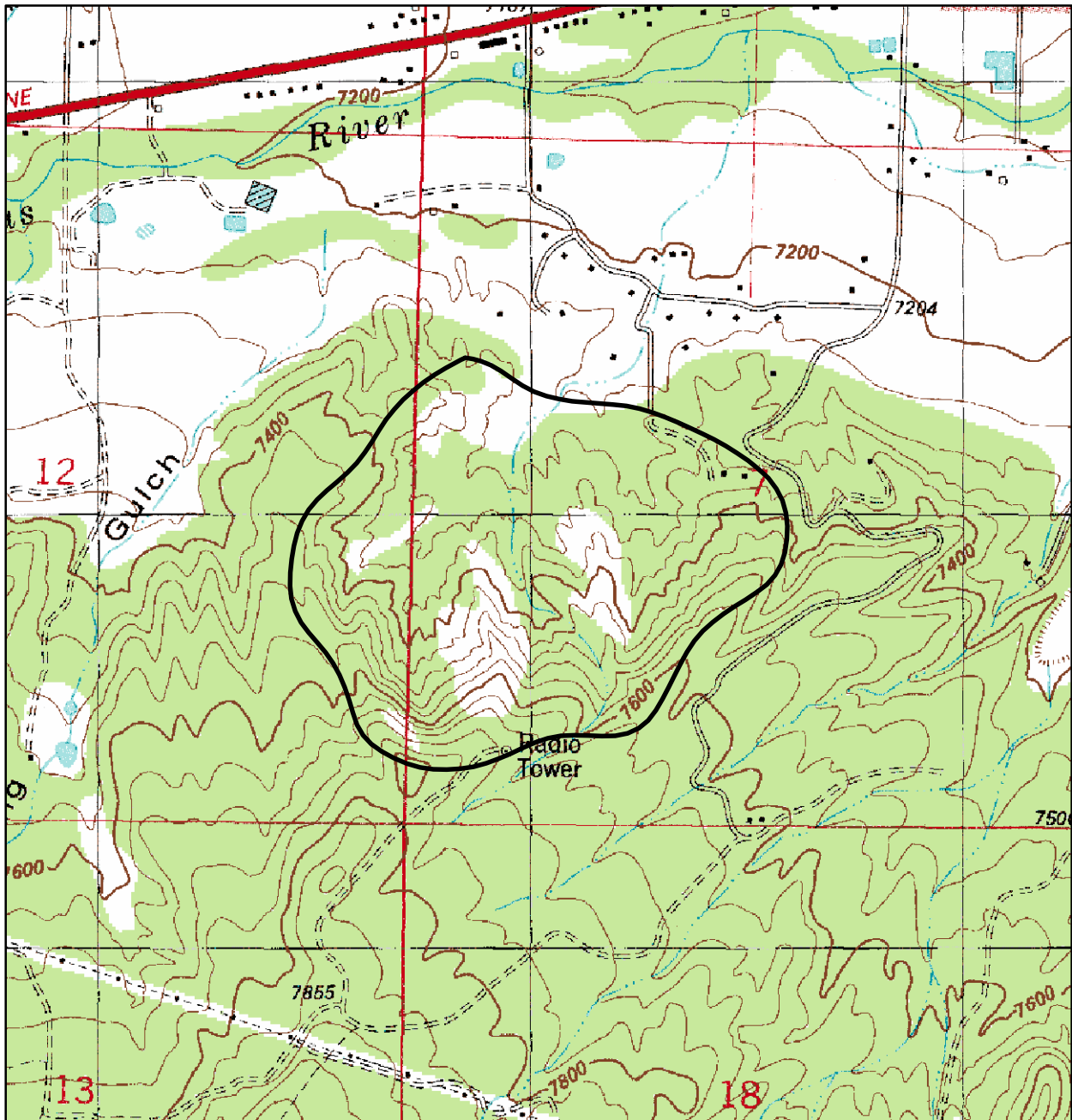
Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.


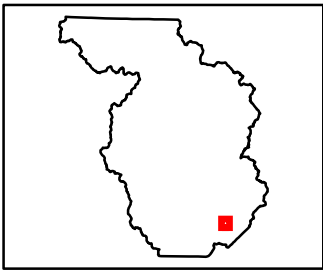
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Wallace et al. 1997. Geologic Map of the Salida East Quad.

Version Author: Neid, S.L.

Version Date: 03/09/2007



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

Mount Princeton

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

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

U.S.G.S. 7.5-minute quadrangles: Saint Elmo, Mount Antero

Size: 3,052 acres (1,235 ha)

Elevation: 8,500 - 13,000 ft. (2,591 - 3,962 m)

General Description: Mount Princeton is a Colorado Fourteener (14,197 ft.) that is a prominent mountain west of Nathrop and is part of the southern extension of the Collegiate Peaks. Mount Princeton is part of a large batholith emplaced in the Sawatch Range during middle Tertiary time (Chronic and Williams 2002, Karnuta 1995). The rock that forms Mount Princeton is a quartz monzonite composed of several metamorphic rocks e.g., white plagioclase, pink orthoclase, biotite, hornblende and quartz (Karnuta 1995). Along Chalk Creek, the quartz monzonite has been altered by geothermal water producing the Chalk Cliffs, located at the base of Mount Princeton. The south-facing slopes of Mount Princeton are representative of the bristlecone pine (*Pinus aristata*) forest that is found scattered throughout the Collegiate Peaks from 10,000-12,250 feet elevation, just below timberline, on moderate to steep slopes on south and east-facing aspects. The bristlecone pine forest is characterized as harsh and xeric, with desiccating winds and broadly fluctuating temperatures. Soils are derived primarily from granitic parent materials. There are minimally developed Typic Cryorthents: shallow, coarse-textured (sandy loams), and with rocks on the surface. Bristlecone pine dominates the tree cover with an average 40-50% cover. Engelmann spruce (*Picea engelmannii*), limber pine (*Pinus flexilis*), and subalpine fir (*Abies lasiocarpa*) are also present. The shrub layer is dominated by common juniper (*Juniperus communis*) with scattered bearberry (*Arctostaphylos uva-ursi*) and grouse whortleberry (*Vaccinium scoparium*). The herbaceous understory layer is moderately sparse, with total cover averaging <20%. The perennial forb alpine clover (*Trifolium dasyphyllum*) clearly dominates, with 10-12% cover. The remaining herbaceous species are a mix of perennial graminoids and forbs. Important species include the graminoids purple reedgrass (*Calamagrostis purpurascens*), dry spike sedge (*Carex siccata*), sheep fescue (*Festuca brachyphylla*), and spike trisetum (*Trisetum spicatum*), and the forbs matted saxifraga (*Saxifraga bronchialis* ssp. *austromontana*), Fendler's sandwort (*Arenaria fendleri*), Whipple's beardstonge (*Penstemon whippleanus*), Jacob's ladder (*Polemonium pulcherrimum* ssp. *delicatum*), stoncrop (*Sedum stenopetalum*), and goldenweed (*Solidago simplex*). A Black Swift (*Cypseloides niger*) colony occurs within the site at Agnes Vail Falls in Cascade Canyon.

Key Environmental Factors: Elevation ranges from 8,500 ft to 13,000 ft. Presence of Clark's Nutcrackers and pine squirrels are important for seed dispersal.

Climate Description: Typical subalpine to alpine climate, intense solar exposure, dry with desiccating winds.

Land Use History: The Lucky Mine, located within the site, was originally called the Hortense Mine and was discovered in 1876. It is located on the side of Mt. Princeton in Chaffee County, Colorado. Nearby is the Hortense Spring, the warmest hot springs in Colorado. The Hortense and Mount Princeton Toll Road led up the mountain to the mine (Denver Public Library Web 2009). This road is still maintained for access to radio towers.

Cultural Features: There is the Bristlecone Park Chalet managed by Young Life Church Group.

Biodiversity Significance Rank Comments (B2): Rank is based on a good (B-ranked) occurrence of a globally imperiled (G2/S2) bristlecone pine community (*Pinus aristata* / *Trifolium dasyphyllum*). This site represents one of the best examples in Colorado of this ancient woodland. It is large enough to ensure that ecological processes, e.g., fire, snow avalanches, and Clark's Nutcrackers seed dispersal and germination are present to remain viable.

Natural Heritage element occurrences at the Mount Princeton PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Pinus aristata</i> / <i>Trifolium dasyphyllum</i> Woodland	Upper Montane Woodlands	G2	S2				B	2008-08-27

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

Boundary Justification: The boundary encompasses the occurrence and much of the lower slopes. The boundary is intended to protect the bristlecone pine forest and provide some buffer to allow fire to occur more naturally. It does not incorporate all large scale ecological processes.

Protection Urgency Rank Comments (P2): Special designation may be needed to protect the site from activities associated with mining and recreation.

Management Urgency Rank Comments (M3): Recreational activities will need to be managed within 5 years to maintain current quality of the occurrence.

Land Use Comments: There is a two track road that leads up to radio towers and a shelter.

Exotic Species Comments: None observed.

References

Chronic, H. and F. Williams. 2002. Roadside Geology of Colorado. Second Edition. Mountain Press Publishing Company. Missoula, MT.

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

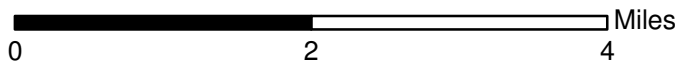
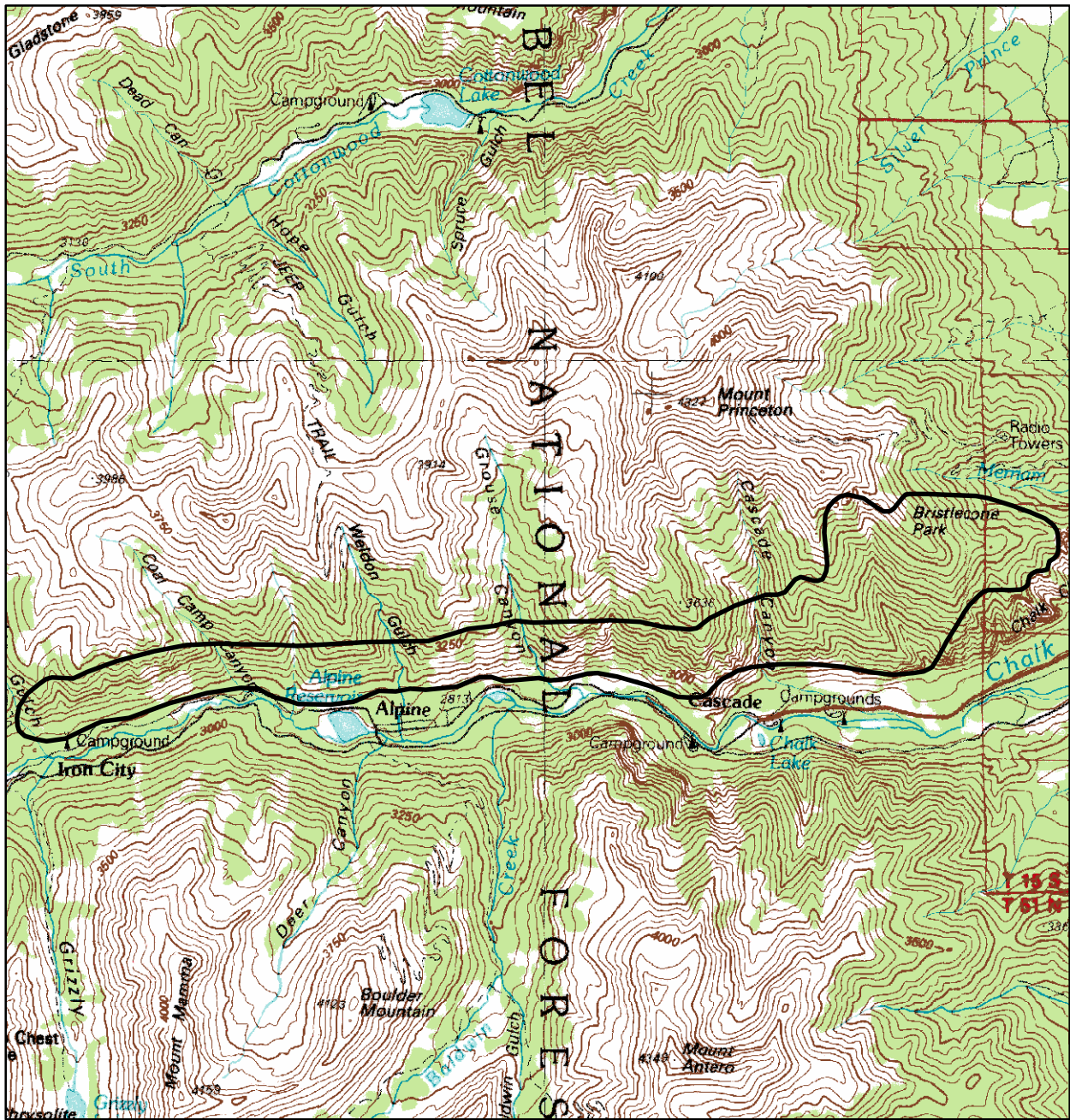
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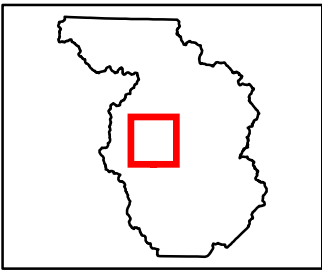
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Ranne, B. M., and W. L. Baker. 1995. Potential Natural Research Areas for bristlecone pine (*Pinus aristata* Engelm.) forests in Colorado. Unpublished report prepared for the U.S. Forest Service - Rocky Mountain forest and Range Experiment Station, Ft. Collins, CO. 23 pp.

Version Author: Culver, D.R.

Version Date: 01/12/2009



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Mount Princeton Potential Conservation Area, B2: Very High Biodiversity Significance

Pass Creek

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: Mount Ouray, Salida West, Maysville

Size: 505 acres (204 ha)

General Description: This site spans Pass Creek, a second order stream running through USFS, BLM, and private land. There appears to be moderate grazing, abundant beaver activity, and some high-impact recreational use during the summer and hunting season. The riparian corridor is fairly wide, dominated by narrowleaf cottonwood (*Populus angustifolia*), Rocky Mountain juniper (*Juniperus scopulorum*), Rocky Mountain maple (*Acer glabrum*) and shining willow (*Salix lucida*). Upland on the slopes there is pinon pine (*Pinus edulis*), quaking aspen (*Populus tremuloides*), oneseed juniper (*Juniperus monosperma*) and mountain mahogany (*Cercocarpus montanus*). There is a dirt road running on the flatter areas adjacent to the stream and that area has a mixture of big sagebrush (*Artemisia tridentata*) and rabbitbrush (*Chrysothamnus nauseosus*) with arid grasses. Overstory is quaking aspen, narrowleaf cottonwood, Rocky Mountain juniper and Rocky Mountain maple with an understory of shrubs and forbs with sparse grazing.

Biodiversity Significance Rank Comments (B2): Rank is based on a good (B-ranked) occurrence of a globally imperiled (G2G3/S2S3) montane riparian forest (*Populus angustifolia* - *Juniperus scopulorum*).

Natural Heritage element occurrences at the Pass Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Populus angustifolia</i> - <i>Juniperus scopulorum</i> Woodland	Montane Riparian Forest	G2G3	S2S3				B	1995-09-06

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

Boundary Justification: Boundaries include the ridge tops used for immediate watershed protection. A road junction forms eastern boundary.

Protection Urgency Rank Comments (P3): The majority of the site is located on

BLM lands.

Management Urgency Rank Comments (M4): Grazing impacts should be monitored.

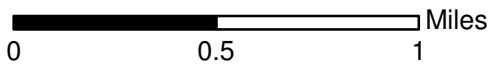
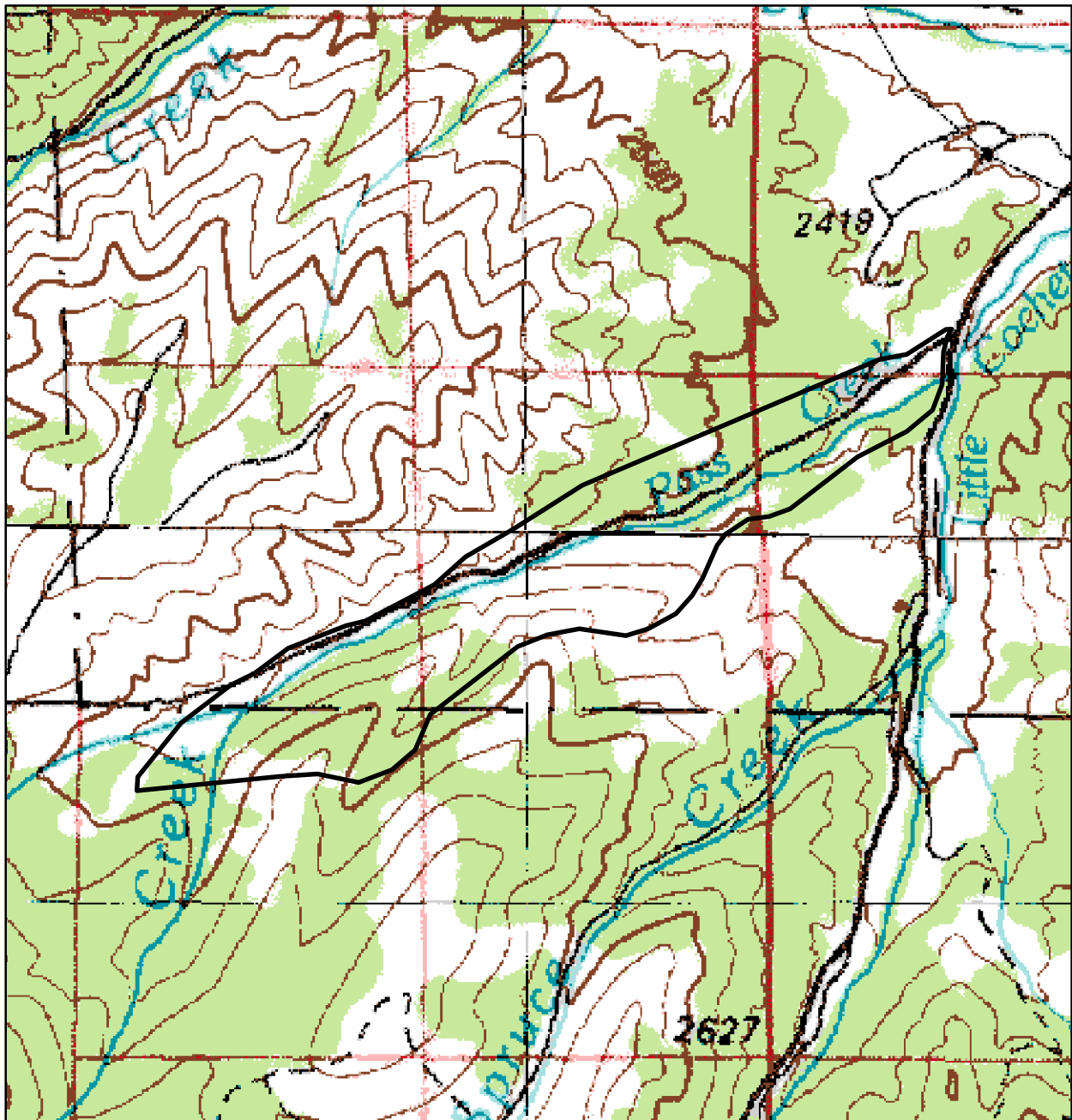
Information Needs: This site was not surveyed during the 2008 county survey. Boundaries and element occurrences need to be updated.


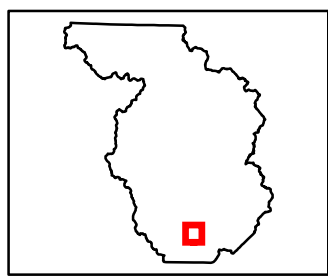
References

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Version Author: Kittel, G.M.

Version Date: 05/12/1997



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Pass Creek Potential Conservation Area, B2: Very High Biodiversity Significance

Ruby Mountain

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: Buena Vista East, Nathrop

Size: 1,245 acres (504 ha)

Elevation: 7,800 - 8,413 ft. (2,377 - 2,564 m)

General Description: Ruby Mountain site is located within the Arkansas Hills, part of the Sawatch uplift (Chronic and Williams 2002). Ruby Mountain itself is made up of rhyolite. On Ruby Mountain and Sugarloaf, one can find garnets and obsidian that formed in gas cavities in the rhyolite flow (Chronic and Williams 2002). The vegetation is typical pinon pine (*Pinus edulis*) with mountain mahogany (*Cercocarpus montanus*) and rabbitbrush (*Chrysothamnus nauseosus*).

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): This site supports a good (B-ranked) occurrence of the globally imperiled (G2/S2) Fendler's townsend-daisy (*Townsendia fendleri*), a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*), an extant occurrence of the globally vulnerable (G3/S3) Front Range alum-root (*Heuchera hallii*) and an extant occurrence of the state imperiled (G4/S1) livemore fiddleleaf (*Nama dichotomum*).

Natural Heritage element occurrences at the Ruby Mountain 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	S2				B	2008-06-13
Vascular Plants	<i>Argyrochosma fendleri</i>	Fendler cloak - fern	G3	S3				C	2008-08-21
Vascular Plants	<i>Heuchera hallii</i>	Front Range alum - root	G3	S3				E	2008-06-31
Vascular Plants	<i>Nama dichotomum</i>	livemore fiddleleaf	G4	S1				E	2004-09-18

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

Boundary Justification: The boundary captures the known populations of rare plants as well as potential habitat.

Protection Urgency Rank Comments (P4): The site is owned by BLM and is designated as the Browns Canyon Area of Critical Environmental Concern (ACEC).

Management Urgency Rank Comments (M4): Need to monitor impacts of OHV.

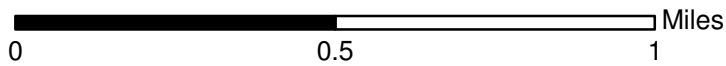
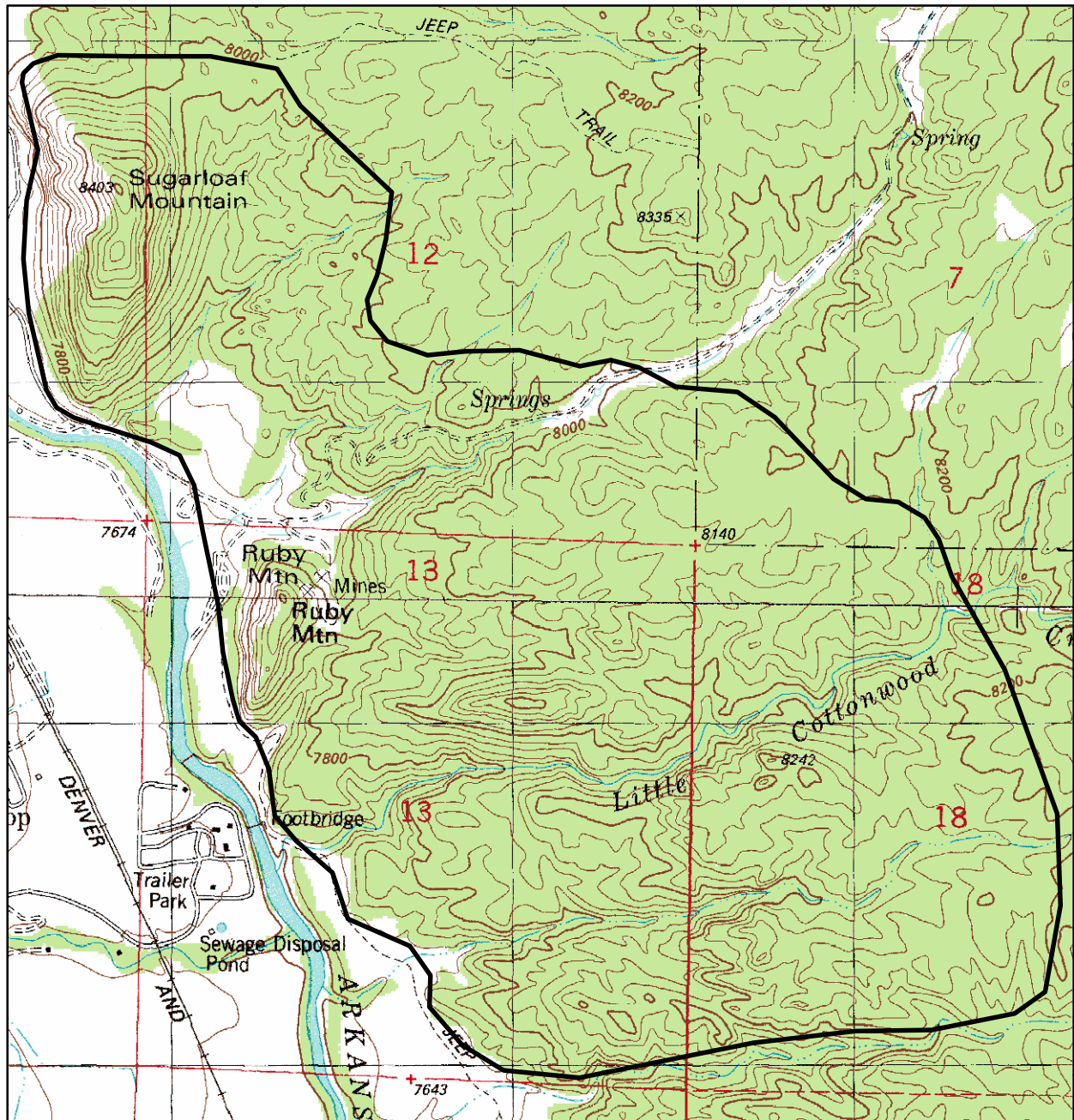
References


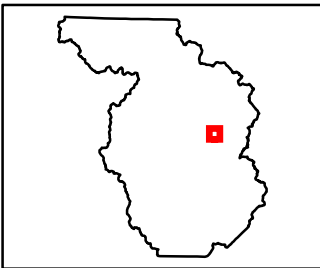
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Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 01/16/2009



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Ruby Mountain 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 grasslands 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 characterized by 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 are often sparsely vegetated with annuals.

Key Environmental Factors: Volcanic bedrock

Climate Description: The area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

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

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	Nuttallia densa	Arkansas Canyon stickleaf	G2	S2			BLM	B	2006-08-02
Vascular Plants	Aletes lithophilus	rock - loving neoparrya	G3	S3			BLM/ USFS	B	2006-08-02
Vascular Plants	Aletes lithophilus	rock - loving neoparrya	G3	S3			BLM/ USFS	E	2000-06-12

** 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.

References

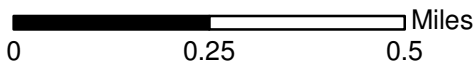
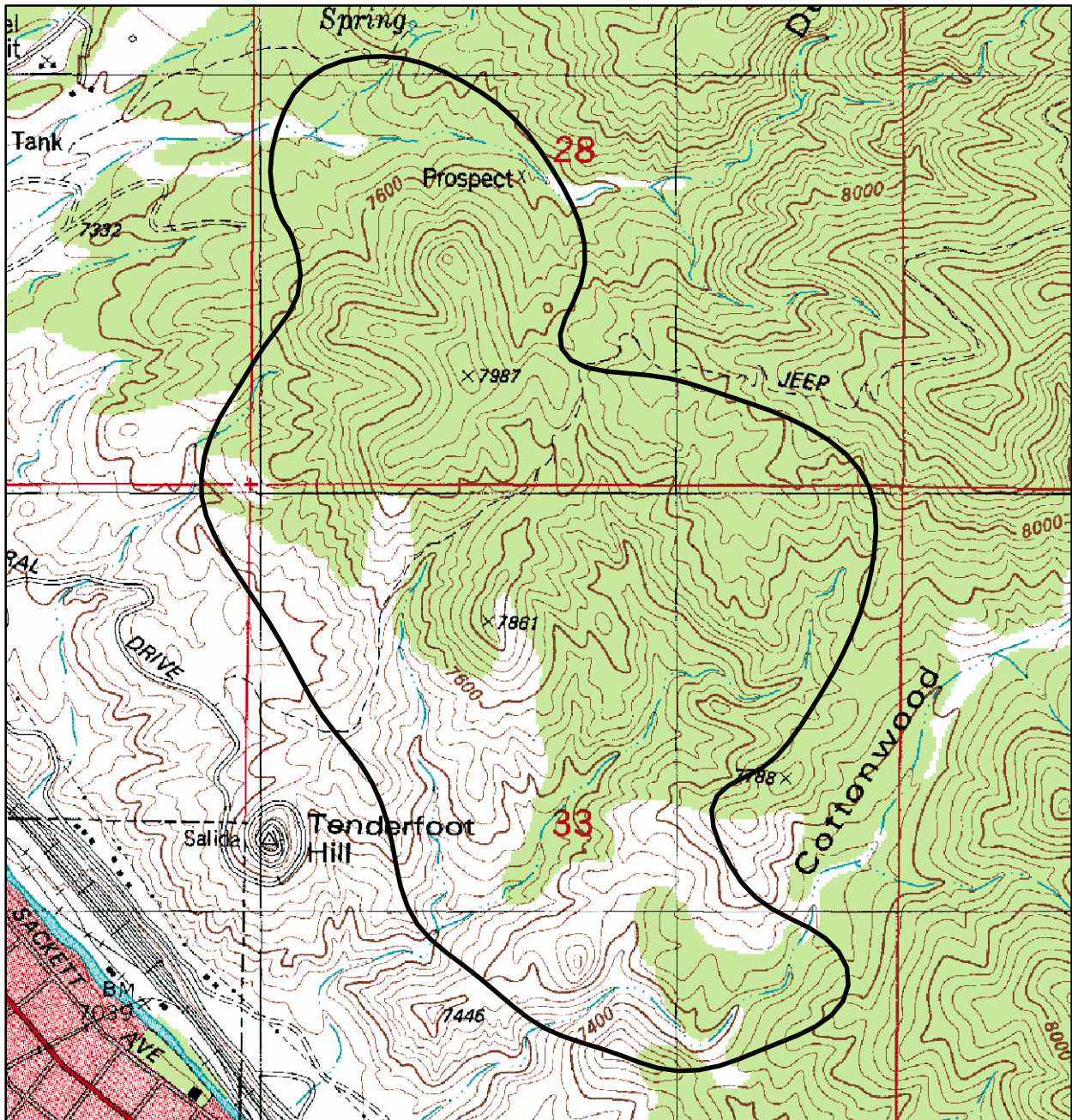
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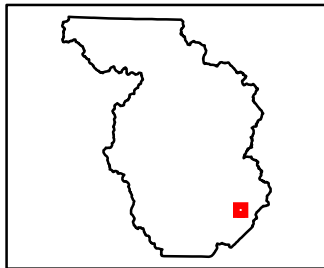
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Wallace et al. 1997. Geologic Map of the Salida East Quad.

Version Author: Neid, S.L.

Version Date: 03/09/2007



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 04/23/2009</p>	<p>Legend</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 Chaffee County</p> 
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Tenderfoot Hill Potential Conservation Area, B2: Very High Biodiversity Significance

Threemile Creek

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: Nathrop, Mount Antero

Size: 2,273 acres (920 ha)

Elevation: 7,800 - 8,800 ft. (2,377 - 2,682 m)

General Description: The Threemile Creek site is located at the base of Mount White in the Collegiate Peaks within the Sawatch Range. It is contained in the Mesa Antero Estates subdivision. The upland vegetation is dominated by pinon pine (*Pinus edulis*), and ponderosa pine (*Pinus ponderosa*) with mountain mahogany (*Cercocarpus montanus*), skunkbush (*Rhus trilobata*) and scattered one-seeded juniper (*Juniperus monosperma*). The understory consists of needle-and-thread grass (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), mountain muhly (*Muhlenbergia montana*), and Arizona fescue (*Festuca arizonica*). On the north-facing slopes the vegetation is dominated by Douglas-fir (*Pseudotsuga menziesii*). Typically, the soils are gravely sandy loam with outcrops of exposed large rocks. Threemile Creek supports a gallery of narrowleaf cottonwood (*Populus angustifolia*) with Rocky Mountain juniper (*Juniperus scopulorum*), river birch (*Betula occidentalis*), and alder (*Alnus incana*). There are springs that support small peat accumulating, "quaking" wetlands that support Nebraska sedge (*Carex nebrascensis*), beaked sedge (*Carex utriculata*), lesser panicled sedge (*Carex diandra*), and Baltic rush (*Juncus balticus*).

Climate Description: This area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B2): The site supports an excellent (A-ranked) occurrence of the globally imperiled (G2/S2) Fendler's townsend-daisy (*Townsendia fendleri*), a good (B-ranked) occurrence of the state imperiled (G5/S1) lesser panicled sedge (*Carex diandra*) and a good (B-ranked) occurrence of the state imperiled (G4G5/S1) low northern sedge (*Carex concinna*).

Natural Heritage element occurrences at the Threemile Creek 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	Townsendia fendleri	Fendler's townsend - daisy	G2	S2				A	2008-06-11
Vascular Plants	Carex concinna	low northern sedge	G4G5	S1			BLM	B	2008-06-11
Vascular Plants	Carex diandra	lesser panicked sedge	G5	S1			USFS	B	2008-08-08

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

Boundary Justification: The boundary was drawn to include the known occurrences and allow a buffer for expansion and seed recruitment of the rare plants.

Protection Urgency Rank Comments (P4): The site is contained within private lands that are owned by conservation-minded land owners.

Management Urgency Rank Comments (M3): There were several non-native plants documented within the site, especially around the peatland. However, land owners are aware of non-natives and are actively eradicating them.

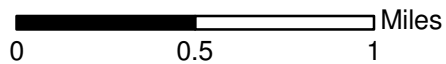
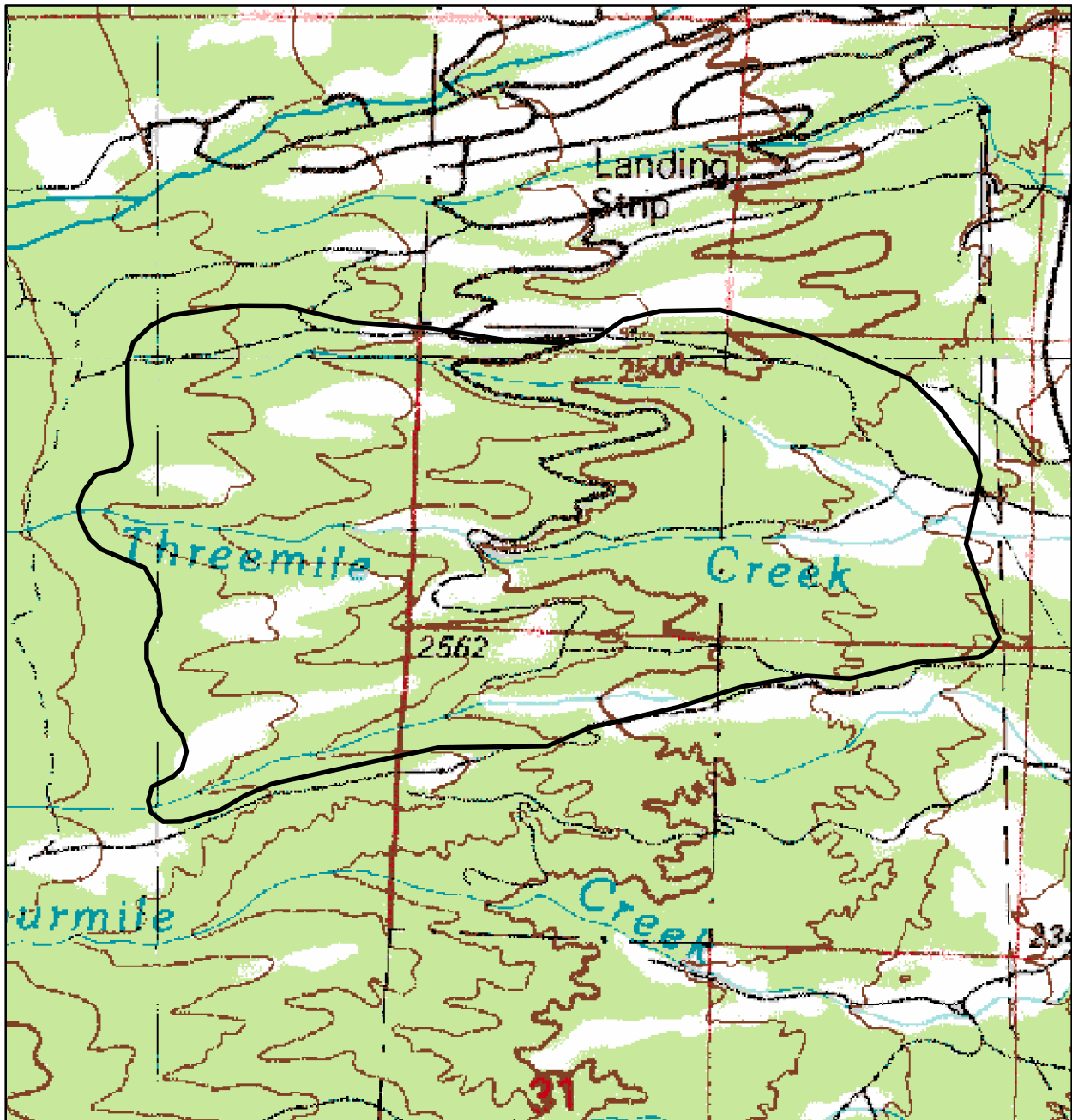
Exotic Species Comments: Non-natives include Canada thistle (*Cirsium arvensis*), common mullein (*Verbascum thapsus*), and cheatgrass (*Bromus tectorum*).


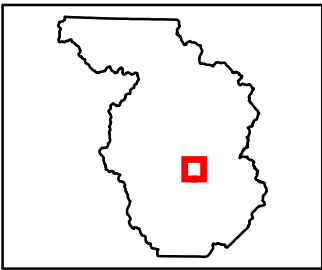
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

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Threemile Creek Potential Conservation Area, B2: Very High Biodiversity Significance

Boss Lake Reservoir

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: Garfield

Size: 293 acres (119 ha)

Elevation: 10,000 - 11,400 ft. (3,048 - 3,475 m)

General Description: Boss Lake Reservoir is located at the base of Bald Mountain (12,856 ft.) and forms the headwaters of the South Arkansas River. The earthen dam was completed in 1894. The reservoir is in a basin surrounded by Banana Mountain (12,329 ft.) and Syncline Hill (11,404 ft.) to the south and Clover Mountain (12,955 ft.) to the north. The upland vegetation is dominated by Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), and narrowleaf cottonwood (*Populus angustifolia*) around the reservoir. The soils are gravelly and are derived from granite.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Land Use History: Recreational fishing for brook and cutthroat trout in Boss Lake Reservoir.

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) reflected moonwort (*Botrychium echo*) and an extant occurrence of the state imperiled (G5/S1) least moonwort (*Botrychium simplex*).

Natural Heritage element occurrences at the Boss Lake Reservoir 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>Botrychium echo</i>	reflected moonwort	G3	S3				B	2005-08-30
Vascular Plants	<i>Botrychium simplex</i>	least moonwort	G5	S1				E	2005-08-30

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

Boundary Justification: The boundary encompasses the immediate watershed of

Boss Lake Reservoir up to the Continental Divide including Hunt Lake and several unnamed lakes. This boundary is drawn to protect the hydrology of the site and potential habitat for the rare elements.

Protection Urgency Rank Comments (P3): The site is on the San Isabel National Forest; no special designation is known. Water rights are unknown and perhaps could be used to enhance the reservoir

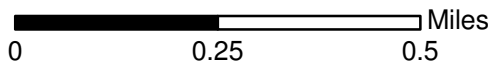
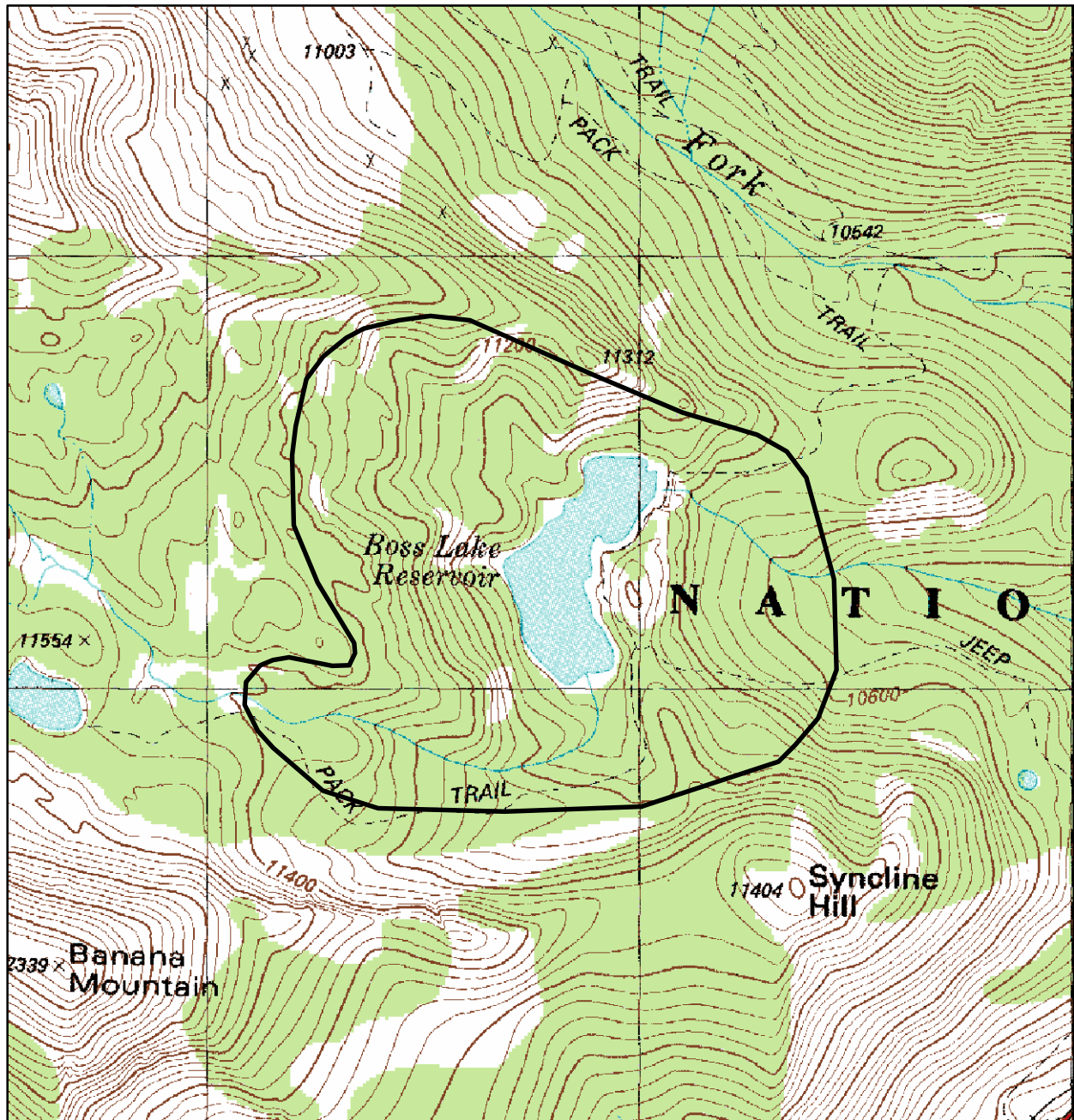
Management Urgency Rank Comments (M3): The site is a relatively easy access for fishing and hiking. There is potential for trampling of the moonworts by recreationists.


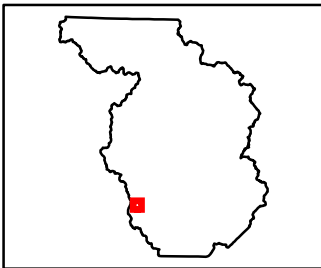
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Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 01/16/2009



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Boss Lake Reservoir Potential Conservation Area, B3: High Biodiversity Significance

Buffalo Meadows

Biodiversity Rank - B3: 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: Harvard Lakes, South Peak

Size: 2,394 acres (969 ha)

Elevation: 11,106 - 11,373 ft. (3,385 - 3,466 m)

General Description: The site occurs in the Buffalo Peaks Wilderness in the Mosquito Mountains. This high elevation wetland has developed in a broad, relatively flat, gently sloping swale in a large depression below the top of a wide, north-south trending ridgeline. These wetlands are the source of numerous streams including Buffalo, Fourmile, and Tumble creeks that flow down steep slopes into the Arkansas Valley below. Mountains here are formed of granitic rocks of 1,400 to 1,700 million years ago with a substrate that is metamorphic or igneous units with a dominantly silicic composition of all ages (Tweto 1979). The granites are highly fractured and in combination with the flat topography on the ridgeline have enabled increased weathering and breakdown of granite into clay which has allowed the development of a wetland on this ridge top swale. Shallow, open water ponds are scattered throughout. Soil moisture is variable and ranges from well-drained to saturated and inundated. Soil characteristics vary from fine-textured mineral soils with high organic matter to peat formation to a depth greater than 0.5 meters. Riparian habitat is characterized by a mosaic of shrublands, herbaceous meadows and open water ponds. Planeleaf willow (*Salix planifolia*) dominates the shrublands and forms a low, dense overstory. A lush, dense herbaceous layer is characterized by a mix of graminoids and forbs that is dominated by tufted hairgrass (*Deschampsia caespitosa*). Other shrub species present included shrubby cinquefoil (*Dasiphora floribunda*). The dense herbaceous understory is species-rich and has several sedge and grass species including water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), ebony sedge (*Carex ebenea*), Bellardi bog sedge (*Kobresia mysuroides*), and alpine timothy (*Phleum alpinum*). Forb cover is also diverse but has a lower cover than the graminoids. Associated forb species include American bistort (*Polygonum bistortoides*), alpine bistort (*Polygonum viviparum*), littleflower penstemon (*Penstemon procerus*), marsh marigold (*Caltha leptosepala*), elephant's head (*Pedicularis groenlandica*), alpine lousewort (*Pedicularis sudetica*), and monkshood (*Aconitum columbianum*). Lincoln's Sparrow (*Melospiza lincolni*), Hermit Thrush (*Catharus guttatus*) and Clark's Nutcracker (*Nucifraga columbiana*) are common bird species. Surrounding uplands are characterized by a mosaic of spruce - fir forests (*Picea engelmannii* - *Abies lasiocarpa*), aspen - lodgepole forests (*Populus tremuloides* - *Pinus contorta*) and open meadows. Lower elevation upland habitat on west-facing slopes is dominated by a mosaic of ponderosa pine (*Pinus ponderosa*), lodgepole pine, and

aspen (*Populus tremuloides*) with limber pine (*Pinus flexilis*) growing on outcrops and exposed ridges.

Climate Description: Climate in the Mosquito Mountains is warmer and drier compared to the climate in the Sawatch Mountains on the west side of the Arkansas River valley, but is wetter and cooler than that of the valley floor. The Mosquitoes are in the rain shadow of the Sawatch Range but may intercept some Pacific moisture as storms track east. They also intercept some moisture from the Gulf of Mexico that is flowing from the southeast to the west and thunderstorms that come out of the west in the summer (Siemer 1977).

Land Use History: The surrounding upland slopes were logged but are recovering.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G2G3) *Salix planifolia* / *Deschampsia caespitosa* subalpine riparian willow carr and a fair (C-ranked) occurrence of a globally critically imperiled (G4T1Q/S1) amphibian, boreal toad (*Bufo boreas*). Toad populations have declined greatly and large breeding populations are now confined to a few areas in Colorado. The causes are not firmly established but die-offs have been associated with chytrid fungal infection and may also be related, at least in part, to habitat degradation, predation by and competition with native and non-native species and fishery management activities (NatureServe 2009).

Natural Heritage element occurrences at the Buffalo Meadows PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Bufo boreas</i> pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		C	2006-99-99
Natural Communities	<i>Salix planifolia</i> / <i>Deschampsia caespitosa</i> Shrubland	Subalpine Riparian Willow Carr	G2G3	S3				A	2008-07-24

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

Boundary Justification: The boundary was developed to enable the ecological and hydrological processes and the environmental gradients that support the occurrences, as well as to maintain sustainable toad habitat and provide a buffer against disturbance. Those processes and environmental characteristics especially important to site sustainability include surface and shallow groundwater flow from surrounding slopes into the ridge top swale to enable groundwater and wetland recharge and appropriate hydroperiod and soil moisture. The boundary encompasses a larger area than was surveyed because the entire site has similar ecological characteristics and a high likelihood of supporting the community and

toad occurrences.

Protection Urgency Rank Comments (P4): The site is located in designated Wilderness. Current recreational pressures are low but could increase as the population increases.

Management Urgency Rank Comments (M4): Maintenance of a natural hydrologic regime is essential to the sustainability of the plant community and the toad population. If recreation increases, a management plan would benefit the elements. Measures to prevent the introduction and spread of chytrid fungus into the toad population are important to its survival. Elk (*Cervus elaphus*) signs are abundant but browsing has not impacted plant vigor.

Off-Site Considerations: Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow must be managed to maintain site viability.

References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

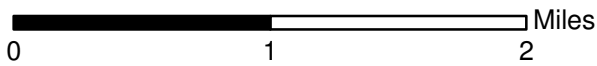
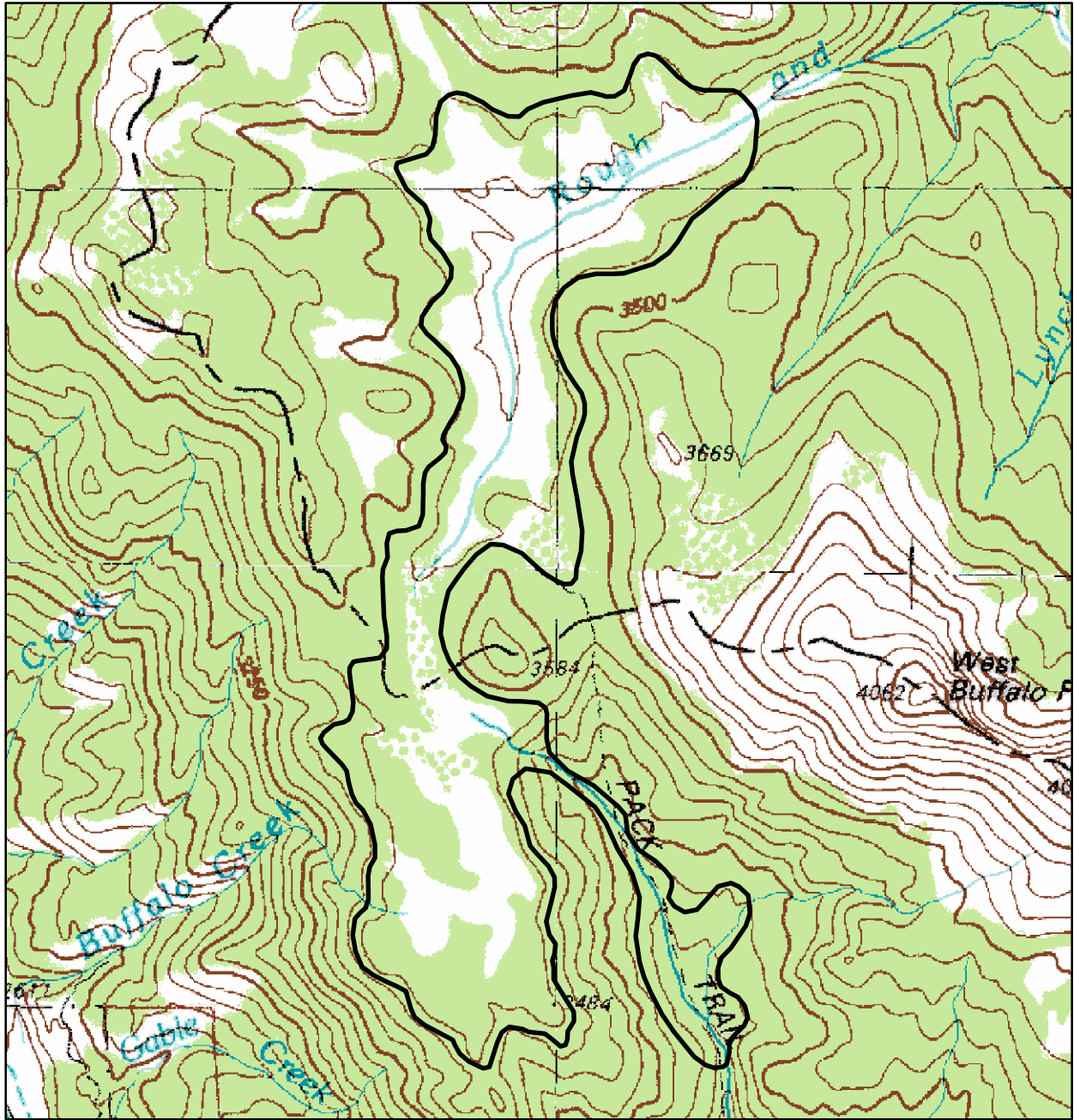
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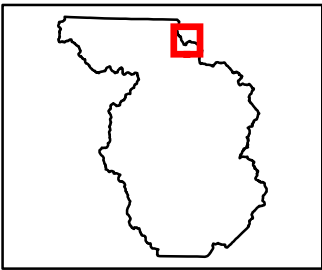
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Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

Version Author: Malone, D.G.

Version Date: 04/07/2009



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Buffalo Meadows Potential Conservation Area, B3: High Biodiversity Significance

Cache Creek

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: Granite

Size: 1,752 acres (709 ha) **Elevation:** 9,600 - 12,500 ft. (2,926 - 3,810 m)

General Description: The Cache Creek site is located at the base of Quail Mountain. Historically the area was the location of gold mining until the 1900s. The shrubland is dominated by bog birch (*Betula nana*) with shrubby cinquefoil (*Dasiphora floribunda*) and several willows (*Salix geyeriana*, *S. monticola*, *S. eriocephala*). Other species include felwort (*Swertia perennis*), hemlock parsley (*Conioselinum scopulorum*), blue joint reedgrass (*Calamagrostis canadensis*), tall manna grass (*Glyceria grandis*), elephanthead (*Pedicularis groenlandica*), and marsh felwort (*Lomatogonium rotatum*). There is a small groundwater discharge area that supports a quaking fen dominated by analouge sedge (*Carex simulata*).

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of a globally vulnerable (G3G4/S3) *Betula nana* / mesic forbs - mesic graminoids shrubland and a good (B-ranked) occurrence of a state rare (G4/S3) *Carex simulata* wet meadow.

Natural Heritage element occurrences at the Cache Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Betula nana</i> / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				B	2008-08-26
Natural Communities	<i>Carex simulata</i> Herbaceous Vegetation	Wet Meadow	G4	S3				B	2008-08-26

** 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 capture the immediate watershed for Cache Creek and the groundwater discharge areas.

Protection Urgency Rank Comments (P3): Area is owned by BLM but there is no special designation to protect the groundwater discharge or springs.

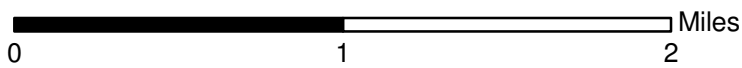
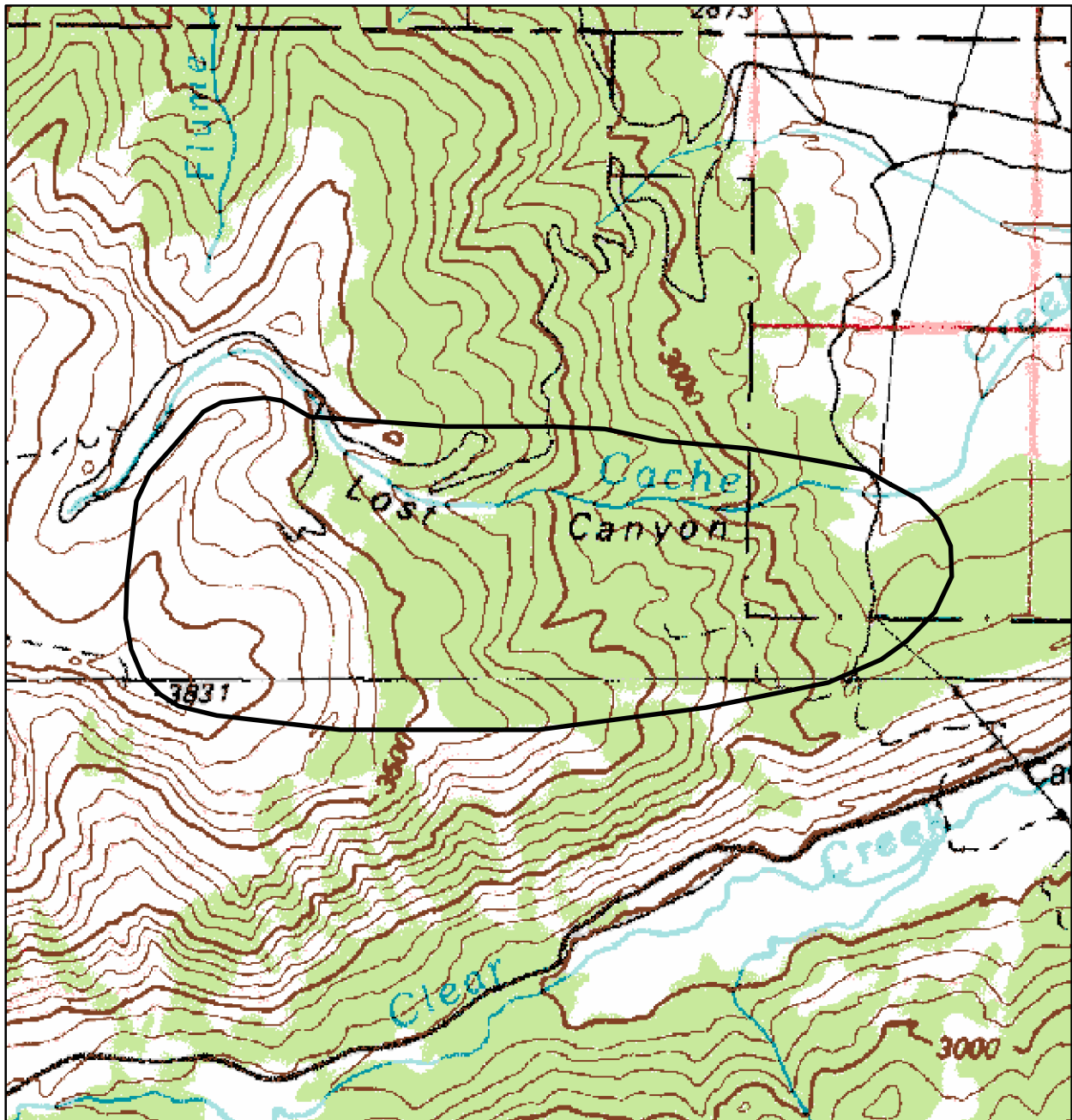
Management Urgency Rank Comments (M3): Grazing impacts may need to be monitored within the fen.


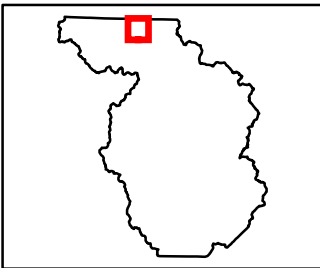
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

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Cache Creek Potential Conservation Area, B3: High Biodiversity Significance

Chalk Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

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

U.S.G.S. 7.5-minute quadrangles: Mount Antero

Size: 1,236 acres (500 ha)

Elevation: 8,320 - 8,800 ft. (2,536 - 2,682 m)

General Description: The Chalk Creek site encompasses the floodplain of Chalk Creek which drains the eastern slope of the Sawatch Mountains and has its confluence with the Arkansas River approximately ten miles downstream of Buena Vista. At the upstream end, the stream enters a wide, low gradient east-west trending valley. Tall, steep relief peaks and ridges flank the valley to the north and south. Mt. Princeton, with an elevation of 14,177 ft, is to the north and Mt. Antero, with an elevation of 14,269 ft, is to the south. Further downstream, the Chalk Cliffs, which form the southeastern flank of Mt. Princeton, create the north wall of the valley. Surrounding peaks are middle tertiary intrusive rocks (20-40 M.Y.) with intermediate to felsic composition with a substrate of metamorphic or igneous units with dominantly silicic composition. The eroded white Chalk Cliffs on the north valley wall contain kaolinite, a soft white clay mineral formed as hot water rising along faults leached feldspar minerals of the batholith - this powdery white rock gives Chalk Creek its name (Chronic and Williams 2002). In this stream reach the glacially carved Chalk Creek Valley is U-shaped with a generally low gradient that increases in the upstream direction. Valley floor substrate is characterized by glacial deposits that are Quaternary-aged younger alluviums and surficial deposits that are from glacial drift of the Pinedale and Bull Lake glaciations with some unclassified glacial deposits. Floodplain soils are characterized by well-drained and well sorted coarse sand, gravel and cobbles with a thin organic layer. Stream characteristics alternate between a mostly broad and meandering stream to a few short reaches that are steeper and less sinuous. Over the majority of the site stream gradient varies from one to two percent and stream type alternates between a Rosgen type "C" stream with moderate to high sinuosity, and, wherever beaver activity occurs, a highly sinuous "E" type stream (Rosgen 1996). Snowmelt is the primary source of water in Chalk Creek and numerous side streams discharge into Chalk Creek, thus this is likely a gaining stream that depends on shallow groundwater discharge. Typically, wherever stream banks are stable and the channel is not downcut, out-of-bank flows are common and riparian vegetation is vigorous. A perennially high water table is indicated by the plant community that dominates the site (NatureServe 2009). The site is characterized by a lush riparian deciduous community of narrowleaf cottonwood (*Populus angustifolia*) in association with river birch (*Betula occidentalis*) that grows in a wide band along the banks of the stream. Narrowleaf cottonwood dominates but other tree species are present including

ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (*Juniperus scopulorum*), Douglas-fir (*Pseudotsuga menziesii*) and blue spruce (*Picea pungens*). River birch dominates the upper shrub canopy often forming dense thickets along the stream bank while in the lower shrub layers several other species co-occur including mountain maple (*Acer glabrum*), thinleaf alder (*Alnus incana*), mountain gooseberry (*Ribes inerme*), mountain willow, coyote willow (*Salix exigua*), Geyer willow (*Salix geyeriana*), Drummond's willow (*Salix drummondiana*), Booth's willow (*Salix boothii*), Bebb's willow (*Salix bebbiana*) and shining willow (*Salix lucida*). Herbaceous cover is typically minor but varies with the density of the canopy cover and is characterized by a patchy mosaic of graminoids and forbs. Common forbs include golden glow (*Rudbeckia ampla*), meadow rue (*Thalictrum fendleri*), star solomonplume (*Smilacina stellata*), green gentian (*Frasera speciosa*), northern bog orchid (*Limnorchis hyperborea*) and willowherb (*Epilobium hornemanii*). Common graminoids include water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), common spikerush (*Eleocharis palustris*), bluejoint reedgrass (*Calamagrostis canadensis*), redtop (*Agrostis gigantea*) and arctic rush (*Juncus balticus*). Several other plant associations occur as small patches adjacent to or mixed in with the cottonwood / river birch community including river birch / mesic graminoid shrubland, narrowleaf cottonwood / mixed willow (*Populus angustifolia* / *Salix* (*monticola*, *drummondiana*, *lucida*)) woodland, Drummond's willow / mesic forb shrubland and mountain willow / water sedge (*Salix monticola* / *Carex aquatilis*) shrubland. The willow shrublands often occur as a result of beaver activity that enhances flooding of adjacent meadow habitat. These areas are characterized by a mosaic of shrub stands and wet meadows where herbaceous cover is dense and includes both graminoids such as beaked and water sedge and forbs such as pale blue-eyed grass (*Sisyrinchium pallidum*), Idaho blue-eyed grass (*Sisyrinchium idahoense*), white bog-orchid (*Limnorchis dilatata*) and wild iris (*Iris missouriensis*). Plant communities on the valley floor but outside of the active floodplain are dominated by a mosaic of ponderosa pine and narrowleaf cottonwood. Upland vegetation on toeslopes is dominated by pinon - juniper (*Pinus edulis* - *Juniperus scopulorum*) woodlands, while on steep-walled north-facing valley slopes by communities are dominated by Douglas-fir forests and on south-facing slopes by scattered patches of Douglas-fir and bristlecone pine (*Pinus aristata*).

Key Environmental Factors: Hydrology, specifically a natural flow regime with annual episodic flooding, and beaver activities that enable out-of-bank flows and high soil moisture, are key driving factors that exert a major influence on the elements at this site.

Climate Description: The site is located midway between the town of Pitkin and the city of Buena Vista and also likely midway between these two sites with regard to climate. Climate records in the town of Pitkin, located approximately 20 miles to the southwest of this site but on the west side of the Continental Divide, indicate that winters are generally cold with abundant snowfall (114.2 inches annual average) and summers are mild and wet. Mean annual precipitation is 16.92 inches; the wettest

months are July and August with an average precipitation of 2.17 and 2.05 inches respectively while the driest are November with 1.01 and June with 1.03 inches; the coldest month is January with an average temperature of 12 deg F and the warmest is July at 55 deg F (Western Regional Climate Center 2009). Climate records for Buena Vista, which is on valley floor and located approximately 9.5 miles to the northeast of the site, indicate a mean annual precipitation 9.79 inches; the wettest months are July and August with 1.7 and 1.65 inches of precipitation per month respectively; the driest month is January with 0.34 inches; the warmest month is July at 64 deg F and the coldest month is January at 24 deg F (Western Regional Climate Center 2009).

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) *Populus angustifolia* / *Betula occidentalis* montane riparian forest. The riparian community is uncommon and although the association appears stable, the condition of high-quality occurrences is extremely threatened by hydrologic modification and development (NatureServe 2009). There is also a good (B-ranked) occurrence of a globally imperiled (G2G3/S2) plant species, pale blue-eyed grass (*Sisyrinchium pallidum*), however this occurrence was not confirmed in 2009. It was last observed in 1994 and current information is needed to verify the rank. If confirmed, the biodiversity significance rank of this site could be elevated to B2.

Natural Heritage element occurrences at the Chalk Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	Montane Riparian Forest	G3	S3				B	2008-08-13
Vascular Plants	<i>Sisyrinchium pallidum</i>	pale blue - eyed grass	G2G3	S2			BLM	B	1994-06-17

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

Boundary Justification: The boundary encompasses the riparian plant community and pale blue-eyed grass as well as the landscape that supports the ecological processes essential to their long-term viability. Both public and private lands are included in the boundary.

Protection Urgency Rank Comments (P2): Riparian and upland habitat is a patchwork of private development and public lands. Primary threats to ecosystem integrity and viability result from hydrologic alteration to riverine or wetland hydrology and damage to or alteration of riparian vegetation and habitat. Proximate causes of alteration include private home and public campground development,

road development and maintenance, invasion of non-native species, grazing, recreation development and stream diversions.

Management Urgency Rank Comments (M3): Maintaining the natural hydrology and a naturally wide riparian zone is essential to the long-term viability of the elements. Maintaining a natural hydrologic regime with ecologically sustainable flows and increasing riparian development and activity setbacks would benefit the element occurrences by enhancing the potential for system self-maintenance. Cottonwood regeneration is dependent on natural river processes including flooding disturbance which, through the process of erosion and deposition create new, moist sandbars where cottonwood seedlings can germinate and become established (Carsey et al. 2003). In Colorado, pale blue-eyed grass depends on wetland habitat where standing water is available through the early growing season and is vulnerable to changes in the hydrologic regime (NatureServe 2009).

Exotic Species Comments: In degraded areas non-native species are common and include oxeye daisy (*Leucanthemum vulgare*), Kentucky bluegrass (*Poa pratensis*), sweetclover (*Melilotus* spp.) and black medic (*Medicago lupulina*).

Information Needs: Additional search needed for the 1994 record of pale blue-eyed grass (*Sisyrinchium pallidum*).

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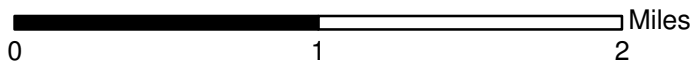
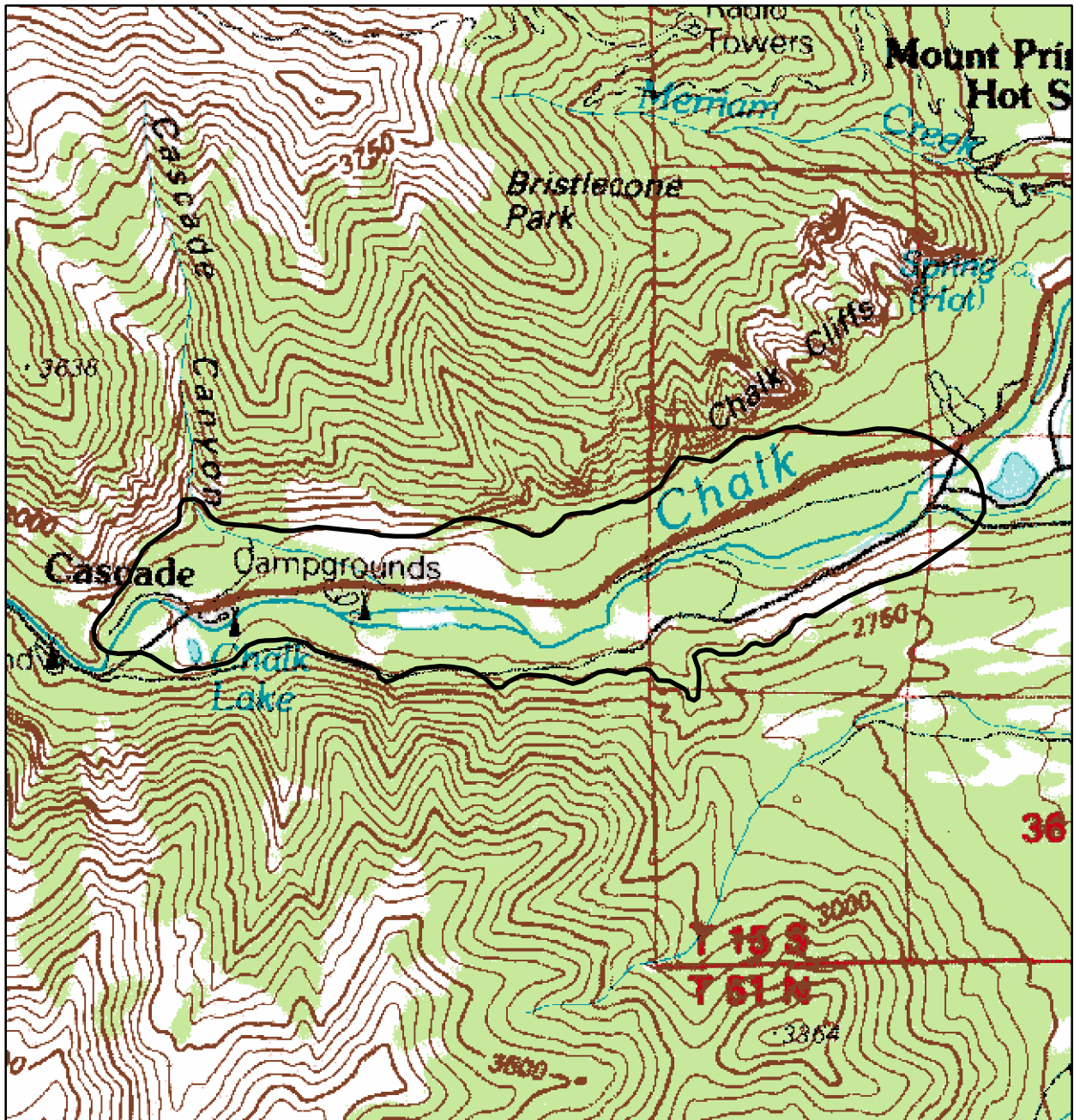
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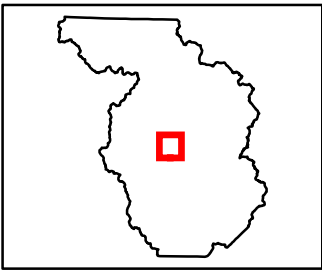
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Chalk Creek Potential Conservation Area, B3: High Biodiversity Significance

Chalk Creek Headwaters

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: Saint Elmo, Garfield

Size: 683 acres (277 ha)

Elevation: 11,040 - 11,880 ft. (3,365 - 3,621 m)

General Description: The site encompasses the valley surrounding the headwaters of Chalk Creek to the historic ghost town of Hancock. This lush riparian area occurs in the valley of a high elevation, glacially carved cirque. The wide, gently undulating, north-south trending valley is surrounded to the south, west and east by steep slopes and ridges characterized by arêtes and horns. Geologically the area is formed of middle tertiary, igneous intrusive rocks (age 20-40 M.Y.) of intermediate to felsic compositions. Substrate is metamorphic or igneous rocks with a dominantly silicic composition (Tweto 1979). Hydrology is bedrock controlled with little, if any, transfer of groundwater into or out of the basin through fractures. Shallow groundwater moves through glacial drift and talus slopes fed by precipitation and snowmelt. Here, slope and valley wetlands are sustained by shallow groundwater discharge. Ultimately, the snowmelt and precipitation that percolates down through the steep talus and scree slopes and wetlands, emerges in the glacial valley and coalesces to form Chalk Creek which is a first order stream until just below the Hancock town site. Valley soils vary from moist to saturated to inundated. Hummocky soils are scattered throughout and peat formation occurs to approximately two feet in a patchy distribution at elevations above 11,600 ft. Otherwise, soils are typically well developed with a thick organic layer. Alluvial deposits of boulders and gravel underlie soils throughout the site (Tweto 1979). Upland alpine plant communities on the steep slopes that surround the basin are a patchwork of fellfields, turf meadows, krummholz and willow carrs interspersed with talus and scree slides. Further down in elevation, upland slopes are dominated by spruce - fir (*Picea engelmannii* - *Abies lasiocarpa*) forests. These steep forested slopes interfinger with the valley meadows abruptly giving way to moisture-loving plants that dominate the valley floor. Valley floor habitat is characterized by a diverse mosaic of willow carrs, herbaceous wet and mesic meadows and open water ponds. This mosaic is a result of numerous processes that have created a variety of soil moisture conditions. These processes include stream meandering and out-of-bank flows, prolific beaver damming activity, and shallow groundwater flow and soil slumping that has created solifluction terraces and lobes. Habitat in this varied environment is species rich and structurally complex with numerous plant communities and associations. Willow carrs are characterized by patches of wolf willow (*Salix wolfii*) in association with planeleaf (*Salix planifolia*) and bareground

willow (*Salix brachycarpa*). Herbaceous cover is characterized by a patchy mosaic of forbs and graminoids with forbs typically dominant. Characteristic forb species include marsh marigold (*Caltha leptosepala*), elephant head (*Pedicularis groenlandica*), king's crown (*Rhodiola integrifolia*), alpine anemone (*Anemone narcissiflora*), triangular-leaf senecio (*Senecio triangularis*), tall fringed bluebells (*Mertensia ciliata*), brook saxifrage (*Saxifraga odontoloma*), star gentian (*Swertia perennis*), globeflower (*Trollius laxus* var *albiflorus*), Bigelow's senecio (*Senecio biglovii*) and Gray's angelica (*Angelica grayi*). Characteristic graminoid species include water sedge (*Carex aquatilis*), western sedge (*Carex scopulorum*), Holm sedge (*Carex heteroneura* var. *chalciolepis*), Rocky Mountain rush (*Juncus saximontanus*), spike rush (*Eleocharis acicularis*), tufted hairgrass (*Deschampsia caespitosa*) and slender cotton grass (*Eriophorum gracile*). Birds observed at the site include White Crowned Sparrow, Pine Grosbeak, Fox Sparrow, Northern Flicker, American Robin, Olive-sided Flycatcher, Mountain Chickadee and Northern Harrier.

Key Environmental Factors: Hydrology and beaver (*Castor canadensis*), a keystone species, are driving factors that exert a major influence on biota at the site. Hydrology is tightly associated with snowmelt. Both a natural hydrologic regime and beaver activity are important to maintaining a high water table.

Climate Description: Climate records in the town of Pitkin, located approximately 9.5 miles to the southwest of Hancock but on the west side of the Continental Divide, indicate that winters are generally cold with abundant snowfall (114.2 inches annual average) and summers are mild and wet. Mean annual precipitation is 16.92 inches; the wettest months are July and August with an average precipitation of 2.17 and 2.05 inches respectively while the driest are November with 1.01 and June with 1.03 inches; the coldest month is January with an average temperature of 12 deg F and the warmest is July at 55 deg F (Western Regional Climate Center 2009).

Land Use History: Hard rock mining dominated the landscape in the late 1800's.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) *Salix wolfii* / mesic forbs subalpine riparian willow carr and an excellent (A-ranked) occurrence of the state imperiled (G5/S2) slender cottongrass (*Eriophorum gracile*).

Natural Heritage element occurrences at the Chalk Creek Headwaters PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix wolfii / Mesic Forbs Shrubland	Subalpine Riparian Willow Carr	G3	S3				A	2008-08-26
Vascular Plants	Eriophorum gracile	slender cottongrass	G5	S2			BLM/USFS	A	2008-08-26

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

Boundary Justification: The boundary encompasses the elements and the ecological processes that sustain them. It should provide a suitable buffer to protect against direct disturbance and allow for community migration. Although the community is widespread, it is never very abundant where it occurs (NatureServe 2009). Two primary ecological processes, hydrology and beaver activity, are essential to maintaining the system. Specifically, the community is reliant on a high water table, shallow surface flow and episodic flooding for long-term viability (NatureServe 2009 and Rondeau 2001) so any activities that alter hydrology or lower the water table threaten community sustainability (NatureServe 2009).

Protection Urgency Rank Comments (P3): The site is a patchwork of private and public lands. Private lands are primarily mining claims and prospects, with an associated web of dirt access roads that crisscross the landscape.

Management Urgency Rank Comments (M3): A network of roads from historic mining activity fragments the landscape. Roads alter surface and shallow groundwater flow and enable motorized access with associated impacts in wilderness areas. Both historic mining-related impacts and current uses related to roads and mine sites have the potential to alter surface and shallow groundwater flow and beaver activity, thereby impacting element viability.

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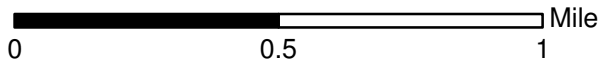
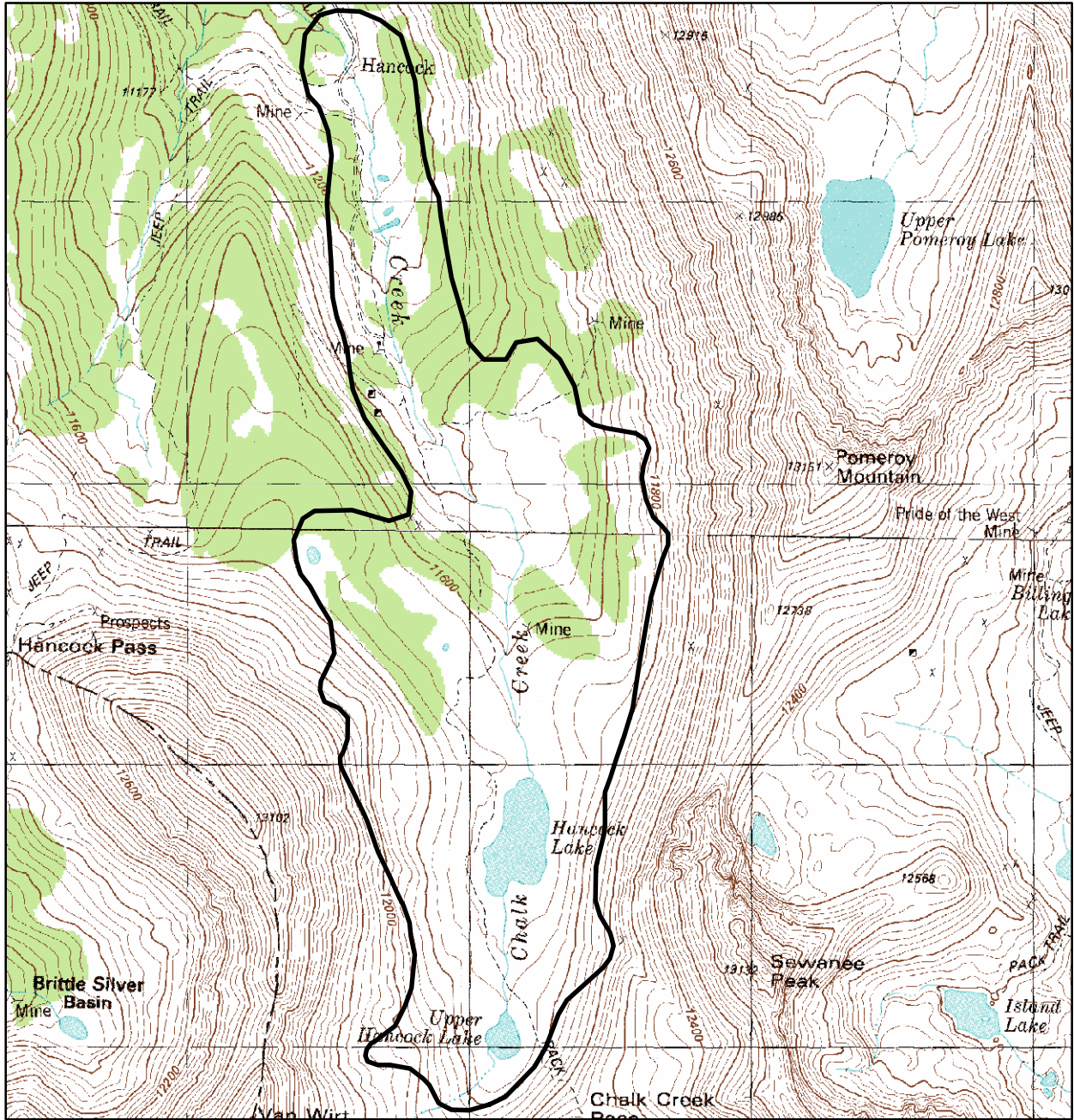
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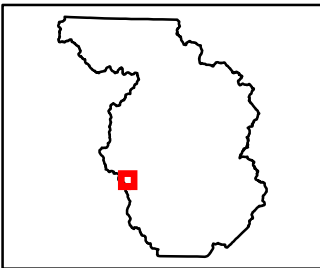
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Version Author: Malone, D.G.

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Chalk Creek Headwaters Potential Conservation Area, B3: High Biodiversity Significance

Chubb Park

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: Buena Vista East, Marmot Peak, Castle Rock Gulch, Antero Reservoir

Size: 2,088 acres (845 ha)

Elevation: 9,185 - 9,340 ft. (2,800 - 2,847 m)

General Description: An intermittent drainage flows through the grassland park which is surrounded by a mixed ponderosa pine (*Pinus ponderosa*) - aspen (*Populus tremuloides*) matrix forest. Ridges have some limber pine (*Pinus flexilis*). Riparian corridors are dominated by sedges (*Carex utriculata*, *Carex aquatilis*, *Carex nebrascensis*) and graminoids (*Calamagrostis canadensis*, *Juncus balticus*) with small thickets of browsed willows (*Salix monticola*, *Salix planifolia*, *Salix eriocephala*) and shrubby cinquefoil. Seepage areas are evident with a spongy substrate and bryophytes. The wetlands are characterized by analogue sedge (*Carex simulata*). There is a small area of floating mat of vegetation with spikerush (*Eleocharis quinquefolia*) and seaside arrowgrass (*Triglochin maritima*) in addition to analogue sedge. There are several types of green algae stonewort (*Chara* spp.) and filamentous present. Forbs also include alkali buttercup (*Ranunculus cymbalaria*), mountain meadowrue (*Thalictrum fendleri*), and Rocky Mountain iris (*Iris missouriensis*).

Biodiversity Significance Rank Comments (B3): This site supports an extant (E-ranked) occurrence of a globally imperiled (G2/S2) caddisfly (*Ochrotrichia susanae*). The Susan's purse-making caddisfly was identified as a new species in 1976, and has only been found in two sites in central Colorado: Trout Creek Spring in Chaffee County, where the species was first described, and High Creek Fen in Park County. This species is seriously threatened by habitat loss, primarily due to the effects of livestock grazing and timbering projects in the Trout Creek Spring area. The site also supports a fair to good (BC-ranked) occurrence of a state vulnerable (G4/S3) wet meadow (*Carex simulata* herbaceous vegetation).

Natural Heritage element occurrences at the Chubb Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Insects	Ochrotrichia susanae	Susan's purse - making caddisfly	G2	S2			USFS	E	2005-99-99
Natural Communities	Carex simulata Herbaceous Vegetation	Wet Meadow	G4	S3				BC	2008-07-08

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

Boundary Justification: The boundary was drawn to include the spring supporting the caddisfly as well as the community and suitable habitat up and downstream of the occurrences. Hydrological processes that originate upstream of this site will need management to assure that the occurrence is protected for the long term.

Protection Urgency Rank Comments (P4): Highway 24 is nearby, but otherwise the wetland is on the edge of an extensive landscape in natural condition. A portion of the site was recently put under conservation easement.

Management Urgency Rank Comments (M3): Management may be needed in the future to maintain the quality of the element occurrence. The limited habitat of Susan's purse-making caddisfly is also threatened by groundwater depletion due to increasing usage by surrounding cities, damage from unregulated off-road recreational vehicle use and hiking, and the effects of drought, altered stream hydrology, and changing water temperature that are likely to occur in the mountainous West due to global climate change. The effects of the current grazing regime should be evaluated. There are some grazing impacts, although the area is generally too wet for excessive grazing.

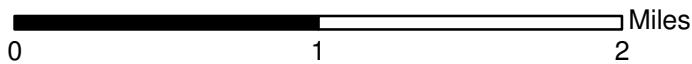
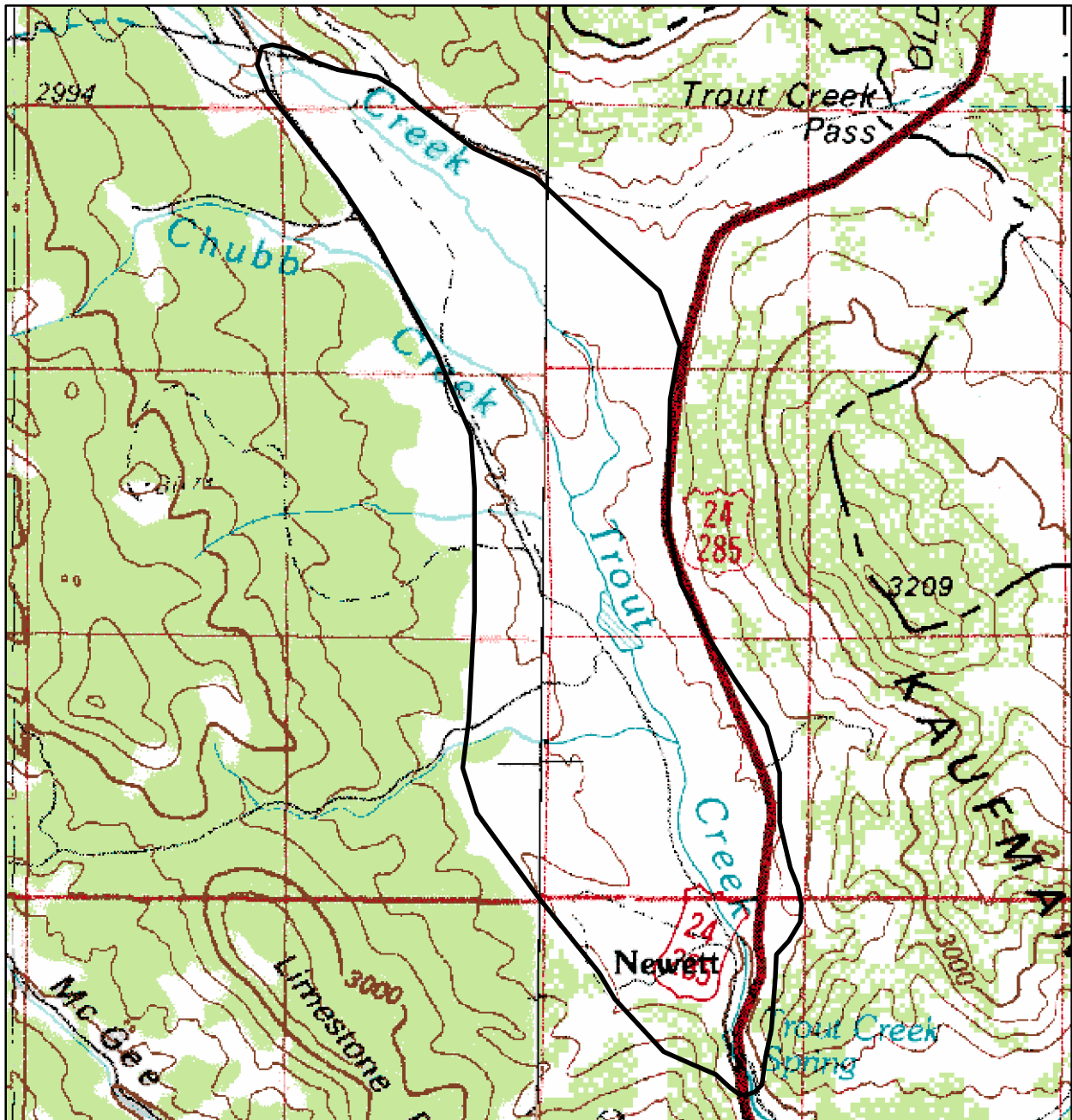
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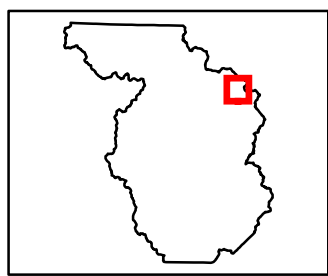
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Version Author: Handwerk, J.E.

Version Date: 03/10/2009



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Chubb Park Potential Conservation Area, B3: High Biodiversity Significance

Cottonwood Pass

Biodiversity Rank - B3: 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: Tincup

Size: 1,304 acres (528 ha)

Elevation: 11,000 - 12,126 ft. (3,353 - 3,696 m)

General Description: Cottonwood Pass site straddles the Continental Divide and the county line between Gunnison and Chaffee counties. The road has been used since the 1800s for access between the mining camps of Buena Vista and northern Gunnison Counties. The site crosses the central portion of the Sawatch Range, which is composed primarily of coarse schists and gneisses intruded by Precambrian granites and of metamorphosed limestone and quartzite (Chronic and Williams 2002). The headwaters of the North Fork of Cottonwood Creek are located within the site. The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that are known to utilize this site and other alpine areas include: American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Climate Description: The area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B3): The Cottonwood Pass site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) reflected moonwort (*Botrychium echo*). An extant and a historical occurrence of the state rare (G5/S2) woods draba (*Draba oligosperma*), known in Colorado only from limestone scree slopes, also occur within the site. Additionally, there are imprecise and historical records of the state rare (G5T3T4/S2S3) dark blue butterfly (*Lycaeides idas sublivens*), last observed in 1961, and the state rare (G5/S3) white-veined Arctic (*Oeneis bore*), last observed in 1972. Both the butterfly and moth occur only in the alpine zone.

Natural Heritage element occurrences at the Cottonwood Pass 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	Botrychium echo	reflected moonwort	G3	S3				B	1999-08-26
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2005-08-10
Vascular Plants	Draba oligosperma	woods draba	G5	S2				H	1986-07-08

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

Boundary Justification: The boundary includes the occurrences and a buffer against direct disturbance. The natural processes are not completely contained within the boundary.

Protection Urgency Rank Comments (P4): Site occurs in the Collegiate Peaks Wilderness of the San Isabel National Forest.

Management Urgency Rank Comments (M4): Monitor impact from off-trail hikers and bicyclists.

Information Needs: Current field surveys are need to locate the rare butterfly and moth and to document the quality of the woods draba populations.

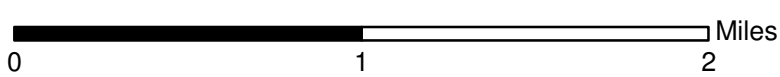
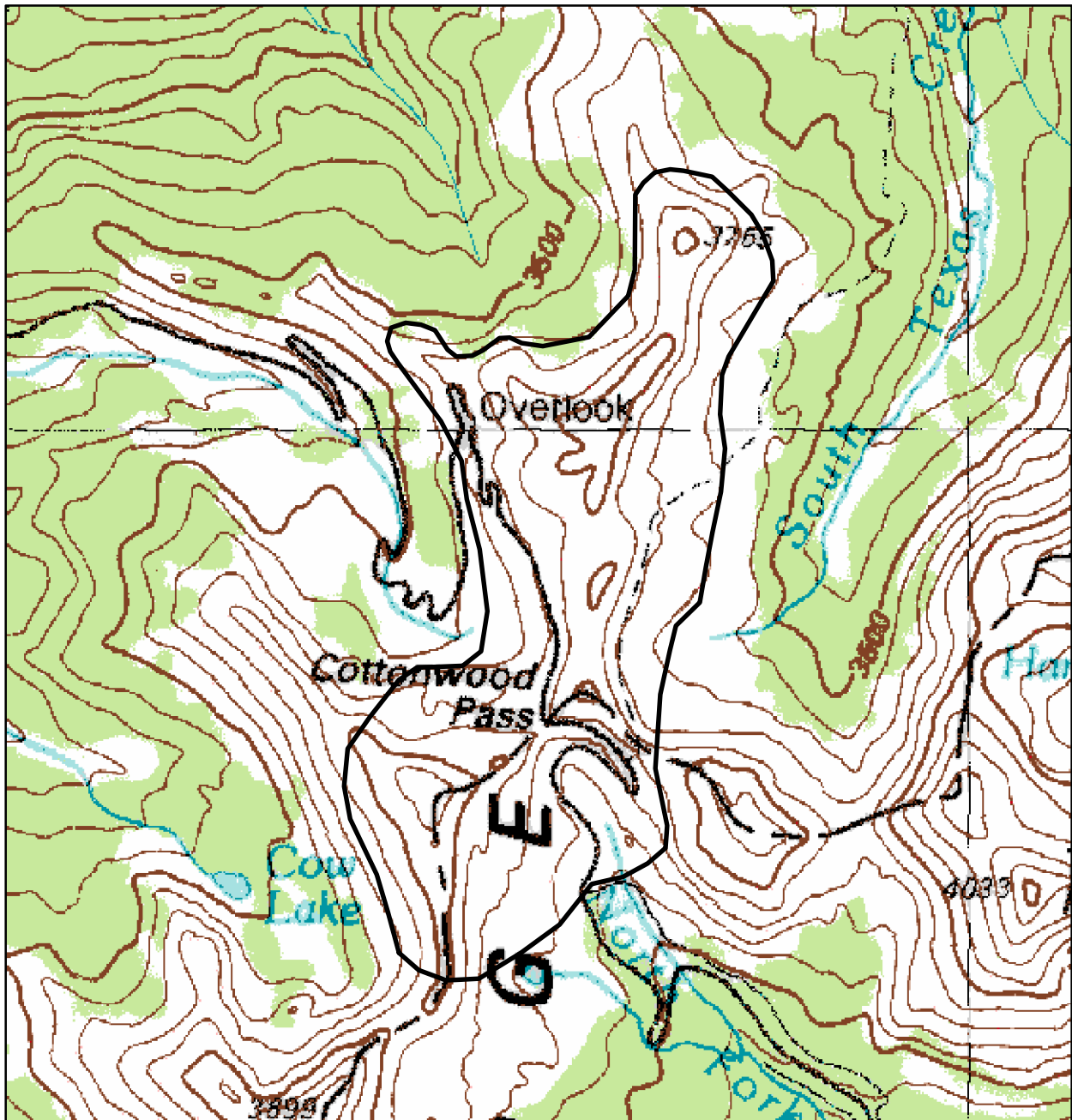
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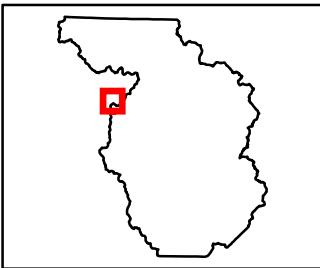
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Version Author: Culver, D.R.

Version Date: 01/20/2009



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Cottonwood Pass Potential Conservation Area, B3: High Biodiversity Significance

Dry Creek at Maxwell Park

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: Buena Vista East, Buena Vista West

Size: 1,162 acres (470 ha) **Elevation:** 8,000 - 9,300 ft. (2,438 - 2,835 m)

General Description: The wetland and riparian area emerges from an otherwise dry grassland park in the Upper Arkansas River Valley. The seepage emerges near the transition between the grassland park and pinon - juniper forest to the east. The riparian woodland is dominated by patches of mature narrowleaf cottonwood (*Populus angustifolia*). The shrub layer is well-developed with Pacific willow (*Salix lasiandra*) common and dominant at the upstream end of the occurrence before dominance switches to dense water birch (*Betula occidentalis*). There are a significant number of side channel seeps with lush bryophyte and herbaceous cover. Brown moss (*Mnium* sp.) is dominant and liverworts (*Marchantia* sp.) are abundant. Common herbaceous species include Hornemann's willowherb (*Epilobium hornemannii*), alkali buttercup (*Ranunculus cymbalaria*), water speedwell (*Veronica catenata*), and beaked sedge (*Carex utriculata*). The latter forms raised terraces along seeps.

Biodiversity Significance Rank Comments (B3): This site supports a good to excellent (AB-ranked) occurrence of a globally vulnerable (G3/S3) montane riparian forest (*Populus angustifolia* / *Betula occidentalis*).

Natural Heritage element occurrences at the Dry Creek at Maxwell Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Populus angustifolia</i> / <i>Betula occidentalis</i> Woodland	Montane Riparian Forest	G3	S3				AB	2008-08-07

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

Boundary Justification: The boundary was drawn to include the community and suitable habitat up and downstream of the occurrence. Hydrological processes that originate upstream of this site will need management to assure that the occurrence is protected in the long-term.

Protection Urgency Rank Comments (P4): Portions of the site are within a State

Wildlife Area. There are several residences nearby with an access road.

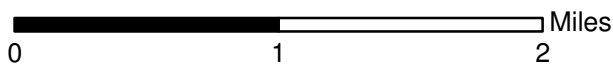
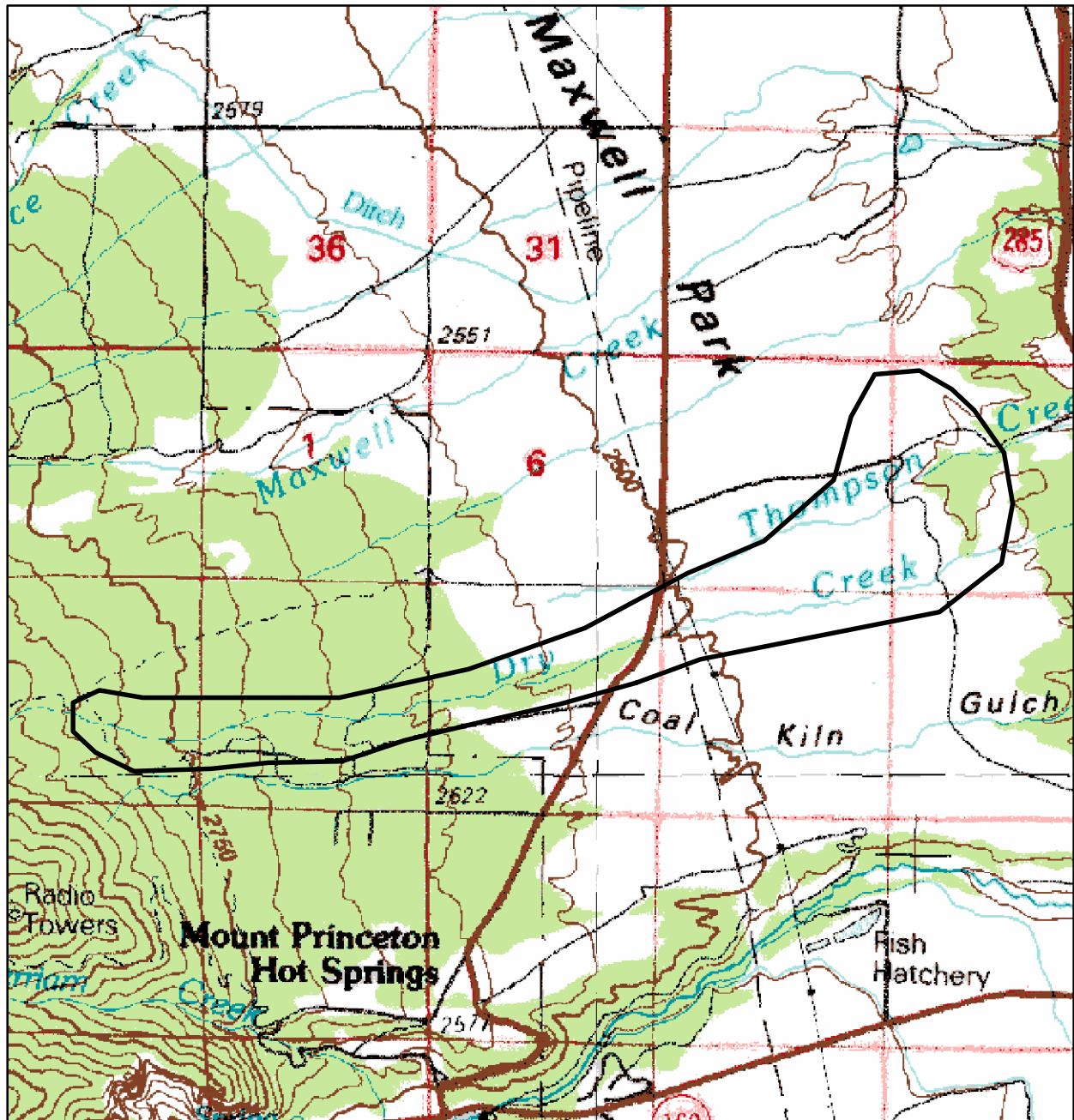
Management Urgency Rank Comments (M3): Management may be needed in the future to maintain the quality of the element occurrence given the development pressures in the surrounding area. The effects of the current grazing regime should be evaluated. There are some pasture species established in the riparian corridor at the upstream end and there are grazing impacts to vegetation where it is not too wet.


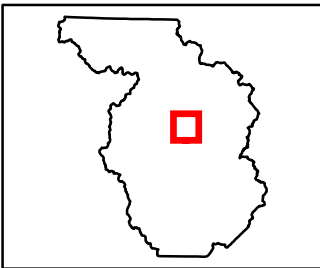
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Handwerk, J.E.

Version Date: 03/10/2009



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Dry Creek at Maxwell Park Potential Conservation Area, B3: High Biodiversity Significance

Fourmile Creek at Annie Mine

Biodiversity Rank - B3: 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: Harvard Lakes, Marmot Peak

Size: 2,872 acres (1,162 ha)

Elevation: 8,580 - 9,200 ft. (2,615 - 2,804 m)

General Description: Fourmile Creek at Annie Mine is located in the upper Arkansas Valley north of Buena Vista. The Arkansas River runs parallel to the western boundary, Fourmile Creek bisects the site and the Buffalo Peaks rise up to the north. The geology of the area consists of granitic rocks and glacial outwash from the Sawatch Range to the west. The site's vegetation is pinon pine (*Pinus edulis*), one-seeded juniper (*Juniperus monosperma*), mountain mahogany (*Cercocarpus montanus*), oceanspray (*Holodiscus discolor*), and gooseberry (*Ribes cereum*).

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*), a regional endemic that also occurs in New Mexico and Wyoming. There is also a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Crandall's rock-cress (*Boechera crandallii*), another regional endemic documented only from west-central Colorado and southwestern Wyoming. The Colorado endemic and globally vulnerable (G3/S3) Front Range alum-root (*Heuchera hallii*) occurs within the site. It is only known from the south of the Pikes Peak region. Lastly, the globally vulnerable (G3?/S3?), regional endemic, jeweled blazingstar (*Nuttallia speciosa*) has also been documented.

Natural Heritage element occurrences at the Fourmile Creek at Annie Mine 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	Boehera crandallii	Crandall's rock - cress	G2	S2			BLM	C	2008-06-07
Vascular Plants	Argyrochosma fendleri	Fendler cloak - fern	G3	S3				B	1995-06-20
Vascular Plants	Heuchera hallii	Front Range alum - root	G3	S3				E	2000-05-30
Vascular Plants	Nuttallia speciosa	jeweled blazingstar	G3?	S3?				E	1998-07-13

** 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 capture the elements and provide a buffer from threats and potential habitat for seed dispersal.

Protection Urgency Rank Comments (P4): The entire site is owned and managed by the Pike-San Isabel Forest.

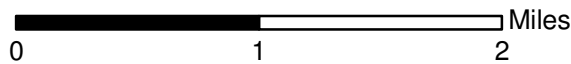
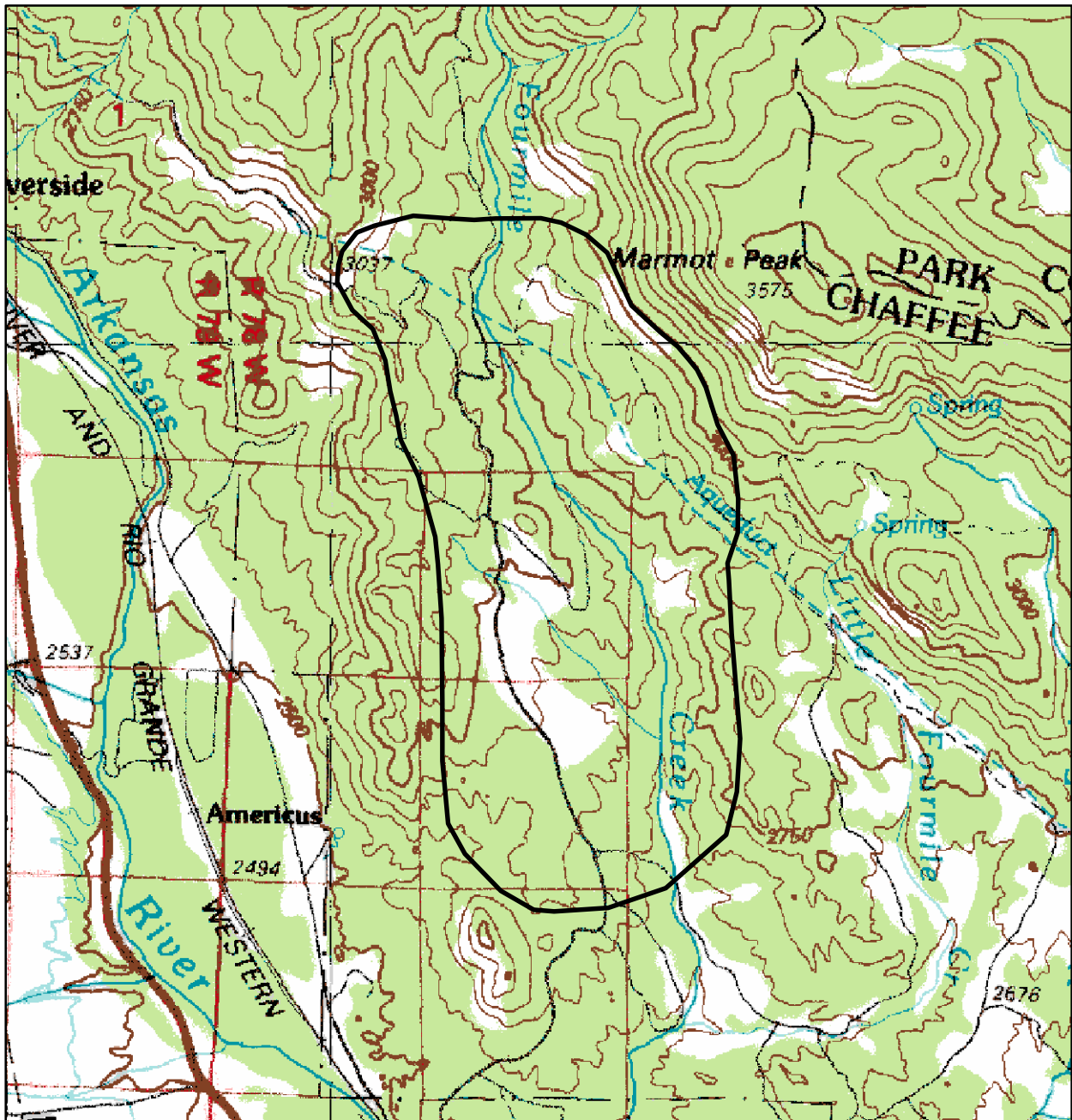
Management Urgency Rank Comments (M4): No weeds or other disturbances were documented.


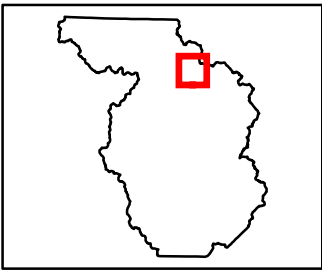
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 03/05/2009



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Fourmile Creek at Annie Mine Potential Conservation Area, B3: High Biodiversity Significance

Grizzly Gulch

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: Saint Elmo

Size: 521 acres (211 ha)

Elevation: 10,180 - 11,880 ft. (3,103 - 3,621 m)

General Description: The site is located in the Sawatch Mountain Range on the east side of the Continental Divide and approximately ¼ mile south of the ghost town of St. Elmo. Grizzly Gulch is a narrow, steep-walled valley that trends north-south between two high-elevation ridgelines. Elevation of the western ridgeline at the upper end above the site is approximately 12,040 ft and goes down to 10,400 ft at the lower, north end of the site; elevation of the ridgeline on the east side of the valley goes from approximately 13,400 ft down to 10,260 ft; elevation of the stream reach and corresponding riparian site begins at 11,880 ft and goes down to 10,180 ft at the north end of the reach. In the upper 2.3 miles of the site, both upstream and immediately below the lake, the stream meanders through a wide, low gradient valley. Within approximately 0.8 miles below the lake the valley narrows and the stream gradient increases. In the lower ½ mile, valley characteristics transition to a steep walled, steep gradient canyon and stream. Geology is formed of middle tertiary intrusive rocks aged 20-40 million years. Substrate is metamorphic of igneous units with a dominantly silicic composition of all ages. A steep-walled glacial cirque and arêtes form the headwalls of Grizzly Gulch. At the base of the headwalls wide, low gradient willow carrs, wet meadows and ponds are sustained by abundant shallow-groundwater slope discharge from snowmelt from surrounding peaks. Discharge from these slopes coalesces into a stream that flows into Grizzly Lake. At the down valley end of the lake the stream flows out of the lake and continues through Grizzly Gulch to its confluence with Chalk Creek. Hydrology of the basin is bedrock controlled. The system is recharged through direct precipitation and snowmelt. Water that flows and discharges through the unconsolidated talus slopes is stored in and sustains the wetlands that feed the stream. There is some contribution from side channels, which are also formed from shallow groundwater discharge, thus the stream that drains Grizzly Gulch is likely a gaining stream. Headwater habitat at Grizzly Gulch is characterized by a mosaic of willow carrs, wet herbaceous meadows and open water ponds. In this headwater, high-elevation habitat willow carrs are dominated by planeleaf willow (*Salix planifolia*) in a variety of associations including with water sedge (*Carex aquatilis*), bluejoint reedgrass (*Calamagrostis canadensis*) and marsh marigold (*Caltha leptosepala*). Other shrub species present include bareground willow (*Salix brachycarpa*), bog birch (*Betula nana*), and shrubby cinquefoil (*Dasiphora floribunda*).

Herbaceous meadows here are characterized by a rich mosaic of lush forb and graminoid communities. Dominant forbs include marsh marigold, king's crown (*Sedum integrifolium*), elephant head (*Pedicularis groenlandica*), star gentian (*Swertia perennis*), brook saxifrage (*Saxifraga odontoloma*), snowball saxifrage (*Saxifraga rhomboidea*), heartleaf bittercress (*Cardamine cordifolia*) and viviparous bistort (*Bistorta vivipara*). Common graminoids include water sedge, tufted hairgrass (*Deschampsia caespitosa*), slender cotton grass (*Eriophorum gracile*), mountain sedge (*Carex scopulorum*), Drummonds rush (*Juncus drummondii*), Tracy's rush (*Juncus tracyi*) and alpine timothy (*Poa alpina*). Below Grizzly Lake, riparian plant communities vary with stream gradient in a linear mosaic along the stream corridor. Wider, flatter reaches are characterized by willow carrs whereas riparian habitat along narrower, steeper stream riparian areas are forested. Characteristic shrub species in the willow carrs include planeleaf willow, barenground willow, Drummond's willow (*Salix drummondiana*) and shrubby cinquefoil. Forested riparian habitat is characterized by a mix of conifers and deciduous trees with an understory of shrubs dominated by willow species and a few non-willow species. Riparian forests in the subalpine and upper montane are characterized by a tree canopy dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) and patches of aspen (*Populus tremuloides*) with a mixed willow and non-willow shrub layer that includes Drummond's, planeleaf, and barenground willow. As elevation decreases the tree canopy quickly transitions to a tree canopy dominated by aspen with a shrub layer that is dominated by Drummond's willow. Other common shrub species include thinleaf alder (*Alnus incana*), twinberry honeysuckle (*Lonicera involucrata*), Wood's rose (*Rosa woodsii*) and gooseberry (*Ribes inerme*). Herbaceous cover here is characterized by a diversity of forbs including tall fringed bluebells (*Mertensia ciliata*), cow parsnip (*Heracleum sphondylium*), meadow rue (*Thalictrum fendleri*), star solomonplume (*Smilacina stellata*), brook saxifrage (*Saxifraga odontoloma*) and cowbane (*Oxypolis fendleri*). Uplands in the alpine are dominated by a mosaic of krummholz patches, willow and bog birch shrublands in avalanche chutes, and turf meadows, fellfields and scree and talus slopes. Subalpine upland habitat is dominated by spruce - fir forests that transition to a patchy mosaic of aspen and spruce - fir stands in the upper montane and montane life zones. Characteristic bird species that were commonly observed in the alpine included White-crowned Sparrow (*Zonotrichia leucophrys*) and Wilson's Warbler (*Wilsonia pusilla*); birds commonly observed in the subalpine and upper montane included Pine Grosbeak (*Pinicola enucleator*), Townsend's Solitaire (*Myadestes townsendi*), Golden-crowned Kinglet (*Regulus satrapa*), Dark-eyed Junco (*Junco hyemalis*) and Clark's Nutcracker (*Nucifraga columbiana*).

Climate Description: Climate records in the town of Pitkin, located approximately 11.5 miles to the southwest of Grizzly Gulch but on the west side of the Continental Divide, indicate that in general winters are cold with abundant snowfall (114.2 inches annual average) and summers are mild and wet. Mean annual precipitation is 16.92 inches; the wettest months are July and August with an average precipitation

of 2.17 and 2.05 inches respectively while the driest are November with 1.01 and June with 1.03 inches; the coldest month is January with an average temperature of 12 deg F and the warmest is July at 55 deg F (Western Regional Climate Center 2009).

Land Use History: Hardrock mining was prolific in surrounding valleys and evidence of prospecting is abundant in Grizzly Gulch.

Cultural Features: The nearby Ghost Town of St. Elmo originated in 1879 and is widely considered Colorado's best preserved ghost town.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3G4/SU) *Populus tremuloides* / *Salix drummondiana* riparian forest.

Natural Heritage element occurrences at the Grizzly 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
Natural Communities	<i>Populus tremuloides</i> / <i>Salix drummondiana</i> Forest		G3G4	SU				A	2008-09-02

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

Boundary Justification: The boundary was developed to encompass the element occurrence as well as the ecological processes and physical characteristics that sustain the element. Specifically the primary ecological process necessary to maintain the element occurrence is hydrology, especially surface flow but also groundwater (Rondeau 2001). Thus sufficient stream flows with a natural flooding regime including out-of-bank flows are important to maintaining this ecological system. The hydrologic system is bedrock controlled and is recharged through direct precipitation and snowmelt. Wetlands at the headwaters both store precipitation and discharge water into the stream to sustain flows. Although there is some contribution to flow from side channels the stream that drains Grizzly Gulch is heavily dependent on wetland function and streamflow at the headwaters and upstream reaches for sustainability.

Protection Urgency Rank Comments (P3): Upper reaches are in public ownership and are managed by the USFS but lands along the lower reaches are a patchwork of public and private ownership. Motorized recreation is prolific.

Management Urgency Rank Comments (M3): Ecologically sustainable stream flows are essential to the maintenance of this site. Protection of instream flows would benefit the riparian and stream system. Motorized recreation has the potential to

have a deleterious impact on the system.

References

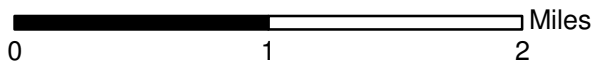
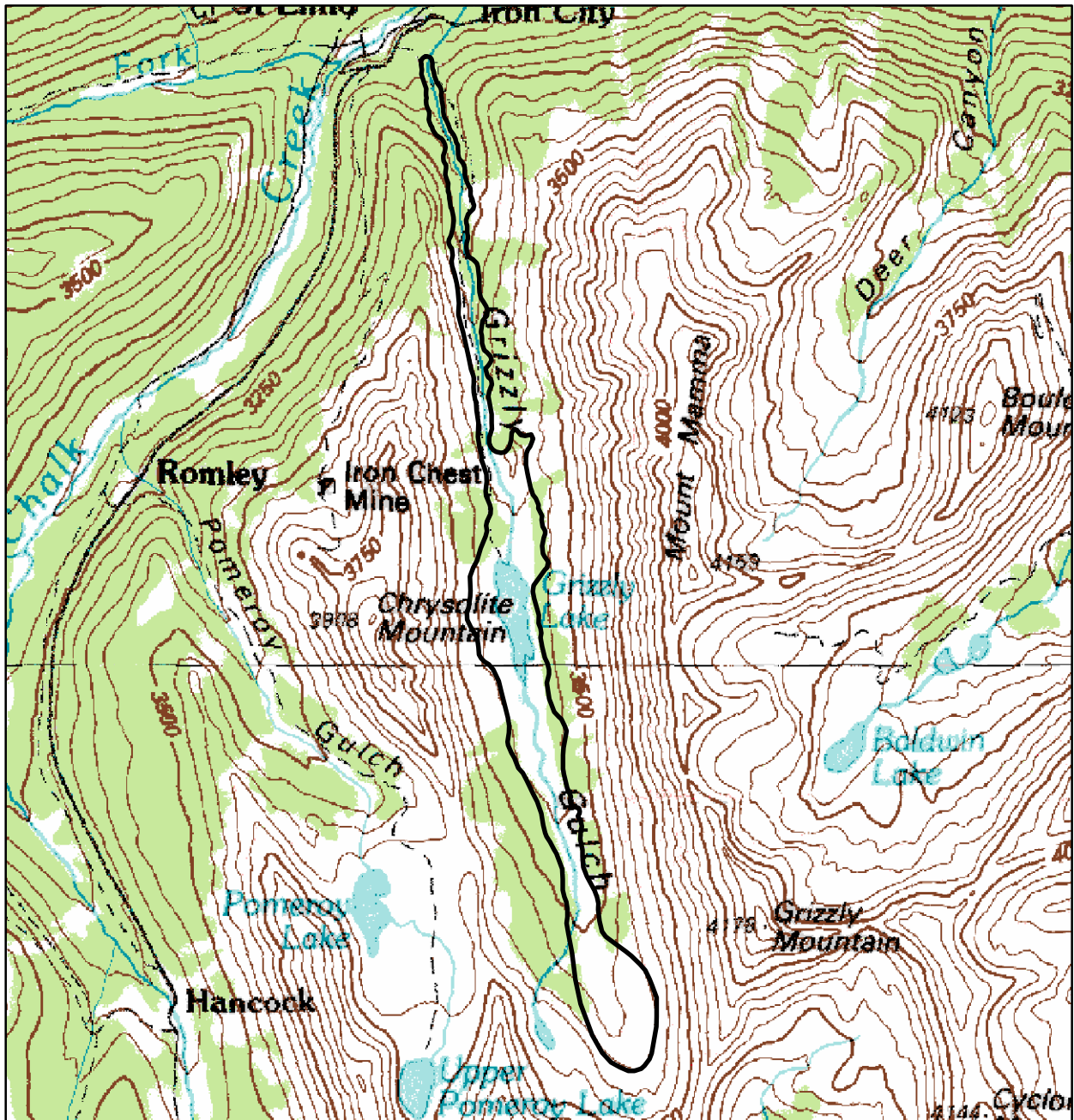
Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.


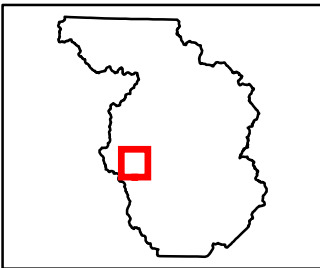
Rondeau, R. 2001. Ecological system viability specifications for Southern Rocky Mountain ecoregion. First Edition. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. 181 pp.

Western Regional Climate Center. 2009. Period of Record Climate Summaries for Buena Vista and Antero stations. Accessed in 2009.
<http://www.wrcc.dri.edu/Climsum.html>

Version Author: Malone, D.G.

Version Date: 04/01/2009



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Grizzly Gulch Potential Conservation Area, B3: High Biodiversity Significance

Huron Peak

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P5: No Action to be Taken on this Site
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Winfield

Size: 343 acres (139 ha)

Elevation: 12,000 - 14,000 ft. (3,658 - 4,267 m)

General Description: The Huron Peak site is located in the northern Sawatch Range (Collegiate Peaks), northwest of Buena Vista and south of Clear Creek and the ghost town of Winfield. Huron Peak (14,005 ft. elevation), is located among other fourteeners: Missouri Mountain, Mount Oxford, and Mount Belford. The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B3): The high biodiversity rank is based on an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) thick-leaf whitlow grass (*Draba crassa*). An unranked occurrence of the state rare (G4/S2S3) Arctic draba (*Draba fladnizensis*) has also been documented.

Natural Heritage element occurrences at the Huron Peak 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>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				A	1994-07-27
Vascular Plants	<i>Draba fladnizensis</i>	arctic draba	G4	S2S3				E	2000-07-23

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

Boundary Justification: The boundary is drawn to protect the occurrences from direct impacts such as trampling or other surface disturbances. A buffer is drawn to provide plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P5): The site is within the Collegiate Peaks Wilderness Area.

Management Urgency Rank Comments (M4): Although not currently threatened, management may be needed in the future to maintain current quality of element occurrences. It is a heavy hiker route.

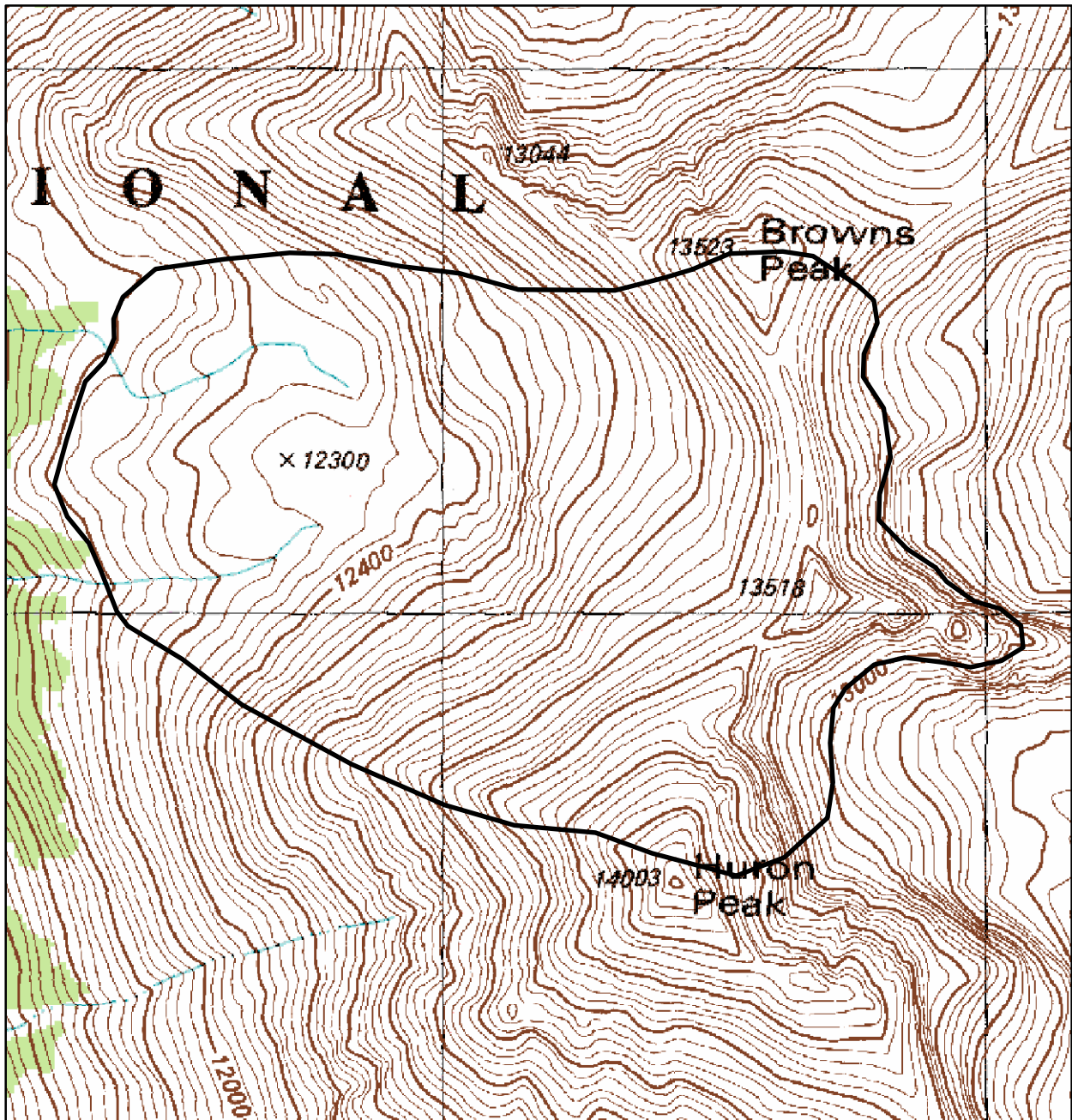
Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.


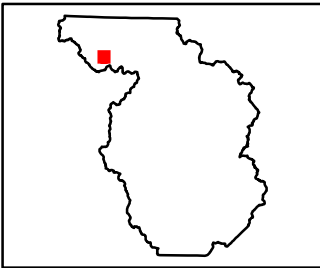
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 03/10/2009



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Huron Peak Potential Conservation Area, B3: High Biodiversity Significance

La Plata Gulch

Biodiversity Rank - B3: 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: Mount Elbert, Independence Pass

Size: 2,038 acres (825 ha)

Elevation: 10,800 - 12,800 ft. (3,292 - 3,901 m)

General Description: The site is located in a high elevation, glacially sculpted, north-south trending valley on the east side of the Continental Divide in the Sawatch Mountain Range. The stream that drains La Plata Gulch has its confluence with Lake Fork Creek approximately 7.5 miles west of the town of Twin Lakes. Glacially carved peaks, arêtes and cirques surround La Plata Gulch to the west, south and east. La Plata Peak, at 14,361 ft, is to the east, Sayre's Peak, at 13,738 ft, is to the south and the peaks and high ridges that form the western wall of the valley reach elevations up to 13,430 ft. Geology of the surrounding slopes on the east side of the gulch, up to approximately 12,000 ft, is Laramide intrusive rock, age 40-72 M.Y., with intermediate felsic composition; above 12,000 ft rocks are Precambrian granites of the 1,700 M.Y. age group; at the southern end of the valley upland slopes are metamorphic rocks, age 1,700 to 1,800 M.Y., of biotitic gneiss, schist, and migmatite; west slopes of the gulch, up to approximately 12,400 ft, are Laramide intrusive rocks, age 40-72 M.Y., with intermediate felsic composition; above 12,000 ft rocks are Oligocene pre-ash-flow andesitic lavas, breccias, tuffs, and conglomerates, age 30-35 M.Y.. Geology in the valley bottom is Pleistocene age glacial drift from the Pinedale and Bull Lake glaciations (Tweto 1979). Soils in the valley bottom have been wet long enough and with enough reliability to build up substantial amounts of organic matter, and develop deep accumulations of peat. Soils are typically hummocky and moist to saturated on terraces, toeslopes and in the valley bottom. Snowmelt from the surrounding ridges sends copious amounts of shallow groundwater and surface flow into the basin below. Snowmelt coalesces into dozens of stream accumulates in the numerous depressions left by the glacier creating lakes and tarns, eventually moving into the valley below and into the stream that drains the Gulch. Valley toeslopes are saturated and support lush plant communities. Early in the upper part of the Gulch the stream becomes a second order stream and is a typical Rosgen type "C" stream (Rosgen 1996) with a moderate gradient and sinuosity. Overbanking flows are common and, in combination with shallow overland surface and groundwater flow from snowmelt, maintain an expansive willow carr-wet meadow mosaic. Habitat in the valley bottom and up onto the toeslopes is characterized by an expansive, dense patchwork of low-growing willows interspersed with open, herbaceous wet meadows. Wolf willow (*Salix wolfii*) is the dominant willow and forms a mosaic with stands of planeleaf willow (*Salix planifolia*). Herbaceous cover is

a dense, lush patchy mosaic of forbs and graminoids responding to varying soil moisture conditions. Although large, homogenous stands of sedges (*Carex* spp.) are encountered throughout the site total overall forb cover is greater than graminoid cover although no one forb species is dominant. Patches of the marsh marigold (*Caltha leptosepala*) herbaceous vegetation association occur under the shrub canopy and in canopy openings where they interfinger with graminoid patches. Adjacent to the stream, patches of the brook saxifrage (*Saxifraga odontoloma*) herbaceous vegetation association is common. Typical forbs include marsh marigold, alpine lousewort (*Pedicularis sudetica*), star gentian (*Swertia perennis*), king's crown (*Rhodiola integrifolia*), brook saxifrage, Parry's primrose (*Primula parryi*), triangular leaf senecio (*Senecio triangularis*), Gray's angelica (*Angelica grayi*) and heartleaf bittercress (*Cardamine cordifolia*). Common graminoids include Rocky Mountain sedge (*Carex scopulorum*), water sedge (*Carex aquatilis*), different-nerve sedge (*Carex heteroneura*) and tufted hairgrass (*Deschampsia caespitosa*). Steep upland slopes in the lower alpine are a mosaic of spruce - fir (*Picea engelmannii* - *Abies lasiocarpa*) forest, shrublands, herbaceous meadows, boulder fields and avalanche chutes where a dense cover of willow thrives. Higher up in the alpine, wide scree and talus slopes are interspersed with stands of Krummholz, and then, higher up into the alpine, the habitat transitions again into an open landscape dominated by fellfields, rock glaciers, and alpine turf meadows.

Key Environmental Factors: Hydrology, especially abundant shallow surface and groundwater flow, and soil, particularly deep accumulations of peat (Carsey et al. 2003), are key driving factor that exert a major influence on biota at the site.

Climate Description: Climate records for Independence Pass, which is approximately 7.5 miles to the northwest and on the west side of the Continental Divide, indicate a mean annual precipitation of 29.82 inches; the wettest months are January and March with a mean precipitation of 3.51 inches and 3.97 inches per month respectively; the driest months are June and September with a mean precipitation of 1.11 inches and 1.70 inches per month respectively; the warmest month is July with a mean temperature of 51.9 deg F and the coldest month January at 12.7 deg F. Average annual snowfall is 335.9 inches with January and March having the greatest monthly snowfall with a mean of 50.1 inches and 58.8 inches respectively (Western Regional Climate Center 2009).

Land Use History: Hardrock mining was prolific throughout the area.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) Wolf's willow (*Salix wolfii*) / mesic forbs subalpine riparian willow carr.

Natural Heritage element occurrences at the La Plata 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
Natural Communities	Salix wolfii / Mesic Forbs Shrubland	Subalpine Riparian Willow Carr	G3	S3				A	2008-08-02

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

Boundary Justification: The boundary includes the element occurrence as well as the immediate watershed to enable essential ecological and hydrological processes. Hydrology, and specifically shallow surface and groundwater flow, is the key environmental factor essential to maintaining the wolf willow / mesic forbs plant association (Rondeau 2001) and to the development of peaty soils with which wolf willow is associated (Carsey et al. 2003). In this landscape snowmelt from surrounding peaks and ridges is the hydrologic driver.

Protection Urgency Rank Comments (P4): Most of the lands in and surrounding La Plata Gulch are publicly owned. The valley bottom and uplands to the west of La Plata Gulch are managed by the USFS and uplands to the east are in the Collegiate Peaks Wilderness Area. However, several private in-holdings, that are likely mining claims, are present at the head of the valley. If these sites are developed they would likely impact the viability of the plant community with direct disturbance and by altering shallow and surface groundwater flow.

Management Urgency Rank Comments (M4): Current management seems to support the long-term viability of the occurrence. If private in-holdings are developed, the persistence of the plant association may likely be impacted if shallow surface flow or groundwater hydrology were altered.

References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

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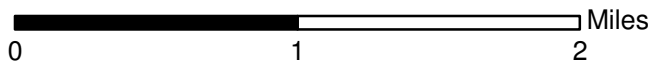
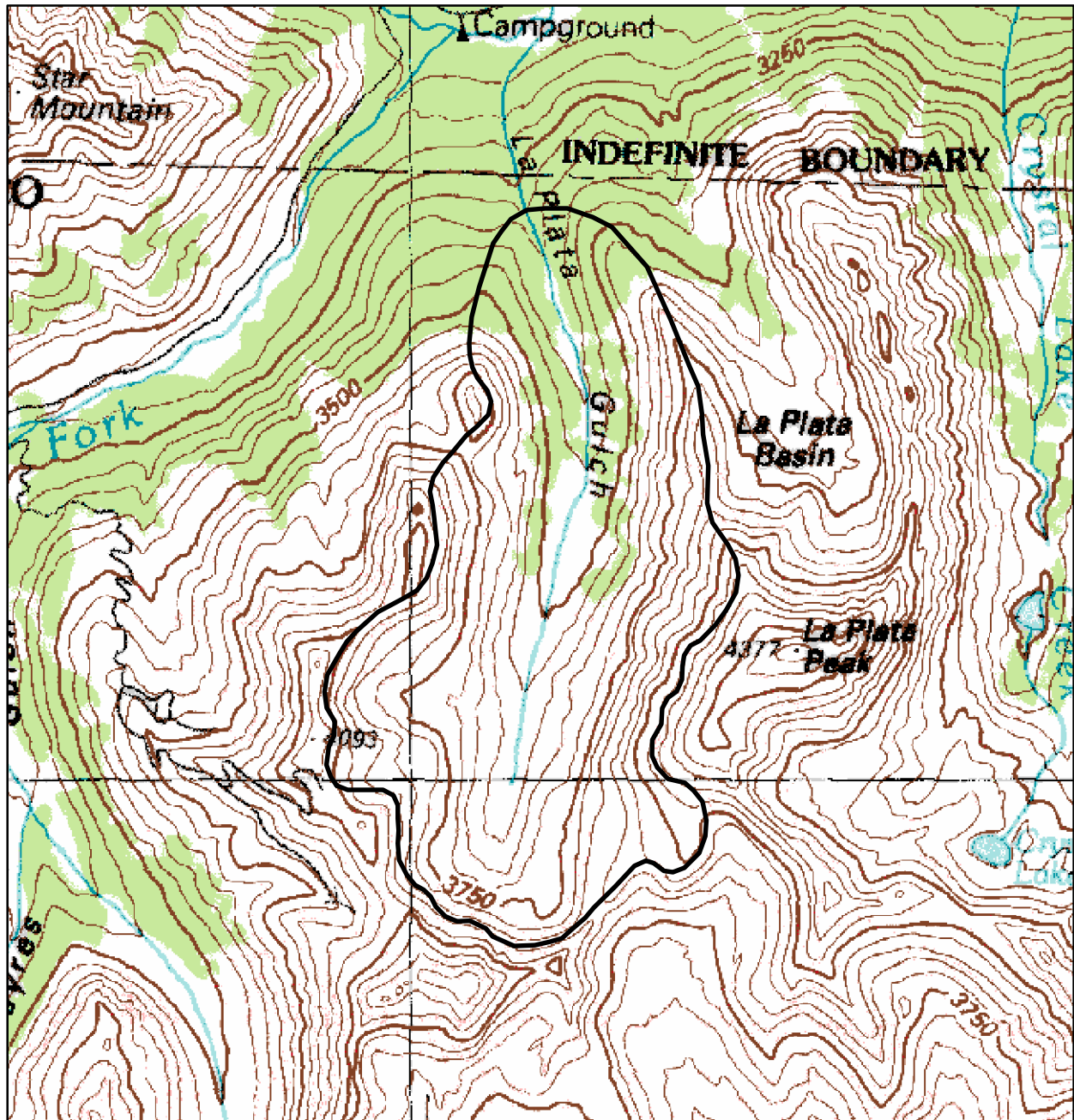
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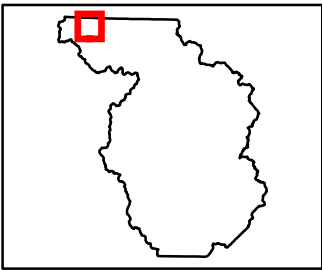
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Version Date: 04/17/2009



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La Plata Gulch Potential Conservation Area, B3: High Biodiversity Significance

Low Pass Gulch at Arkansas River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P?: Unknown

Management Urgency Rank - M?: Unknown

U.S.G.S. 7.5-minute quadrangles: Granite, South Peak

Size: 264 acres (107 ha)

General Description: Low Pass Gulch site contains a perennial stream that flows through it for about 5.5 miles down steep mountain slopes to the Arkansas River, one mile above Granite, and 13 road miles south of Leadville. There is a jeep trail running one-third of the way up the gulch and there has been heavy mining use of the area. The riparian corridor is dominated by Douglas-fir (*Pseudotsuga menziesii*) / blue spruce (*Picea pungens*) on the north-facing slope, and Geyer willow (*Salix geyeriana*) / mesic graminoid on the south-facing slope. The uplands on the south-facing slope are dominated by big sagebrush (*Artemisia tridentata*)

Biodiversity Significance Rank Comments (B3): Rank is based on good (B-ranked) occurrences of two globally rare plant communities, the globally vulnerable (G3/S3) *Salix geyeriana* / *Carex aquatilis* willow carr and the globally vulnerable (G3?/S2?) *Picea pungens* / *Equisetum arvense* montane riparian forest.

Natural Heritage element occurrences at the Low Pass Gulch at Arkansas River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> / <i>Carex aquatilis</i> Shrubland	Montane Willow Carr	G3	S3				B	1995-07-27
Natural Communities	<i>Picea pungens</i> / <i>Equisetum arvense</i> Woodland	Montane Riparian Forest	G3?	S2?				B	1995-07-27

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

Boundary Justification: The boundary encompasses the gulch and surrounding ridge tops for immediate watershed protection.

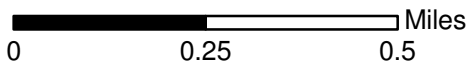
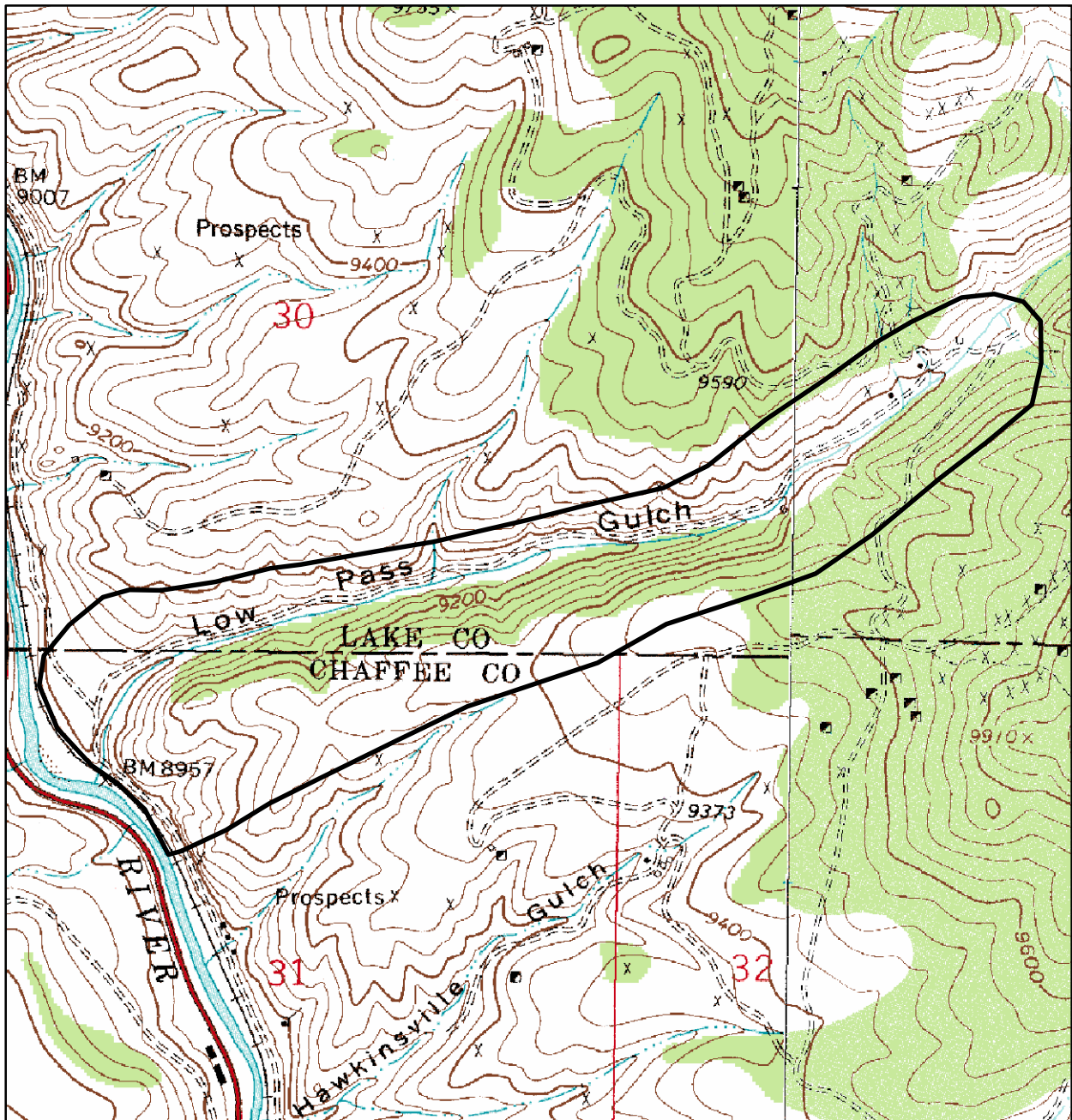
Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.


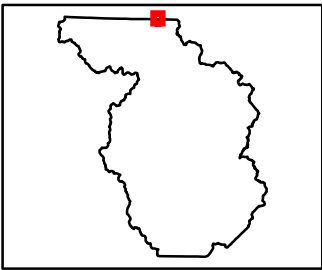
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Version Author: Kittel, G.M.

Version Date: 05/12/1997



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Low Pass Gulch at Arkansas River Potential Conservation Area, B3: High Biodiversity Significance

Maxwell Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Buena Vista East, Buena Vista West

Size: 2,195 acres (888 ha)

Elevation: 7,950 - 9,900 ft. (2,423 - 3,018 m)

General Description: Maxwell Creek begins on the northeast face of Mt. Princeton and flows intermittently through the upper montane elevation zone above the grassland park. Its flow is pushed up to the surface, likely by underlying bedrock layers, and emerges as a cluster of springs at approximately 8,000-8,500 ft in the middle of Maxwell Park, forming small oases in an otherwise dry grassland. There are several small areas where this hydrology occurs in the valley, but the Maxwell Creek expression is currently one of the largest known concentrations of seeps and springs in the area. The riparian corridor has a mosaic of riparian shrubland and wet meadow vegetation. Along much of the channel the riparian shrublands are dominated by willow (*Salix monticola*, *S. bebbiana*, etc.) and alder (*Alnus incana*) with an understory of wet meadow plant species. However, there is a series of streamside springs that emerge from the hillside north of the channel at approximately 8,000 ft in elevation. In this seepage area, the riparian corridor broadens. It has a greater diversity of shrub species and becomes dominated by river birch (*Betula occidentalis*). The understory here has high species diversity with a mix of graminoids and forbs, many of which are mineral seepage indicators like fowl mannagrass (*Glyceria striata*), speedwell (*Veronica catenata*), and yellow monkeyflower (*Mimulus guttatus*). Below the seepage area, the riparian shrubland reverts to the willow - alder expression that occurs upstream. There is also seepage that emerges from higher on the hillslope on the south side of Maxwell Creek in this vicinity. The slope wet meadow that results is dominated by sedges (*Carex aquatilis*, *C. nebrascensis*, and *C. utriculata*). To the north of Maxwell Creek is another cluster of springs not affiliated with the riparian corridor. These seeps and springs pump significant amounts of groundwater to the surface and have formed a fen (peatland) wetland complex, which is unusual at such a low elevation in this montane valley. There is a sizable quaking sedge mat that hovers over a black sandy clay layer in the soil profile. The bulk of the quaking sedge mat is comprised of water sedge (*Carex aquatilis*) and beaked sedge (*Carex utriculata*). However, in the wettest portions of the fen, where there are surface pools and watercourses, few-flowered spikerush (*Eleocharis quinqueflora*) and analogue sedge (*Carex simulata*) become prominent graminoids. In this wettest area is also a very large population of lesser bladderwort (*Utricularia minor*), a diminutive, carnivorous, aquatic plant that is thought to be an indicator of

water quality (Neid 2006). This is one of the largest known occurrences of lesser bladderwort in Colorado.

Climate Description: The area averages 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Land Use History: The primary land use on the site is cattle ranching; ranch roads cross the site to support these uses and access ranch residences.

Cultural Features: The area has very high values for wildlife and open space. The site is very scenic, surrounded in all directions by a rural landscapes set against the backdrop of the Collegiate Peaks. There is abundant local interest in seeing that the ranching values remain in the area. There is also interest in the historical aspects of the site, especially the ranching history as well as Native American and possibly prehistoric human history.

Biodiversity Significance Rank Comments (B3): This site supports an excellent to good (AB-ranked) occurrence of a globally vulnerable (G3/S2) montane riparian shrubland (*Betula occidentalis* / mesic graminoids) shrubland. It also supports a good (B-ranked) occurrence of a state imperiled (G4/S3) herbaceous plant community, the analogue sedge (*Carex simulata*), and an excellent (A-ranked) occurrence of the state imperiled (G5/S2) lesser bladderwort (*Utricularia minor*).

Natural Heritage element occurrences at the Maxwell Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Betula occidentalis</i> / Mesic Graminoids Shrubland	Lower Montane Riparian Shrublands	G3	S2				AB	2007-07-12
Natural Communities	<i>Carex simulata</i> Herbaceous Vegetation	Wet Meadow	G4	S3				B	2007-07-12
Vascular Plants	<i>Utricularia minor</i>	lesser bladderwort	G5	S2			USFS	A	2007-07-12

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

Boundary Justification: The boundary was drawn to include the elements and suitable habitat up and downstream of the occurrences. Hydrological processes that originate upstream of this site will need management to assure that the occurrences are protected in the long term.

Protection Urgency Rank Comments (P1): This property is a critical inholding between the State Land Board (State of Colorado) parcels in the Upper Arkansas River Valley. Other privately owned large ranches currently have no formal protection status and the area continues to be under heavy development pressure due to its proximity to Buena Vista and Salida.

Management Urgency Rank Comments (M4): There are no current management needs for the property as the current management seems to favor the persistence of biodiversity elements present. Management may be needed in the future to maintain the quality of the element occurrences given the development pressures in the surrounding area. Management issues at this site include a low abundance of invasive species, such as Canada thistle (*Cirsium arvense*). There is some Kentucky bluegrass (*Poa pratensis*) and Canada bluegrass (*Poa compressa*) in the wet meadows along the edge of the fen.

Exotic Species Comments: There is a low abundance of invasive species including Canada thistle (*Cirsium arvense*), Kentucky bluegrass (*Poa pratensis*) and Canada bluegrass (*Poa compressa*).

Information Needs: This site contains a unique wetland complex in the Upper Arkansas Valley. Further investigation of the hydrology, especially groundwater flow data and water chemistry, soil profile, and possible impeding bedrock layers would round out the entirety of the wetland story on the Kelly Ranch. Also, additional field visits to further characterize the extent of the wetland vegetation types will likely prove that they are larger than currently mapped. Faunal surveys of the property may elucidate further wetland resources.

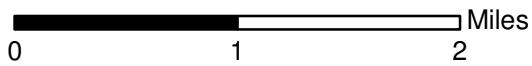
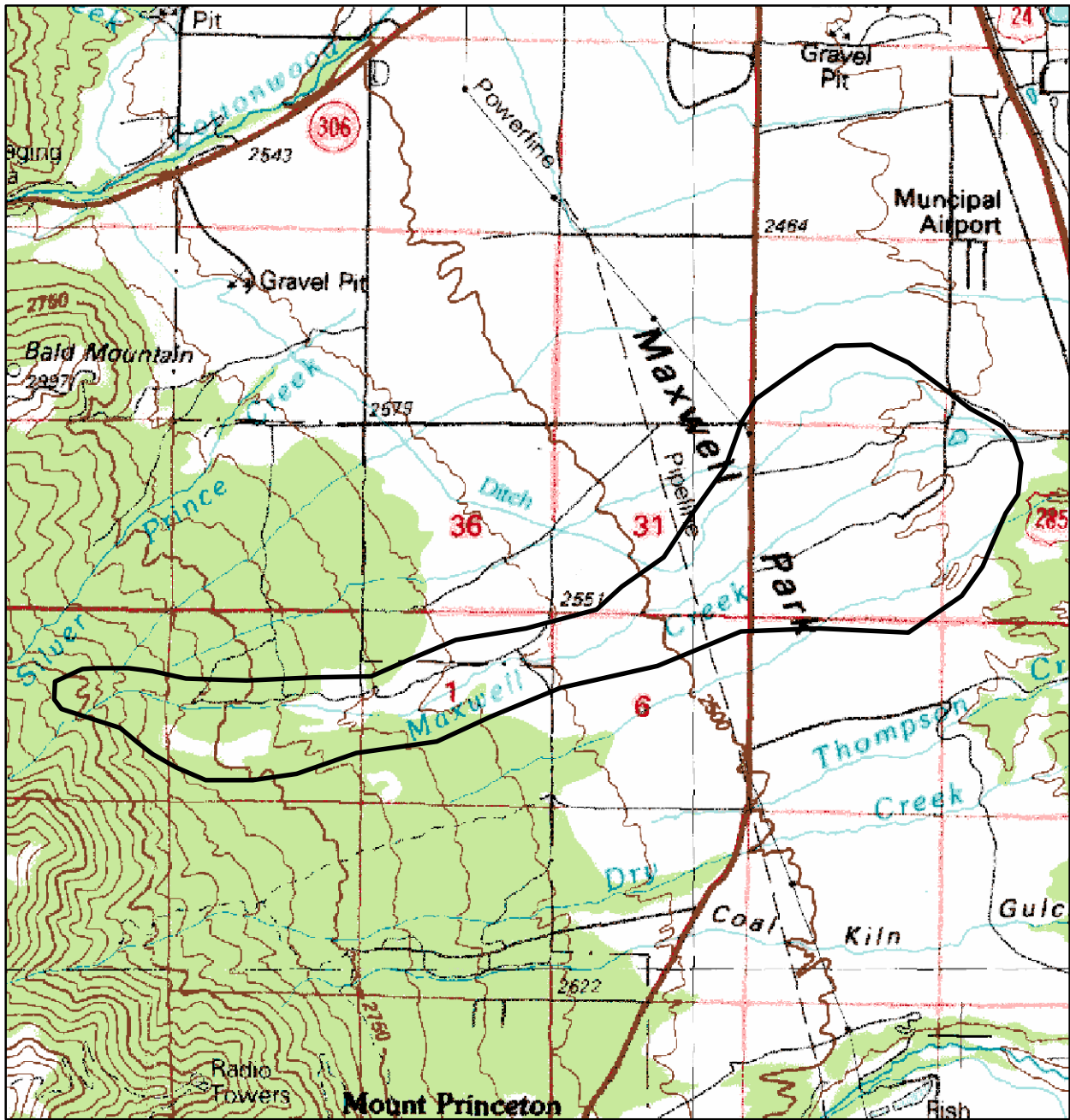
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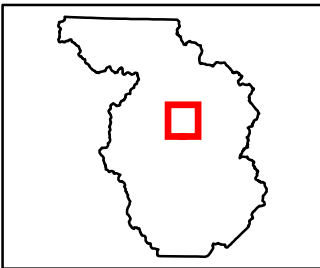
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Version Author: Handwerk, J.E.

Version Date: 03/10/2009



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Maxwell Creek Potential Conservation Area, B3: High Biodiversity Significance

Methodist Mountain

Biodiversity Rank - B3: 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: Wellsville, Poncha Pass

Size: 2,340 acres (947 ha) **Elevation:** 8,400 - 11,500 ft. (2,560 - 3,505 m)

General Description: The Methodist Mountain site is located on the north side of the Sangre de Cristo Range on the north face of Methodist Mountain. The dominant vegetation consists of ponderosa pine (*Pinus ponderosa*), pinon pine (*Pinus edulis*), and Douglas-fir (*Pseudotsuga menziesii*). Loggie Gulch is an ephemeral drainage that bisects the site. A Forest Service road parallels Loggie Gulch and then switchbacks to the top of Methodist Mountain. The Methodist Mountain road is a popular single track for summer recreation activities.

Climate Description: Average 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's and evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B3): The site supports an extant occurrence of the globally imperiled (G2/S2) Degener beardtongue (*Penstemon degeneri*) and an extant occurrence of the globally vulnerable (G3/S3) rock-loving neoparrya (*Aletes lithophilus*).

Natural Heritage element occurrences at the Methodist Mountain 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>Penstemon degeneri</i>	Degener beardtongue	G2	S2			BLM/ USFS	E	1999-08-18
Vascular Plants	<i>Aletes lithophilus</i>	rock - loving neoparrya	G3	S3			BLM/ USFS	E	1999-08-18

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

Boundary Justification: The boundary is drawn to encompass the rare plant populations and adjacent potential habitat.

Protection Urgency Rank Comments (P4): The site is owned and managed by San Isabel National Forest.

Management Urgency Rank Comments (M4): Impacts from mountain biking and hiking may need to be monitored.

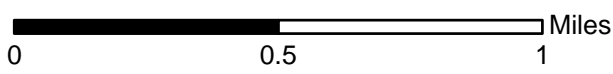
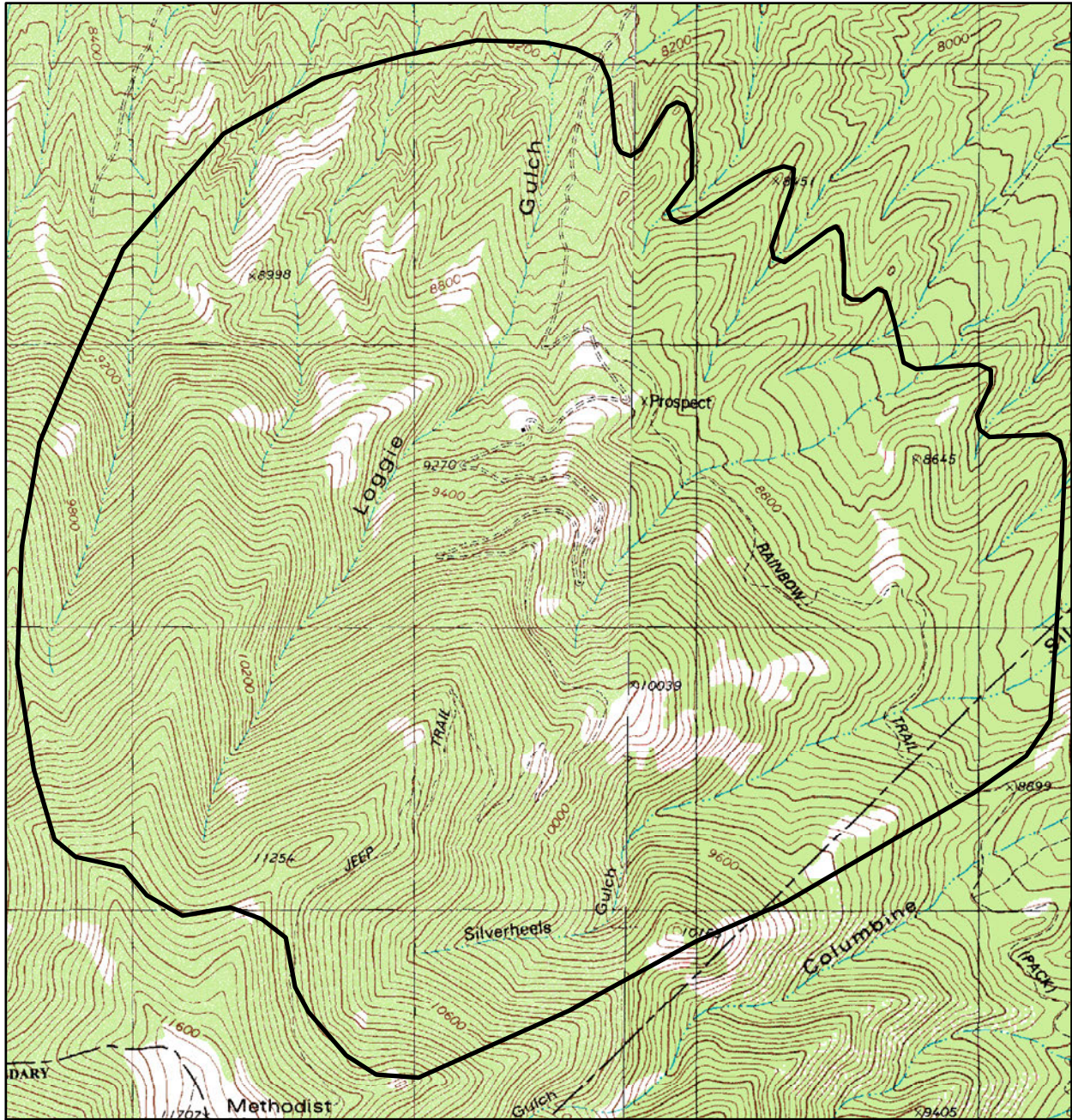
Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.


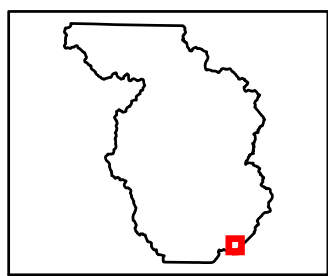
References

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Version Author: Culver, D.R.

Version Date: 01/20/2009



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Methodist Mountain Potential Conservation Area, B3: High Biodiversity Significance

Middle Clear Creek Canyon

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: Winfield, Mount Elbert, Granite, Mount Harvard

Size: 4,792 acres (1,939 ha)

Elevation: 8,959 - 10,068 ft. (2,731 - 3,069 m)

General Description: The site is along Clear Creek in riparian habitat that extends from the subalpine down into the montane life zone. Clear Creek drains a glacially carved valley on the eastern slope of the Sawatch Mountains and has its confluence with the Arkansas River approximately 2.5 miles below the town of Granite. The valley is steep-walled and north-south trending. Valley bottom topography alternates between narrow with a steep-gradient and wider openings with a gently sloping gradient. Stream channel and riparian habitat characteristics vary with valley bottom topography. Narrow reaches of the valley are typically drained by a steep-gradient, Rosgen type "B" (Rosgen 1996) stream with low sinuosity and a narrow riparian zone. Wider valley openings characteristically have a low-gradient, Rosgen type "C" or "E" (Rosgen 1996) stream and channel with high sinuosity and a broad riparian zone. In these wider valley openings beaver (*Castor canadensis*) activity is prolific. Soils vary from well to poorly drained and are derived mainly from valley alluvium. Valley bottom geology is glacial drift from the Pinedale and Bull Lake glaciation that occurred during the Pleistocene; upland geology is Precambrian granitic rock of 1700 M.Y. and, in upstream reaches Laramide intrusive rocks of 40-72(?) M.Y. with mainly intermediate to felsic compositions (Tweto 1979). Riparian habitat is characterized by a linear mosaic of plant communities in various stages of succession. Steep, narrow valley reaches with cold air drainage and limited sunlight are characterized by evergreen riparian forests interspersed with patches of riparian shrubs. Conifer forests are dominated by the blue spruce / thinleaf alder (*Picea pungens* / *Alnus incana*) association. Other trees include aspen (*Populus tremuloides*), Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*). Although thinleaf alder dominates the upper shrub canopy other shrubs are common in the lower two layers and include Drummond's willow (*Salix drummondiana*), twinberry honeysuckle (*Lonicera involucrata*), mountain gooseberry (*Ribes inerme*), and golden currant (*Ribes aureum*). Herbaceous cover is characterized by a diverse mix of forbs and graminoids. Forbs include heartleaf bittercress (*Cardamine cordifolia*), tall fringed bluebells (*Mertensia ciliata*), and cow parsnip (*Heracleum maximum*). Graminoids include subalpine rush (*Juncus mertensianus*), bluejoint reedgrass (*Calamagrostis canadensis*), and water sedge (*Carex aquatilis*). Shrublands in these steeper reaches are characterized by a dense cover of the

thinleaf alder / Drummond's willow plant association which occurs on the margins of the stream and within the active floodplain. Drummond's willow dominate the tall, closed-canopy but other shrub species are also present including narrowleaf cottonwood (*Populus angustifolia*) saplings, mountain willow (*Salix monticola*), coyote willow (*Salix exigua*), twinberry honeysuckle, and mountain gooseberry. Herbaceous cover includes forbs and graminoids and varies with soil characteristics and canopy cover. Common forbs in stands with developed soils include heartleaf bittercress, geranium (*Geranium richardsonii*) and monkshood (*Aconitum columbianum*). Typical graminoids include woodrush (*Luzula parviflora*), arctic rush (*Juncus balticus*) and field horsetail (*Equisetum arvense*). Further away from the stream, behind the alder - willow band and at the outer periphery of the riparian zone the plant community is characterized by a mixed conifer - deciduous tree canopy of aspen, blue spruce and narrowleaf cottonwood. Riparian habitat in wide valley openings is a mosaic of deciduous woodlands, willow shrublands, wet herbaceous meadows and open water ponds. Beaver (*Castor canadensis*) activity is prolific in the shrubland and meadow ecosystems and is often closely associated with the plant community occurrences. Deciduous woodlands, dominated by narrowleaf cottonwood, occur along stream banks or the periphery of the willow shrublands. Wide expanses of willow shrublands characterize the low-gradient valley openings. Willow species in these shrublands are dominated by the mountain willow and Geyer willow (*Salix geyeriana*) but other shrubs are also common including Drummond's and planeleaf willow (*Salix planifolia*), shrubby cinquefoil (*Dasiphora floribunda*), and mountain gooseberry. Herbaceous cover is a lush and diverse patchy mosaic of forbs and graminoids that varies with environmental factors such as soil characteristics and canopy cover. Common graminoids include beaked sedge, water sedge, bluejoint reedgrass smallwing sedge (*Carex microptera*), ebony sedge (*Carex ebenea*), cliff sedge (*Carex scopulorum*), swordleaf rush (*Juncus ensifolius*), subalpine rush, longstyle rush (*Juncus longistylus*) and common spikerush (*Eleocharis palustris*). Common forbs include Elephant heads (*Pedicularis groenlandica*), blue-eyed grass (*Sisyrinchium montanum*), shooting-star (*Dodecatheon pulchellum*), monkshood, king's crown (*Rhodiola integrifolia*), broad-lipped twayblade (*Listera convallarioides*) and northern bog-orchid (*Limnorchis hyperborea*). A variety of plant communities provides the diversity of resources that has enabled an abundant and species rich riparian bird community. Commonly observed birds include Lincoln's Sparrow, Swainson's Thrush, Cordilleran Flycatcher, Cedar Waxwing, Townsend's Solitaire, MacGillivray's Warbler, Warbling Vireo, Dark-eyed Junco, Ruby-crowned Kinglet, Tree Swallow, White-crowned Sparrow, and Red-naped Sapsucker. Additionally, boreal toads (*Bufo boreas*) have been observed in the site, but breeding in the area has not been confirmed. Upland plant communities adjacent to upstream reaches on north-facing slopes are characterized by spruce - fir (*Picea engelmannii* - *Abies lasiocarpa*) forests and on south-facing slopes by a mosaic of aspen and lodgepole pine woodlands and spruce - fir forests. Upland plant communities adjacent to downstream reaches on south-facing slopes are characterized by sage (*Artemisia tridentata*) shrublands with scattered stands of Douglas-fir (*Pseudotsuga menziesii*).

North-facing upland slopes are characterized by a mosaic of Douglas-fir forests, sage shrublands and aspen (*Populus tremuloides*) woodlands.

Key Environmental Factors: Driving factors that exert a major influence on biota at the site include hydrology and soil.

Climate Description: Climate records for Independence Pass, which is approximately 12 miles to the northwest and on the Continental Divide, indicate a mean annual precipitation of 29.82 inches; the wettest months are January and March with a mean precipitation of 3.51 inches and 3.97 inches per month respectively; the driest months are June and September with a mean precipitation of 1.11 inches and 1.70 inches per month respectively; the warmest month is July with a mean temperature of 51.9 deg F and the coldest month is January at 12.7 deg F. Average annual snowfall is 335.9 inches with January and March having the greatest monthly snowfall with a mean of 50.1 inches and 58.8 inches respectively (Western Regional Climate Center 2009).

Land Use History: Hardrock mining and ranching was historically common in the upper stream reaches.

Cultural Features: Mining ghost town of Winfield.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) *Picea pungens* / *Alnus incana* montane riparian forest, a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix geyeriana* - *Salix monticola* / mesic forbs shrubland, a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix monticola* / *Carex utriculata* montane riparian willow carr, and a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Alnus incana* - *Salix drummondiana* montane riparian shrubland.

Natural Heritage element occurrences at the Middle Clear Creek Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Alnus incana - Salix drummondiana Shrubland	Montane Riparian Shrubland	G3	S3				B	2008-07-15
Natural Communities	Picea pungens / Alnus incana Woodland	Montane Riparian Forests	G3	S3				A	2008-07-15
Natural Communities	Salix geyeriana - Salix monticola / Mesic Forbs Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				B	2008-07-16
Natural Communities	Salix monticola / Carex utriculata Shrubland	Montane Riparian Willow Carr	G3	S3				B	2008-07-16

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

Boundary Justification: This site includes approximately four miles of good to excellent quality riparian habitat that supports four plant communities of concern. A buffer was included on each side of the stream to help maintain the natural hydrologic regime, especially annual episodic flooding, and to protect the plant communities from direct disturbances such as road maintenance, recreational trampling, and development. Although not designed for this subspecies, one adult boreal toad was documented within the site in 2005. No breeding occurrences have been noted but potential breeding habitat does exist.

Protection Urgency Rank Comments (P3): Riparian and upland habitats to the north of the stream are managed by the USFS and to the south are mostly protected by Wilderness designation. Several mining claims occur in the upper mile of the site and riparian habitat on the lower 1/2 mile is privately owned and was historically ranched. Currently much of this property is managed for conservation values. Historic mine sites and mining-related impacts include roads, and mine shacks that have been renovated and are now used as recreation sites. A dirt road parallels the stream resulting in hydrologic alteration and excess sedimentation from runoff. Also, in those areas where the road is in close proximity to the stream channelization where downcutting and excessive bank erosion occur, water quality is degraded by road runoff and sedimentation. Other road-related impacts include invasion of non-native weeds and vegetation trampling and physical damage to vegetation due to numerous social trails, car pullouts and bandit campsites that emanate from the road. Additionally, several social trails, which initiate at the Missouri Gulch trailhead, traverse through riparian habitat and result in vegetation trampling.

Management Urgency Rank Comments (M3): Riparian plant communities and

stream habitat would benefit by the closing and revegetation of social trails, bandit campsites and automobile pullouts that encroach into riparian habitat. Riparian and stream habitat would also benefit by road management that included strategies to minimize hydrologic alteration and sedimentation. Although disease is the primary causative agent for toad decline, most habitat alterations from timber harvest, grazing, recreation, and water development would likely not be beneficial to long-term enhancement of boreal toad habitat (CDOW 2009). Conversely, protection of lentic, intermittent water that creates marshes, wet meadows, and intermittent wetlands that form much of the primary habitat for this species would benefit the toad.

Information Needs: If breeding occurrences of the boreal toad are found, this could increase the biodiversity significance of this site.

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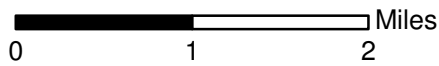
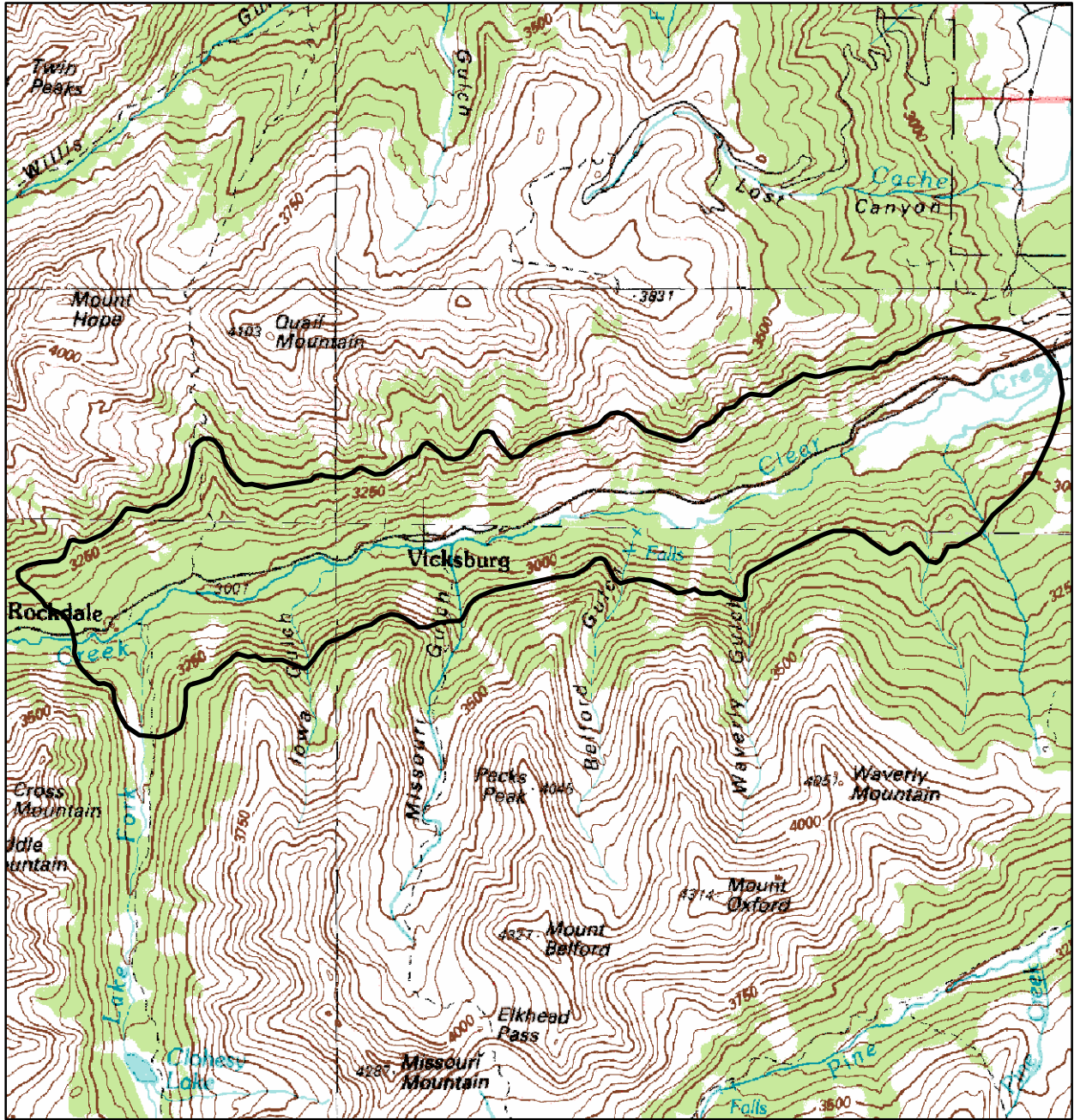
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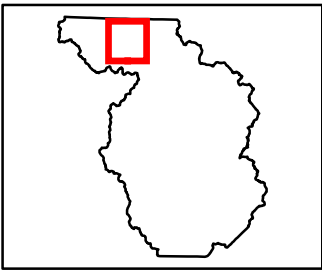
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Version Author: Malone, D.G.

Version Date: 04/01/2009



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 04/04/2009</p>	<p>Legend</p> <p> PCA Boundary</p> <p>Gunnison, 38106-E1 Leadville, 39106-A1</p> <p>30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey</p>	<p>Location in Chaffee County</p> 
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Middle Clear Creek Canyon Potential Conservation Area, B3: High Biodiversity Significance

Missouri Mountain Complex

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

U.S.G.S. 7.5-minute quadrangles: Winfield, Mount Harvard

Size: 2,911 acres (1,178 ha)

Elevation: 12,500 - 14,197 ft. (3,810 - 4,327 m)

General Description: The Missouri Mountain Complex site is located in the northern Sawatch Range (Collegiate Peaks) northwest of Buena Vista. Missouri Mountain (14,067 ft.), Mount Belford (14,197 ft.) and Mount Oxford (14,153 ft.) are located between Clear Creek to the north and Pine Creek to the south. Elkhead Pass separates Missouri Mountain from Mounts Belford and Oxford. The Sawatch Range is composed primarily of coarse schists and gneisses intruded by Precambrian granites and of metamorphosed limestone and quartzite. The northern portion is primarily Precambrian gneiss and schist (Chronic and Williams 2002). The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 60's to low 70's with evening temperatures in the high 30's and low 40's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Cultural Features: Mount Belford was named for Territorial Judge James B. Belford, the first Colorado member of the U.S. House of Representative. Mount Oxford is a member of the Collegiate Peaks named by John Hart (Bright 2004).

Biodiversity Significance Rank Comments (B3): This site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) thick-leaf whitlow-grass (*Draba crassa*), and an excellent (A-ranked) occurrence of the globally vulnerable (G3G4/S1) woolly fleabane (*Erigeron lanatus*). Additional species include a fair to poor (CD-ranked) occurrence of the globally imperiled (G2/S2) Gray's Peak whitlow-grass (*Draba grayana*), a Colorado endemic, the state rare (G4G5/S2) tundra buttercup (*Ranunculus gelidus* ssp. *grayi*) and the state rare (G5/S2) dwarf hawksbeard (*Askellia nana*). The majority of these species are circumpolar, occurring

only in Colorado's alpine zone.

Natural Heritage element occurrences at the Missouri Mountain Complex 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>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			USFS	CD	2005-07-27
Vascular Plants	<i>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				A	2001-08-05
Vascular Plants	<i>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				H	1983-07-23
Vascular Plants	<i>Erigeron lanatus</i>	woolly fleabane	G3G4	S1				A	1994-07-27
Vascular Plants	<i>Erigeron lanatus</i>	woolly fleabane	G3G4	S1				E	2005-07-27
Vascular Plants	<i>Ranunculus gelidus</i> ssp. <i>grayi</i>	tundra buttercup	G4G5	S2			USFS	E	2006-06-19
Vascular Plants	<i>Askellia nana</i>	dwarf hawksbeard	G5	S2				A	1994-07-27

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

Boundary Justification: The site is drawn to protect the element occurrences from direct impacts such as trampling or other surface disturbances. A buffer is drawn to provide plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P5): The site is within the Collegiate Peaks Wilderness Area in the San Isabel National Forest.

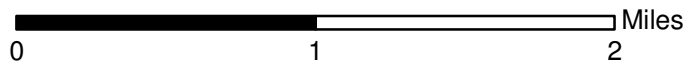
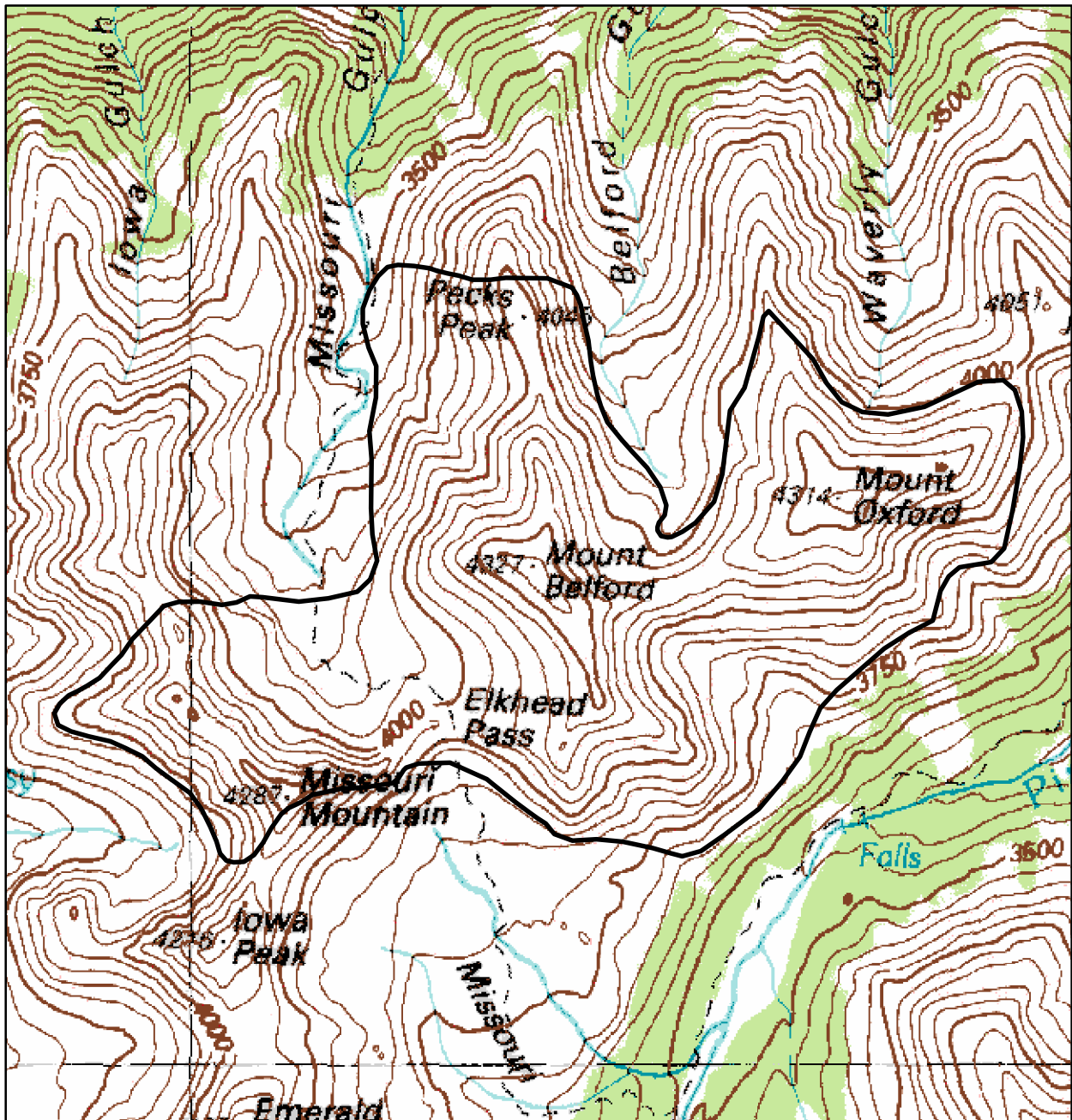
Management Urgency Rank Comments (M3): This area receives a high concentration of hikers and social trails could threaten some individuals. Trail designation and signs directing one to this trail are needed. Collection of rare alpine plants is also a concern.


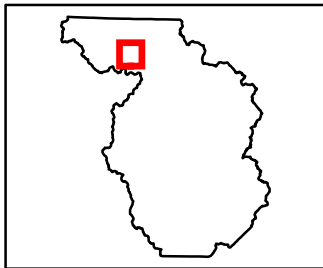
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- Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 02/13/2009



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Missouri Mountain Complex Potential Conservation Area, B3: High Biodiversity Significance

Monarch Pass

Biodiversity Rank - B3: 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: Garfield, Pahlone Peak

Size: 1,292 acres (523 ha)

Elevation: 11,000 - 11,900 ft. (3,353 - 3,627 m)

General Description: Monarch Pass is located on the Continental Divide at the southern end of the Sawatch Range along the border between Gunnison and Chaffee counties. The pass carries U.S. Highway 50 over the Sawatch Range, providing a route between Tomichi Creek in the upper basin of the Gunnison River on the west and the South Arkansas River, a tributary of the Arkansas River on the east. This site is used heavily for recreation activities such as downhill and backcountry skiing, hiking, and mountain biking. The vegetation is dominated by Engelmann spruce (*Picea engelmannii*) and grouse whortleberry (*Vaccinium* sp.) with granitic outcrops and scree slopes.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 60's to low 70's with evening temperatures in the high 30's and low 40's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Cultural Features: Monarch Pass construction, part of the Rainbow Highway project, was started in July 1919. During this highway work, a campground complete with ovens and shelter houses was built at Monarch Park in 1920, and the new Monarch Pass was opened for auto travel in September 1921 with a celebration and dedication at Monarch Park. This 22-mile road was reported to cost about \$10,000 per mile. The 1919 pathway taken over the Divide is today known as Old Monarch Pass, a pleasant gravel road in the summer and a favorite cross-country ski route in the winter (Bright 2004).

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S3) reflected moonwort (*Botrychium echo*), an extant occurrence of the globally vulnerable (G3/S3) Colorado Divide whitlow-grass (*Draba streptobrachia*) and an extant occurrence of the state imperiled (G5/S1) least moonwort (*Botrychium simplex*).

Natural Heritage element occurrences at the Monarch Pass 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	Botrychium echo	reflected moonwort	G3	S3				B	2005-08-08
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				E	2000-07-10
Vascular Plants	Botrychium simplex	least moonwort	G5	S1				E	2004-08-16

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

Boundary Justification: The boundary is drawn to include the occurrences and a buffer against direct disturbance. The natural processes are not completely contained within the boundary, and off-site activities within the larger area have the potential to impact the rare plant populations.

Protection Urgency Rank Comments (P3): The site is owned by San Isabel National Forest, however a portion is leased to Monarch Ski Area.

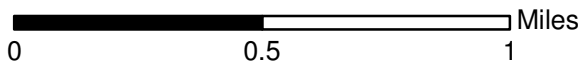
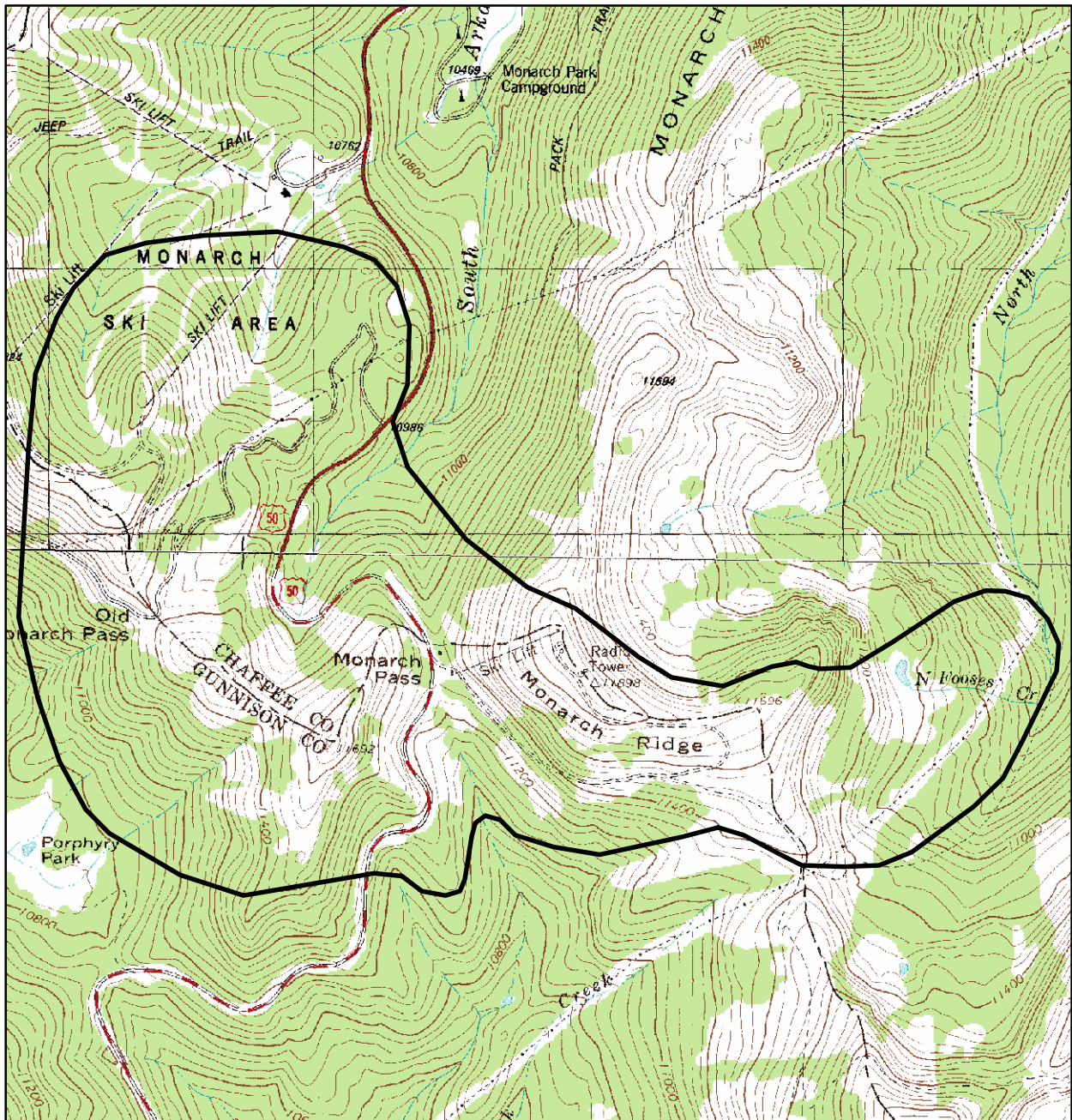
Management Urgency Rank Comments (M4): Monitor the impacts of recreation activities.


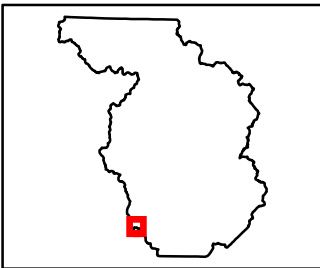
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Version Author: Culver, D.R.

Version Date: 01/20/2009



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Monarch Pass Potential Conservation Area, B3: High Biodiversity Significance

Mount Shavano

Biodiversity Rank - B3: 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: Mount Antero, Maysville

Size: 411 acres (166 ha)

Elevation: 12,500 - 14,229 ft. (3,810 - 4,337 m)

General Description: The Mount Shavano site is located in the southern Sawatch Range (Collegiate Peaks) west of Salida. The Sawatch Range is composed primarily of coarse schists and gneisses intruded by Precambrian granites and of metamorphosed limestone and quartzite (Chronic and Williams 2002). The southern portion of the Sawatch Range, Mounts Princeton, Shavano and Antero, are part of a much younger intrusion that melted and pushed in here as molten magma in early Tertiary time. Chalk Creek separates Mount Shavano from Mount Princeton. Mount Shavano is named for Chief Shavano of the Tabeguache band of Ute Indians. A legendary "snow angel" or Angel of Shavano emerges on the east face of the mountain during snow melt each spring. The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Key Environmental Factors: Typical subalpine to alpine climate with intense solar exposure and dry with desiccating winds.

Biodiversity Significance Rank Comments (B3): The site supports a fair (C-ranked) occurrence of the globally imperiled (G2/S2) and Colorado endemic, Gray's Peak whitlow-grass (*Draba grayana*), and a fair to poor (CD-ranked) occurrence of the state rare (G4/S2S3) plant, arctic draba (*Draba fladnizensis*).

Natural Heritage element occurrences at the Mount Shavano 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	Draba grayana	Gray's Peak whitlow - grass	G2	S2			USFS	C	2005-07-19
Vascular Plants	Draba fladnizensis	arctic draba	G4	S2S3				CD	2005-07-19

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

Boundary Justification: The site is drawn to protect occurrences from direct impacts such as trampling or other surface disturbances. A buffer is included to provide plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P4): This site is located on FS land and the FS is aware of its presence.

Management Urgency Rank Comments (M4): Although not currently threatened, management may be needed to maintain current quality of element occurrences. High recreational use exists, an established trail would minimize impact.

Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.

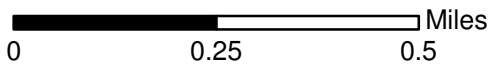
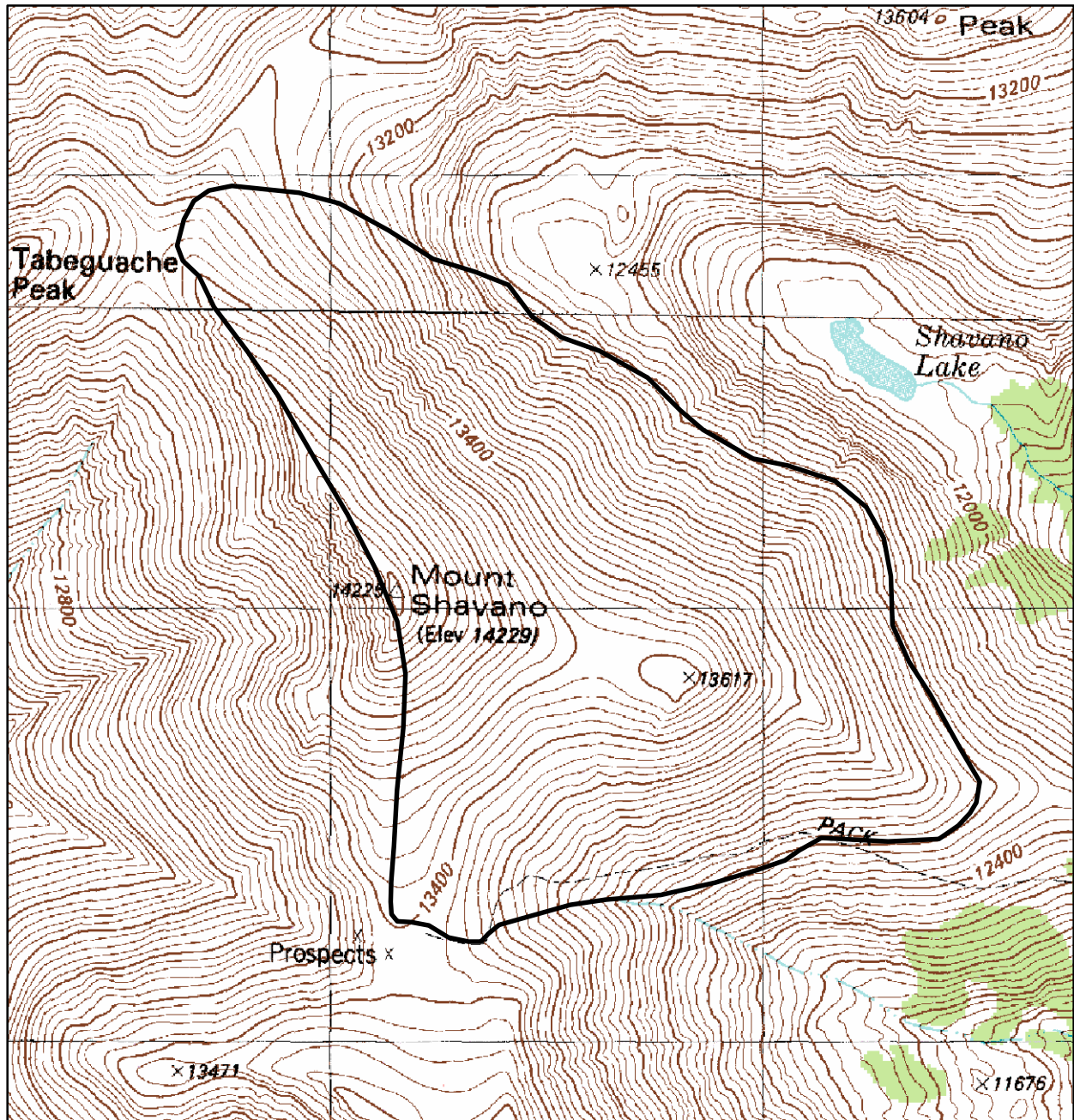
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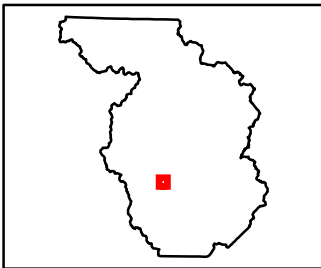
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Version Author: Culver, D.R.

Version Date: 01/13/2009



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Mount Shavano Potential Conservation Area, B3: High Biodiversity Significance

Mount Yale

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

U.S.G.S. 7.5-minute quadrangles: Mount Yale

Size: 1,398 acres (566 ha)

Elevation: 12,200 - 14,196 ft. (3,719 - 4,327 m)

General Description: Mount Yale site is located within the Collegiate Peaks of the Sawatch Range. Mount Yale, at 14,196 ft., is one of nine fourteeners in the Collegiate Peaks. From Mount Yale north, peaks of the Sawatch Range are composed of Precambrian gneiss and schist derived from ancient sedimentary and volcanic rocks deposited along the continent's margin about 1.8 billion years ago (Chronic and Williams 2002). The soils are shallow and rocky. The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that are known to utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Land Use History: The Mount Yale trail is a very popular hike for mountaineers.

Cultural Features: Mount Yale was first climbed by a research team from Harvard University led by Josiah Whitney. The group named the taller Mount Harvard (14,420 ft) after their own university and the shorter Mount Yale after Whitney's alma mater. Due to the similarity in heights of Mount Princeton and Mount Yale (Mount Princeton is 1 foot higher), it was once a tradition for the alumni of each school to carry rocks to the top of their respective mountain in order to add to the stone pyramid built at the summit. The graduates used these rock towers to ensure their mountain was the tallest (Bright 2004).

Biodiversity Significance Rank Comments (B3): This alpine site supports a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Colorado endemic Gray's Peak whitlow-grass (*Draba grayana*) and an extant occurrence of the globally vulnerable (G3/S3) thick-leaf whitlow-grass (*Draba crassa*).

Natural Heritage element occurrences at the Mount Yale 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>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			USFS	C	2005-07-17
Vascular Plants	<i>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				E	2005-07-17

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

Boundary Justification: The boundaries are drawn to encompass the rare plant populations and potential habitat on Mount Yale.

Protection Urgency Rank Comments (P5): The site is owned and managed by San Isabel National Forest and is located in the Collegiate Peaks Wilderness.

Management Urgency Rank Comments (M4): Management may be needed in the future to monitor impacts from mountaineering trails.

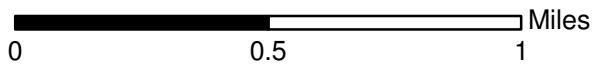
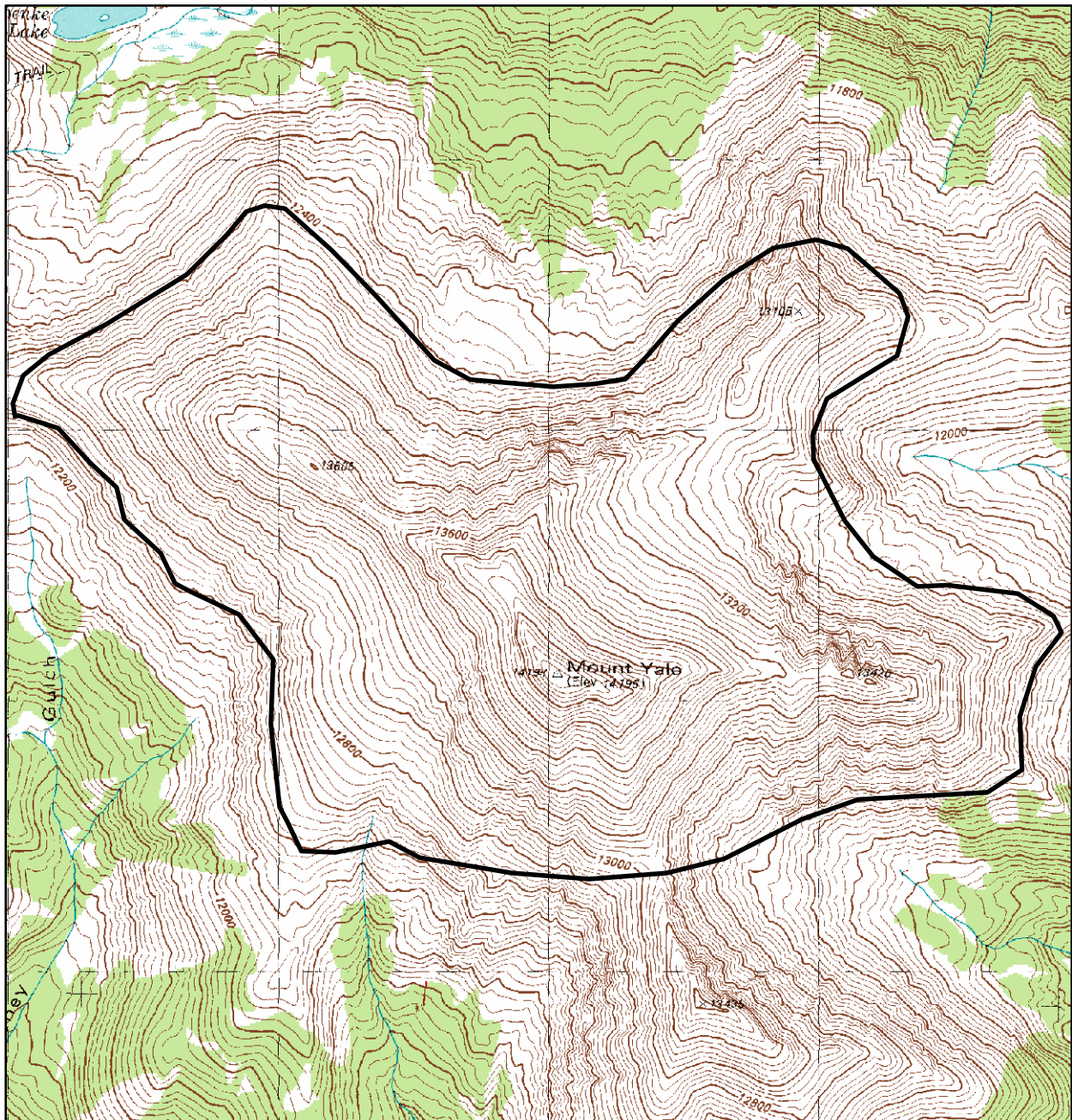
Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.


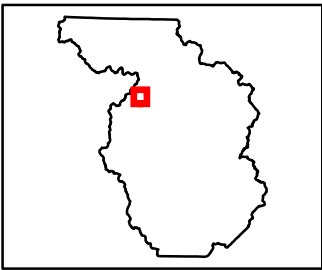
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Version Date: 01/16/2009



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Mount Yale Potential Conservation Area, B3: High Biodiversity Significance

Mounts Harvard and Columbia

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

U.S.G.S. 7.5-minute quadrangles: Mount Harvard

Size: 3,123 acres (1,264 ha)

Elevation: 12,500 - 14,420 ft. (3,810 - 4,395 m)

General Description: The Mounts Harvard and Columbia site is located in the Sawatch Range (Collegiate Peaks) northwest of Buena Vista. Pine Creek separates Mount Harvard from Mount Oxford. Mount Harvard at 14,420 ft., is the highest peak in Chaffee County and the third highest in Colorado. It was named in 1864 by a Harvard College geologist. Mount Columbia at 14,073 ft., was named in 1919 by Roger Toll of the Colorado Mountain Club when he found an unnamed peak and named it after his alma mater (Bright 2004). The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Colorado wild buckwheat (*Eriogonum coloradense*) was collected on Mt. Harvard in 1896 by F.E. Clements, but it has not been observed again since that time. Animals that utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Biodiversity Significance Rank Comments (B3): The site encompasses two globally vulnerable (G3) whitlow grasses; thick-leaf (*Draba crassa*) and Colorado Divide (*Draba streptobrachia*), both are uncommon and occur only in Colorado in the alpine. The thick-leaf whitlow-grass occurrence is in good (B-ranked) condition and is driving the biodiversity rank of the site. Two occurrences of the state rare (G5/S2) dwarf hawksbeard (*Askellia nana*), one in good (B-ranked) condition and one in poor (D-ranked) condition, are also within the site. The dwarf hawksbeard is a circumpolar species that occurs in Colorado only within the alpine zone.

Natural Heritage element occurrences at the Mounts Harvard and Columbia 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>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				B	1994-08-03
Vascular Plants	<i>Draba streptobrachia</i>	Colorado Divide whitlow - grass	G3	S3				E	2000-07-13
Vascular Plants	<i>Askellia nana</i>	dwarf hawksbeard	G5	S2				B	1994-08-02
Vascular Plants	<i>Askellia nana</i>	dwarf hawksbeard	G5	S2				D	1994-08-03

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

Boundary Justification: The site encompasses both peaks and alpine habitat. The boundaries are drawn to protect rare plants and the ecological processes from direct impacts such as trampling or other surface disturbances. A buffer is drawn to provide plants with suitable habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P5): This site is within the Collegiate Peaks Wilderness Area in the San Isabel National Forest.

Management Urgency Rank Comments (M4): Naturally disturbed area. An established trail may protect occurrences from hiker impacts. Heavy recreational use, hikers and some horse use. No active grazing allotments.

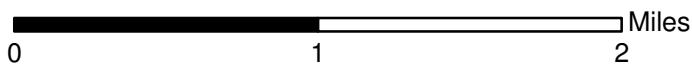
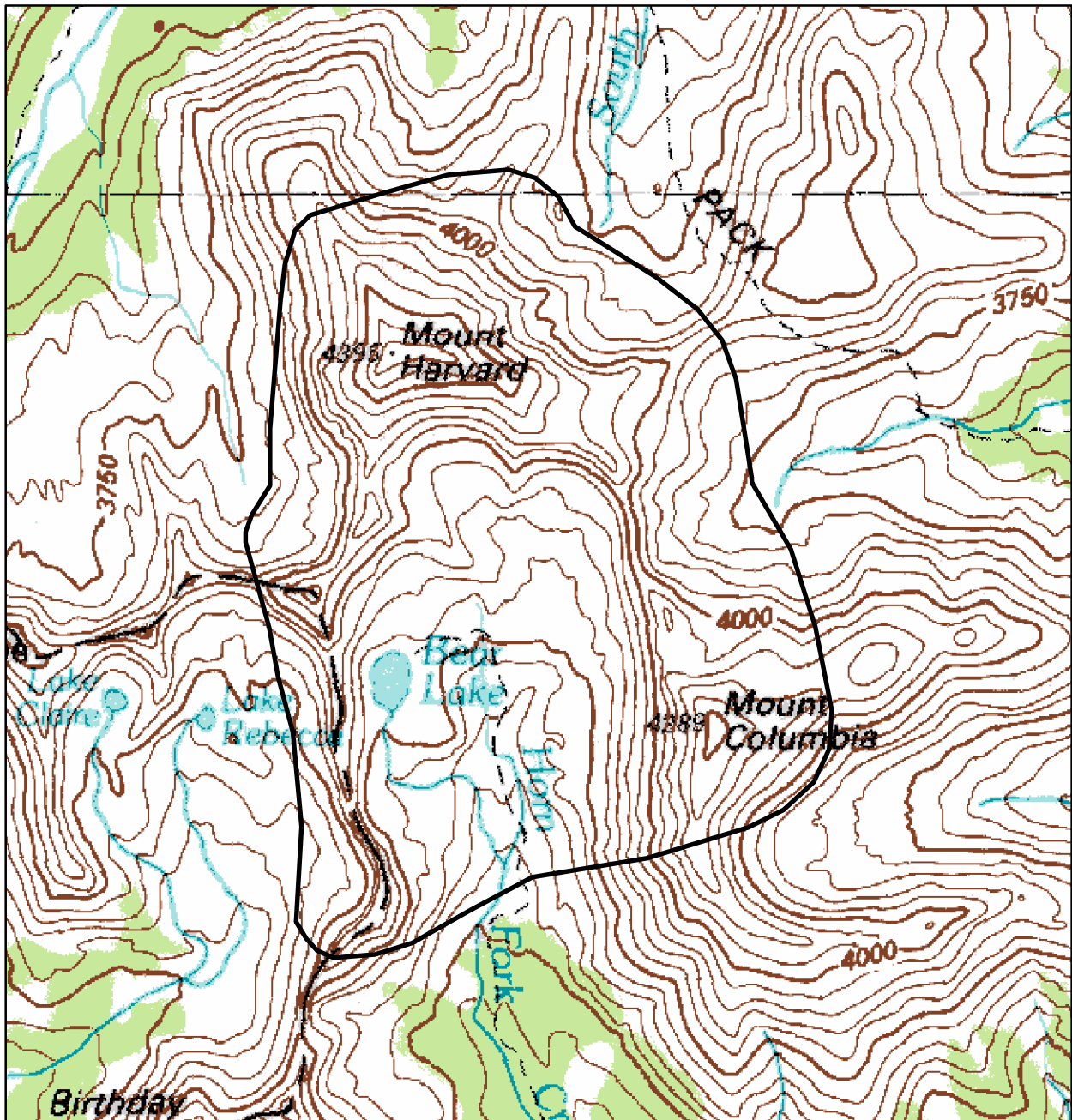
Information Needs: This site and element occurrences were not visited during the 2008 county survey and need to be updated.


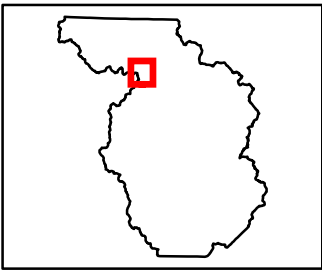
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Version Author: Culver, D.R.

Version Date: 01/13/2009



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 02/13/2009</p>	<p>Legend</p> <p> PCA Boundary</p> <p>Gunnison, 38106-E1</p> <p>30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey</p>	<p>Location in Chaffee County</p> 
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Mounts Harvard and Columbia Potential Conservation Area, B3: High Biodiversity Significance

Red Deer and Mercury Creeks

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: Mount Yale, Buena Vista West

Size: 3,394 acres (1,373 ha)

Elevation: 8,400 - 11,960 ft. (2,560 - 3,645 m)

General Description: The site is located in the montane zone on the east slope of the Sawatch Mountain Range. Both creeks flow eastward. Red Deer Creek has its confluence with North Cottonwood Creek on the valley floor approximately three miles west of the city of Buena Vista. Mercury Creek is diverted into an irrigation ditch upon reaching the valley floor approximately 0.5 miles before reaching its confluence with North Cottonwood Creek. Here, the Sawatch Mountains rise steeply from the valley floor. Red Deer Creek begins near the top of a ridge as a first order stream and flows eastward in a very narrow, steep ravine soon becoming a second order stream as several streams coalesce. Mercury Creek begins near the top of a ridge as a first order stream and flows eastward in a very narrow, steep ravine, remaining a first order stream over its' entire length. The streams drain steep hillslopes in this basin-shaped sub-watershed before flowing onto the valley floor. Geology of the southern flanks of the sub-watershed from the ridge top down to approximately 8,400 ft are Middle Tertiary intrusive rocks (age 20-40 M.Y.) with intermediate to felsic compositions; below 8,400 ft down onto the valley floor the rocks are Quaternary age gravels and alluviums from the Pinedale and Bull Lake glaciations. Geology of the northern half of the sub-watershed from the top of the ridge down to approximately 9,000 ft is biotitic gneiss, schist and migmatite that is derived principally from sedimentary rocks of Precambrian age; from approximately 9,100 ft down to 8,400 ft substrate is unconsolidated surficial deposits and rocks of Quaternary age that are older gravels and alluviums (pre-Bull Lake); and below 8,400 ft down onto the valley floor rocks are Pinedale and Bull Lake age gravels and alluviums (Tweto 1979). Riparian plant communities vary with elevation along this steep gradient (20% to 30%) stream but are typically narrow bands of vegetation lining the ravine. In the subalpine zone, above approximately 10,000 ft, riparian habitat is characterized by spruce - fir (*Picea engelmannii* - *Abies lasiocarpa*) forests with a shrub understory characterized by a diversity of shrubs including thinleaf alder (*Alnus incana*), mountain maple (*Acer glabrum*) and red-osier dogwood (*Cornus sericea*) and an herbaceous layer dominated by forbs such as tall-fringed bluebells (*Mertensia ciliata*), monkshood (*Columbianum aconitum*) and triangular-leaf senecio (*Senecio triangularis*). Between 9,000 ft and 10,200 ft, riparian habitat is characterized by an association of aspen (*Populus tremuloides*) with thinleaf alder. Several conifer species, including subalpine fir and Engelmann spruce, also occur in the tree canopy

but aspen is clearly the dominant along the streambanks. Thinleaf alder dominates the shrub canopy but other common shrubs include Rocky Mountain maple, red-osier dogwood, Drummond's willow (*Salix drummondiana*), twinberry honeysuckle (*Lonicera involucrata*) and Wood's rose (*Rosa woodsii*). Herbaceous cover is characterized by a lush, dense cover of forbs with a few graminoids. Common forbs include triangular leaf senecio, brook saxifrage (*Saxifraga odontoloma*), tall fringed bluebells, subalpine larkspur (*Delphinium barbeyi*), sweet cicely (*Osmorhiza occidentalis*), and twisted stalk (*Streptopus amplexifolius*). Further down in elevation and down to the valley floor riparian vegetation transitions to a mixed tree canopy of aspen, blue spruce (*Picea pungens*) and Douglas-fir (*Pseudotsuga menziesii*) and a mixed shrub understory of thinleaf alder, Rocky Mountain maple, Drummond's willow, shining willow (*Salix lasiandra*) and Bebb's willow (*Salix bebbiana*) with no one tree or shrub species dominant. The herbaceous layer is a patchy mix of forbs and graminoids with neither dominant. The juxtaposition of riparian and upland habitats contributes to the development of a diverse bird community. Commonly observed birds include Cordilleran Flycatcher (*Empidonax occidentalis*), Gray Flycatcher (*Empidonax wrightii*), Western Wood-peewee (*Contopus sordidulus*), Warbling Vireo (*Vireo gilvus*), Plumbeous Vireo (*Vireo plumbeus*), Western Scrub-Jay (*Aphelocoma californica*), Stellar's Jay (*Cyanocitta stelleri*), Clark's Nutcracker (*Nucifraga columbiana*), Black-capped Chickadee (*Poecile atricapilla*), Mountain Chickadee (*Poecile gambeli*), Red-breasted Nuthatch (*Sitta canadensis*), Golden-crowned Kinglet (*Regulus satrapa*), Swainson's Thrush (*Catharus ustulatus*), Mountain Bluebird (*Sialia currucoides*), Townsend's Solitaire (*Myadestes townsendi*), Western Tanager (*Piranga ludoviciana*), Dark-eyed Junco (*Junco hyemalis*), Brewer's Sparrow (*Spizella breweri*), Chipping Sparrow (*Spizella passerina*), Savannah Sparrow (*Passerculus sandwichensis*), and Lincoln's Sparrow (*Melospiza lincolnii*). Upland plant communities are characterized by mesic and drought tolerant plant communities. South-facing slopes are a mosaic of aspen and lodgepole pine (*Pinus contorta*) forests, and herbaceous meadows dominated by graminoids with scattered conifers including Douglas-fir and limber pine (*Pinus flexilis*). North-facing slopes are dominated by Douglas-fir forests or by dense "dog-hair" stands of second-growth lodgepole pine with a sparse herbaceous understory and, on ridge tops, by limber pine.

Key Environmental Factors: Climate, hydrologic regime and soil moisture and stability are key driving factors that exert a major influence on biota at the site. The eastern slopes of the Sawatch Mountains are drier than the west slope due to the interception of eastward-moving Pacific moisture by the west slope. Steep ravines, where shallow ground and surface water coalesce into streams, support lush riparian vegetation and are uniquely contrasted with the dry surrounding uplands. Bank-stabilizing riparian vegetation is essential to channel stability in this environmental setting.

Climate Description: Climate information for Buena Vista, which is approximately four miles to the east and on the valley floor at an elevation of 8,080 ft, records a

mean annual precipitation 9.79 inches; the wettest months are July and August with 1.7 and 1.65 inches of precipitation per month respectively; the driest month is January with 0.34 inches; the warmest month is July at 64 deg F and the coldest month is January at 24 deg F (Western Regional Climate Center 2009).

Land Use History: Historic mining and logging impacts are apparent throughout the site.

Biodiversity Significance Rank Comments (B3): This site supports an excellent (A-ranked) and a good (B-ranked) occurrence of a globally imperiled (G3/S3) *Populus tremuloides* / *Alnus incana* montane riparian forest.

Natural Heritage element occurrences at the Red Deer and Mercury Creeks PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus tremuloides / Alnus incana Forest	Montane Riparian Forests	G3	S3				B	2008-09-03
Natural Communities	Populus tremuloides / Alnus incana Forest	Montane Riparian Forests	G3	S3				A	2008-08-29

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

Boundary Justification: The boundary encompasses the element occurrences, a buffer against direct disturbances and the immediate watershed to enable the hydrological and ecological processes that support the plant communities. Annual and episodic flooding is important to maintaining this ecological system and alteration of the flooding regime by diversions or impoundments may result in changes to the plant and community composition (Rondeau 2001).

Protection Urgency Rank Comments (P3): The majority of this site is publicly owned and managed by the USFS although a few private in-holdings are present.

Management Urgency Rank Comments (M3): Maintaining site hydrology, specifically a natural flow regime with annual and episodic flooding, and preventing direct disturbance to upland and riparian habitat from roads and recreation would benefit the occurrences. Prior land uses, including mining and logging, continue to impact the landscape by altering the hydrologic runoff regime and contributing to excess erosion. Lower elevation reaches are impacted by residential and agricultural development. Water diversions could alter plant community viability. This plant community is a high-quality, streambank stabilizing association and is important in preventing bank erosion and maintaining channel stability (USDA 2004).

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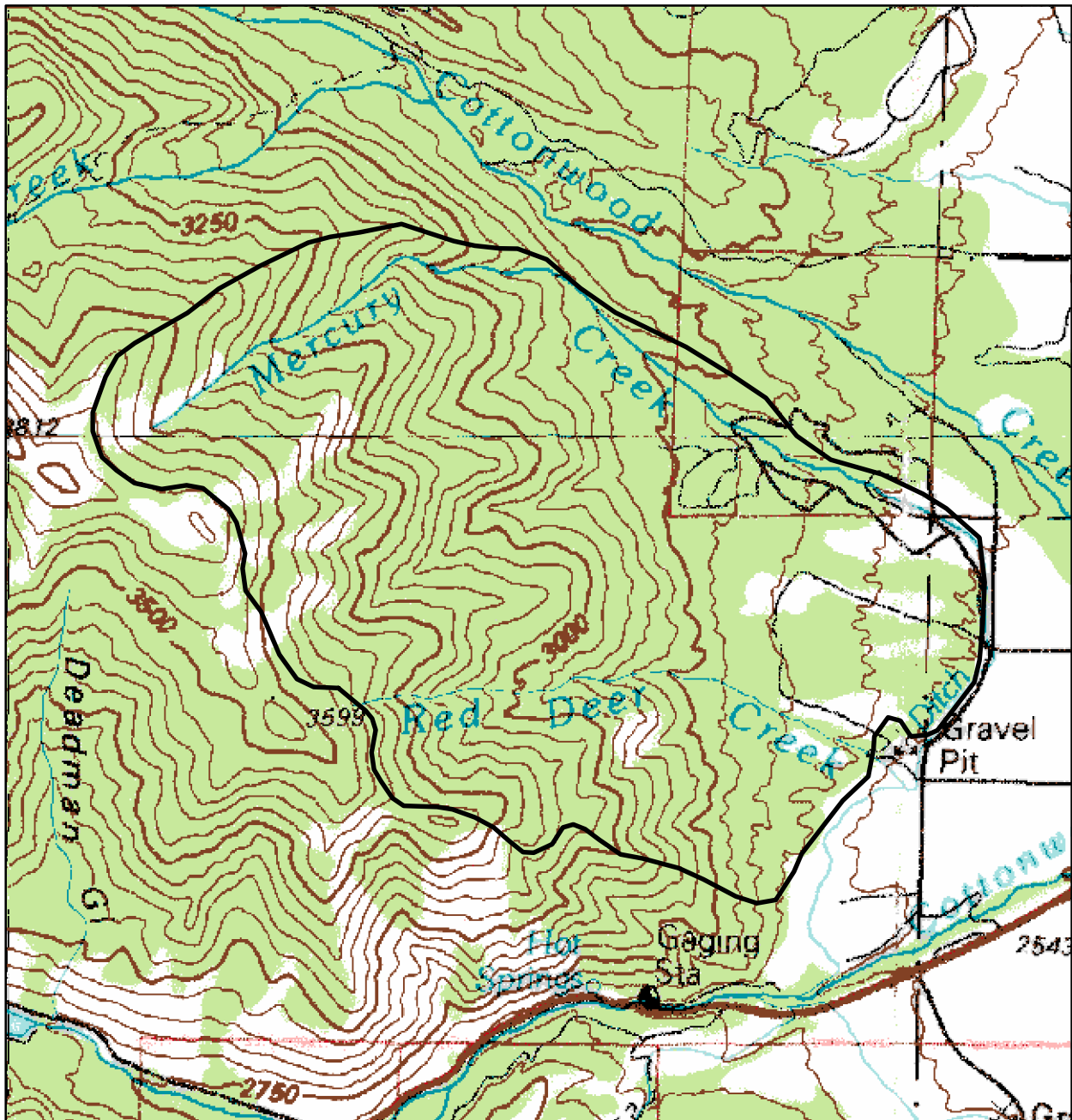
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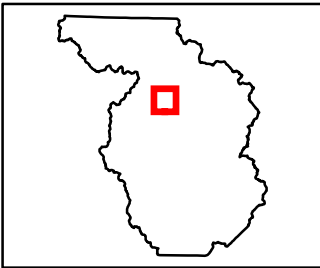
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Version Author: Malone, D.G.

Version Date: 04/17/2009



<p>Colorado Natural Heritage Program Colorado State University 254 General Services Building 1474 Campus Delivery Fort Collins, CO 80523-1474</p> <p>Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu</p> <p>Map Date: 04/20/2009</p>	<p>Legend</p> <p> PCA Boundary</p> <p>Gunnison, 38106-E1</p> <p>30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey</p>	<p>Location in Chaffee County</p> 
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Red Deer and Mercury Creeks Potential Conservation Area, B3: High Biodiversity Significance

Romley

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: Saint Elmo, Cumberland Pass

Size: 551 acres (223 ha)

Elevation: 10,000 - 10,440 ft. (3,048 - 3,182 m)

General Description: The site occurs in the lower subalpine and upper montane zone in riparian habitat and adjacent forested hillslopes along Chalk Creek. The creek drains the eastern slope of the Collegiate Range, with the confluence with the Arkansas River approximately 10 miles downstream of Buena Vista. This site is located downslope of extensively mined hillsides and an abandoned mining operation with large tailings piles occurs along the mid-reaches of the site. Within the site, the valley trends southwest to northeast. Hillslopes on both sides of the valley are steep and the valley floor is relatively narrow. Surrounding ridges and peaks on the east side of the valley reach 12,536 ft and on the west side of the valley 12,870 ft; upstream elevation in the valley is 10,440 ft and downstream elevation is 10,000 ft. Stream gradient is 2%-3% and the stream is a characteristic Rosgen "B" type stream with rapids dominated bed morphology. Abundant beaver activity in the upper and lower reaches has increased stream sinuosity and decreased gradient thereby increasing out-of-bank flows which helps maintain sufficient soil moisture in those reaches. Geology of the surrounding landscape is formed of middle tertiary intrusive rocks (age 20-40 M.Y.) with intermediate to felsic composition. Substrate is metamorphic or igneous units with a dominantly silicic composition of all ages (Tweto 1979). Soils on forested toeslopes are moist to saturated with a deep organic layer and are overlain with a thick cover of mosses. Soils on the flatter gradient riparian valley floor are moist to inundated with open water ponds scattered throughout. Riparian soils are highly organic and, wherever they are not inundated, are hummocky and covered with a thick and dense layer of mosses including sphagnum. Peat formation, up to approximately 17 inches, is typical of these hummocky sites. Shallow groundwater and surface flow is abundant and is essential to maintaining soil moisture in both forested and riparian habitat. Forested upland habitat on north-facing slopes is characterized by 2nd growth spruce - fir (*Picea engelmannii* - *Abies lasiocarpa*) forest and on south-facing slopes by a mix of spruce, subalpine fir (*Abies lasiocarpa*) and Douglas-fir (*Pseudotsuga menziesii*). The shrub understory is characterized by a mix of willow species such as planeleaf (*Salix planifolia*) and bareground (*Salix brachycarpa*) and non-willow shrubs such as bog birch (*Betula nana*), gooseberry (*Ribes inerme*), twinberry honeysuckle (*Lonicera involucrata*) and shrubby cinquefoil (*Dasiphora floribunda*). Herbaceous cover is characterized by a thick layer of mosses and a mix of forbs and graminoids

including pink pyrola (*Pyrola asarifolia*), heart-leaf arnica (*Arnica cordifolia*), bishops cap (*Mitella stauropetala*), meadow rue (*Thalictrum fendleri*), lesser wintergreen (*Pyrola minor*), one-sided wintergreen (*Ramischia secunda*), Richardson's geranium (*Geranium richardsonii*), and northern twayblade (*Listera borealis*). Riparian plant communities vary with stream gradient in a linear mosaic along the stream corridor. Wider, flatter reaches are characterized by willow carrs, non-willow shrublands and wet meadows whereas narrower, steeper stream riparian habitat is typically forested with spruce and fir. Willow shrublands are dominated by a mix of planeleaf, barrenground and wolf willow (*Salix wolfii*). Non-willow shrublands are dominated by bog birch in association with planeleaf, barrenground and wolf willow and shrubby cinquefoil (*Dasiphora floribunda*). The herbaceous layer is a rich and diverse mix of forbs with a few graminoids. Forb characterize herbaceous growth on moss-covered hummocks and include alpine meadow rue (*Thalictrum alpinum*), white bog-orchid (*Limnorchis dilatata*), marsh marigold (*Caltha leptosepala*), elephant head (*Pedicularis groenlandica*), cowbane (*Oxypolis fendleri*), grass-of-parnassus (*Parnassia fimbriata*), and star gentian (*Swertia perennis*). Graminoids are dominant in inundated areas and include water sedge (*Carex aquatilis*) and bluejoint reedgrass (*Calamagrostis canadensis*).

Key Environmental Factors: Soil moisture and water quality characteristics are the driving factors that exert a major influence on biota at the site.

Climate Description: Climate records in the town of Pitkin, located approximately 11.5 miles to the southwest of Grizzly Gulch but on the west side of the Continental Divide, indicate that in general winters are cold with abundant snowfall (114.2 inches annual average) and summers are mild and wet. Mean annual precipitation is 16.92 inches; the wettest months are July and August with an average precipitation of 2.17 and 2.05 inches respectively while the driest are November with 1.01 and June with 1.03 inches; the coldest month is January with an average temperature of 12 deg F and the warmest is July at 55 deg F (Western Regional Climate Center 2009).

Land Use History: Hard rock mining with associated impacts was extensive and included deforestation, stream channelization, road building, and water quality degradation due to acid mine drainage.

Cultural Features: The nearby Ghost Town of St. Elmo originated in 1879 and is widely considered Colorado's best preserved ghost town.

Biodiversity Significance Rank Comments (B3): This site is drawn to include a good (B-ranked) occurrence of the globally vulnerable (G3G4/S3) Bog birch (*Betula nana*) / mesic forb - mesic graminoids shrubland and a fair (C-ranked) occurrence of the state rare (G4/S2) plant species, northern twayblade (*Listera borealis*). The state imperiled (G4G5/S1) low northern sedge (*Carex concinna*) is historically known from the site.

Natural Heritage element occurrences at the Romley PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				B	2008-08-26
Vascular Plants	Listera borealis	northern twayblade	G4	S2			BLM	C	1990-07-16
Vascular Plants	Carex concinna	low northern sedge	G4G5	S1			BLM	H	1975-07-25

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

Boundary Justification: The boundary encompasses the element occurrences and the ecological processes essential to sustaining them and provides a buffer against direct disturbance. The primary ecological process essential to long-term community viability is hydrology, specifically shallow groundwater or surface flow with annual episodic flooding (Rondeau 2001 and NatureServe 2009). Snowmelt runoff from the surrounding watershed and/or beaver activity maintains this hydrologic system (Rondeau 2001 and NatureServe 2009) and are important processes to include in the site.

Protection Urgency Rank Comments (P3): Northwest-facing slopes are a patchwork of public and private lands with mining claims. Additionally, numerous mining-associated roads fragment upland landscapes, altering groundwater flow, increasing soil erosion and providing off-road vehicle access into natural landscapes.

Management Urgency Rank Comments (M3): Activities that alter groundwater flow or surface flow, increase erosion or impact beaver activity have the potential to negatively affect ecosystem processes and viability of the elements. Off-road motorized recreational use of the area is high and has the potential to result in vegetation trampling or damage with consequently deleterious effects to biological resources.

Off-Site Considerations: Mine site reclamation was recently conducted by the U.S. Environmental Protection Agency (USEPA) to remediate acid mine drainage that was resulting in heavy metal pollution (zinc and cadmium) in Chalk Creek (USEPA 2009). The Mary Murphy Mine, which is located on the northwest-facing slope above Chalk Creek, contains steeply dipping gold-silver deposits and lead-zinc sulfide fissure-vein deposits through extensive underground workings on 14 different levels in the Tertiary-aged Mount Princeton quartz-monzonite (USEPA 2009). In 1986 the mine was identified by the USEPA as the single greatest contributor of heavy metals (zinc and cadmium) to Chalk Creek and was

subsequently listed as impaired and scheduled for reclamation. An extensive reclamation project was undertaken in 1998 and completed in 2006; although zinc levels were dramatically decreased they continue to exceed Colorado water quality standards (USEPA 2009).

Information Needs: Current field surveys are needed to locate low northern sedge (*Carex concinna*) and the Northern twayblade (*Listera borealis*).

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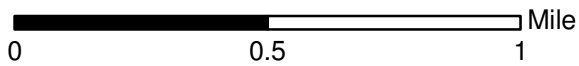
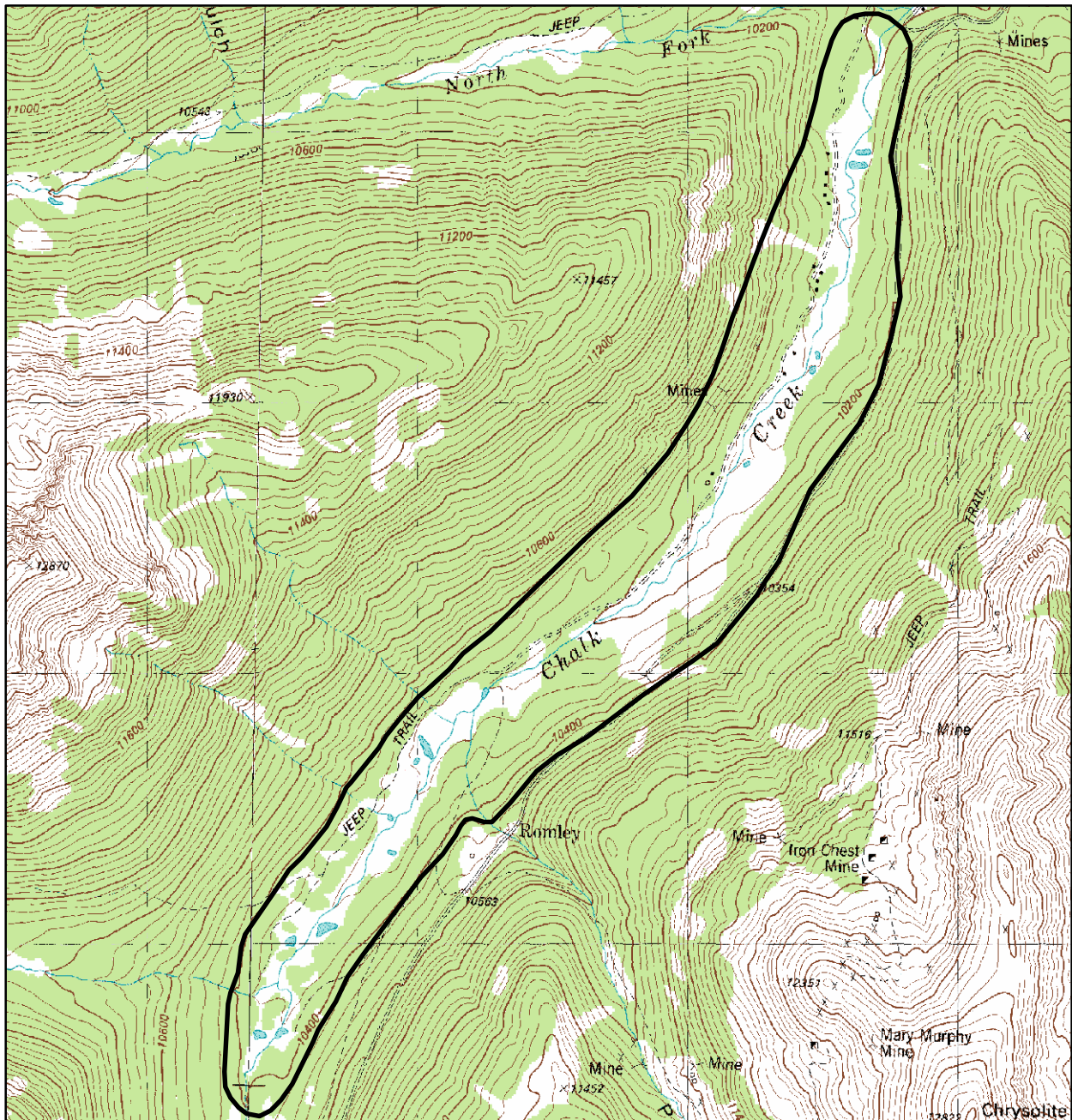
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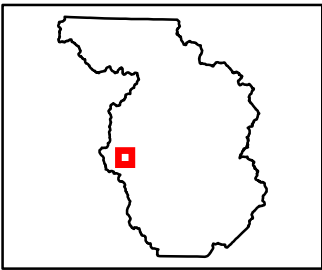
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Version Date: 04/01/2009



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Romley Potential Conservation Area, B3: High Biodiversity Significance

Sawmill Gulch

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: South Peak

Size: 1,990 acres (805 ha)

Elevation: 8,800 - 11,880 ft. (2,682 - 3,621 m)

General Description: The Sawmill Gulch site is located on the west slope of the Mosquito Mountain Range and encompasses a funnel-shaped sub-watershed. Numerous streams originate at the top of the "funnel" and just below the ridge line that delineates the upper portion of the site. These first order streams soon coalesce into the second order stream that drains the remaining majority of Sawmill Gulch and had its confluence with the Arkansas River approximately 2.5 miles downstream of the town of Granite. In this part of the watershed the Mosquito Mountains rise steeply from the floor of the Arkansas Valley at an elevation of 8,800 ft in the montane life zone. In about 3.4 miles, the mountains rise over 12,000 ft to the upper sub-alpine life zone. Steep hillslopes with narrow ravines and steep gradient streams characterize this site. Beaver (*Castor canadensis*) are active throughout much of the drainage. Their dam-building activity has resulted in stair-stepped valley topography and plant communities that alternate with the landscape with wide willow carrs on flatter gradients and narrow bands of forested riparian habitat on steeper reaches. Geology from the foot of the hillslopes on the floor of the Arkansas Valley up to approximately 9,200 ft is Precambrian igneous or metamorphic granitic rocks of 1,650 to 1,730 M.Y. From 9,200 ft to the ridge top at 12,060 ft, rocks are Precambrian igneous or metamorphic granitic rocks of 1,400 to 1,700 M.Y. (Tweto 1979). Riparian soils have been positively impacted by beaver activity; riparian soils are moist to inundated and have a well developed organic layer. Upland soils continue to be impacted by historic logging activity; soils here are highly erodible with little to no layer of humus or duff. Beaver also have a major impact on hydrology and on the shrubland ecological systems that are present in this valley. Riparian plant communities alternate between shrublands and forest, corresponding to the presence or absence of beaver activity. Flatter gradient stream reaches, where beaver have been active, are characterized by willow carrs while steeper, undammed reaches are dominated by narrow bands of riparian forested habitat. Forested habitat is typically dominated by aspen (*Populus tremuloides*) with a few lodgepole pine (*Pinus contorta*). Willow carrs are characterized by a mosaic of willow stands, herbaceous meadows and open water ponds. From the montane to the lower subalpine willow carrs are characterized by the Geyer willow - mountain willow (*Salix geyeriana* - *Salix monticola*) / mesic forb shrubland association or by the mountain willow / water sedge (*Salix monticola* / *Carex aquatilis*) shrubland

association. Willow carrs dominated by the Geyer willow - mountain willow association have a thick herbaceous layer of forbs and graminoids. Forb cover is greater than graminoid cover and commonly includes species such as white bog orchid (*Platanthera dilatata*), geranium (*Geranium richardsonii*), elephant head (*Pedicularis groenlandica*), and pink pyrola (*Pyrola asarifolia*). Typical graminoids include water sedge and beaked sedge (*Carex utriculata*). Other shrub species include Drummond's willow (*Salix drummondiana*), planeleaf willow (*Salix planifolia*) and shrubby cinquefoil (*Dasiphora floribunda*). In those willow carrs dominated by the mountain willow / water sedge association herbaceous vegetation is dominated by water sedge interspersed with patches of beaked sedge, bluejoint reedgrass (*Calamagrostis canadensis*) and a variety of forbs. Common forbs include northern green orchid (*Platanthera hyperborea*), elephant head, cowparsnip (*Heracleum sphondylium*) fireweed (*Epilobium angustifolium*), pink pyrola, and Swertia (*Swertia perennis*). Other common shrubs include Drummond's willow, barenground willow (*Salix brachycarpa*) and shrubby cinquefoil. Subalpine riparian shrublands are characterized by a dense canopy of Drummond's willow with an herbaceous layer that, in canopy openings, is dominated by a lush and dense cover of forbs including triangular leaf senecio (*Senecio triangularis*), tall fringed bluebells (*Mertensia ciliata*), heartleaf bittercress (*Cardamine cordifolia*) and brook saxifrage (*Saxifraga odontoloma*). A narrow zone of tree cover is typically present between upland and willow carr habitat which, in the montane zone, is characterized by a mix of aspen, lodgepole pine and blue spruce, and in the subalpine by Engelmann spruce (*Picea engelmannii*). Uplands continue to be impacted by historic logging. Lower elevation, montane, east-facing slopes are characterized by a mosaic of sage (*Artemisia* spp.) shrublands and lodgepole and limber pine (*Pinus flexilis*) woodlands. West-facing slopes are a mosaic of lodgepole and aspen. Higher elevation, subalpine slopes are a mosaic of aspen, lodgepole and Engelmann spruce.

Key Environmental Factors: Hydrology and climate are key driving factors that exert a major influence on biota at the site.

Climate Description: Climate in the foothills of the Mosquito Range is warmer and drier compared to the mountains in the Sawatch Range on the west side of the Arkansas River valley but is wetter and cooler than that of the valley floor. The Mosquitoes are in the rain shadow of the Sawatch Range but may intercept some Pacific moisture as storms track to the east but they also intercept moisture from the Gulf of Mexico that is flowing from the southeast to the west and intercept thunderstorms that come out of the west in the summer (Siemer 1977). So, although not as wet and cool as the Sawatch Range, the Mosquitoes are wetter and cooler than the river valley which is in the rain shadow of both the Sawatch and Mosquito mountains. Climate information for Buena Vista, which is on the valley floor, records a mean annual precipitation 9.79 inches; the wettest months are July and August with 1.7 and 1.65 inches of precipitation per month respectively; the driest month is January with 0.34 inches; the warmest month is July at 64 deg F and the coldest month is January at 24 deg F (Western Regional Climate Center 2009). In

Antero, to the east and south of the site, at an elevation of 8,920 ft, records indicate that the wettest months are July and August with a mean precipitation of 2.30 inches, the driest is January at 0.21 inches; the warmest month is July at 76.2 deg F and the coldest is January at 32.5 deg F (Western Regional Climate Center 2009).

Land Use History: Past uses of the site include logging.

Biodiversity Significance Rank Comments (B3): This site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix geyeriana* - *Salix monticola* / mesic forbs shrubland, a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix monticola* / *Carex aquatilis* montane riparian willow carr and a good (B-ranked) occurrence of a globally vulnerable (G3G4/SU) *Populus tremuloides* / *Salix drummondiana* forest. Montane and subalpine shrubland ecological systems occupy less than 1% of the Southern Rocky Mountain ecoregion (Rondeau 2001). As of 2009, the *Salix geyeriana* - *Salix monticola* / mesic forbs shrublands is only known from Colorado (NatureServe 2009).

Natural Heritage element occurrences at the Sawmill 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
Natural Communities	<i>Salix geyeriana</i> - <i>Salix monticola</i> / Mesic Forbs Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				B	2008-07-19
Natural Communities	<i>Salix monticola</i> / <i>Carex aquatilis</i> Shrubland	Montane Riparian Willow Carr	G3	S3				B	2008-07-19
Natural Communities	<i>Populus tremuloides</i> / <i>Salix drummondiana</i> Forest		G3G4	SU				B	2008-07-19

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

Boundary Justification: The boundary includes the plant communities as well as the immediate watershed that enables the hydrologic and ecological processes that maintain them. Hydrology, and specifically surface flow, is the primary abiotic ecological process necessary to maintain these shrubland ecosystems; and beaver are the primary biotic maintainers of these shrubland systems (Rondeau 2001). Mountain willow appears to grow only where the water table does not drop below 3 ft from the surface and Geyer willow is most stable in this environment (Carsey et al. 2003).

Protection Urgency Rank Comments (P3): The majority of the site is publicly owned and managed by the USFS.

Management Urgency Rank Comments (M3): The plant communities would benefit from enhanced beaver activity and by forestry that helps stabilize soils. Historic logging impacts continue to threaten community viability with unstable and eroding upland soils. Additionally, numerous social trails fragment the landscape, contributing to further soil erosion. The natural hydrologic regime and especially shallow surface and groundwater flow, can be impacted by eroding and unstable soils.

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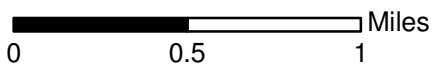
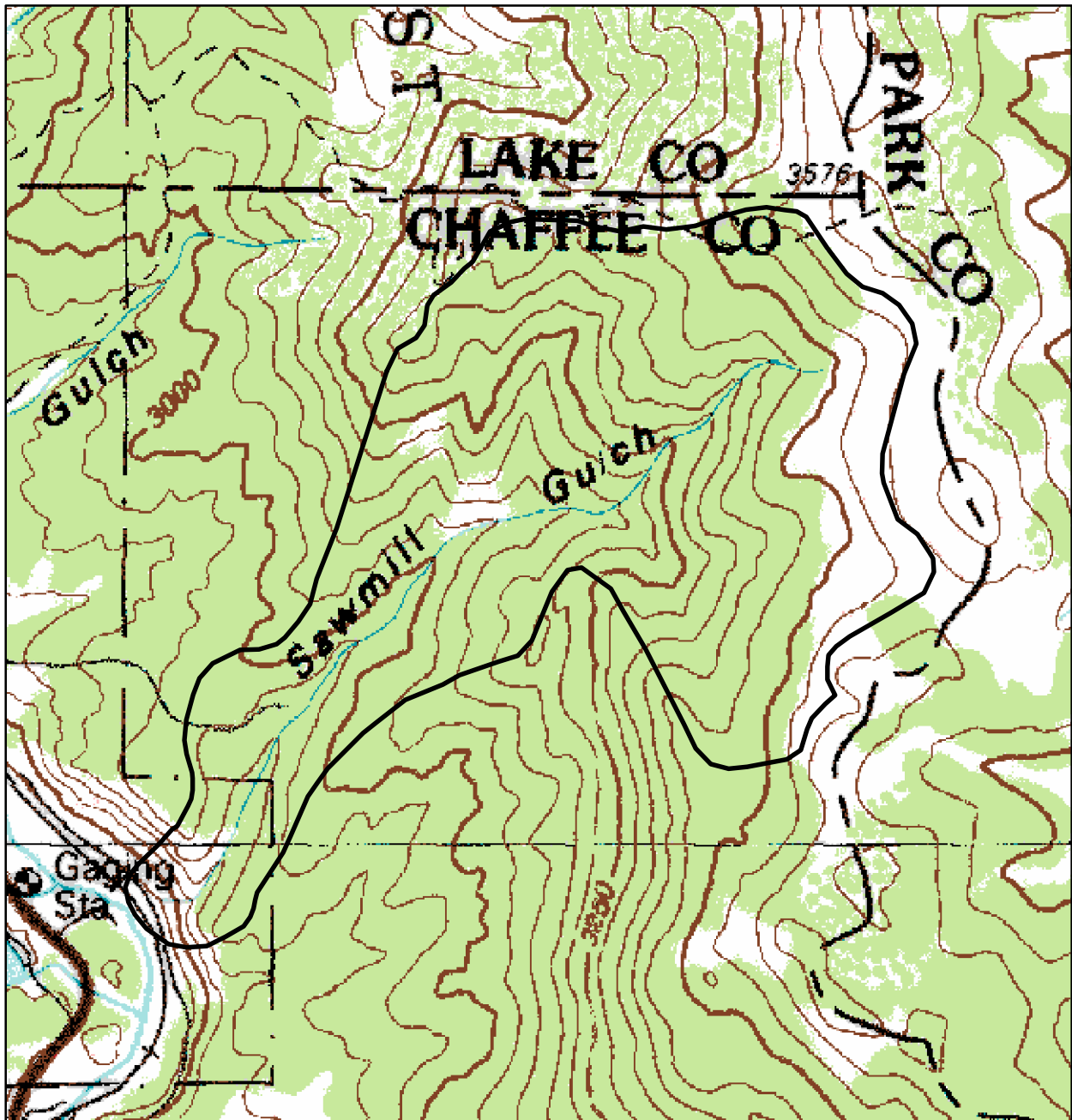
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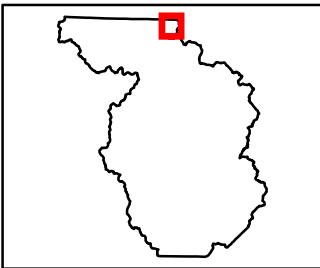
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Sawmill Gulch Potential Conservation Area, B3: High Biodiversity Significance

Sevenmile Creek

Biodiversity Rank - B3: High Biodiversity Significance

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

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Buena Vista East, Marmot Peak

Size: 2,371 acres (959 ha)

Elevation: 8,200 - 9,800 ft. (2,499 - 2,987 m)

General Description: The Sevenmile site is located in the foothills of the Mosquito Range on the east side of the Arkansas River Valley and to the northeast of the City of Buena Vista. The foothills rise to approximately 9,800 ft and are formed of Precambrian granitic rocks (1,700 M.Y.) whereas the highest peaks in the range reach elevations in excess of 14,000 ft and are typically formed of pre-Pennsylvanian and Pennsylvanian aged sedimentary rocks and late cretaceous and tertiary-aged intrusive igneous rock (Tweto 1979). The Mosquito Range, which forms the eastern border of the Arkansas River Valley, is part of the Sawatch uplift and was historically continuous with the Sawatch Range which forms the west border of the valley. During the Laramide orogeny, 35 M.Y.A., the formation of a fault-bounded rift valley separated the Mosquito Range from the Sawatch Range which subsequently resulted in the development of the Arkansas River (Topper et al. 2003). Faulting has created extensive fractures in the granite rocks that form the foothills of the Mosquito Range. This fracturing has created a system with greater groundwater recharge than would otherwise occur (Emerick pers. comm. 2009). Surface discharge from this groundwater system supplies water to several creeks in these foothills including Sevenmile Creek. The highly fractured landscape erodes more quickly and into the more rounded land shapes that characterize the foothills (Emerick pers. comm. 2009). Granite typically weathers and disintegrates into grus that consists of large feldspar and quartz crystals that are highly porous with little moisture holding capacity. Moisture holding capacity has typically increased on hilltops as the grus has further weathered into clay and organic matter accumulated. On hillslopes, as the granite weathered, the eroded granite crystals have been carried to the valley floor leaving hillslope soils thin and eroding. In valley bottoms, the combination of increased moisture from fracture discharge and rich plant growth has enabled the development of deeper soils. Consequently hilltops and low-gradient slopes typically have deeper soils with greater vegetation cover than steeper hillslopes. Valley bottoms, where moisture and soils have accumulated, are well-vegetated and frequently drained by ephemeral or permanent streams. In stream valleys, riparian soils vary from coarse sand to fine-grained, highly organic soil depending on the characteristics of adjacent slopes and the presence or absence of beaver activity. Uplands are characterized by rounded hilltops cut with steep canyons and ridge-tops punctuated by granite boulder outcrops. Upland plant communities are

in stark contrast with the lush riparian habitat. Soils are well drained and support a mosaic of drought-tolerant woodland, shrubland and grassland communities. Forested habitat is characterized by a widely scattered mix of ponderosa pine (*Pinus ponderosa*) and pinon - juniper (*Pinus edulis* - *Juniperus scopulorum*) woodlands, with Douglas-fir (*Pseudotsuga menziesii*) and aspen (*Populus tremuloides*) on north-facing slopes and in gullies and draws. Shrublands and herbaceous meadows interfinger with the woodlands. Shrublands are characterized by a mosaic of mountain mahogany (*Cercocarpus montanus*) in association with antelope bitterbrush (*Purshia tridentata*) and large patches of sagebrush (*Artemisia* spp.) shrubland. Herbaceous meadows are characterized by a mix of mesic to xeric graminoids with a few forbs depending on soil, moisture, and exposure. Common graminoids include needle-and-thread (*Hesperostipa comata*), Indian ricegrass (*Stipa hymenoides*), spike fescue (*Leucopoa kingii*) and blue gramma (*Bouteloua gracilis*). Common forbs include miner's candle (*Oreocarya virgata*), prickly pear (*Opuntia* spp.), Indian paintbrush (*Castilleja* spp.) and blazing star (*Nuttalia* spp.). Riparian habitat is characterized by a linear mosaic of woodlands that alternate with shrublands, wet meadows and open water ponds. Beaver activity is prolific and their dams are an important structural feature of stream and riparian habitat to help conserve scarce water resources which then also contributes to creating and expanding riparian and wetland plant communities. Riparian woodlands are species rich and structurally complex. In more open canyons riparian woodlands are characterized by associations of narrowleaf cottonwood (*Populus angustifolia*) with a variety of willow species (*Salix* spp.) including shining willow (*Salix lucida*), mountain willow (*Salix monticola*) and coyote willow (*Salix exigua*) and non-willow shrubs including river birch (*Betula occidentalis*), thinleaf alder (*Alnus incana*), Wood's rose (*Rosa woodsii*), gooseberry and currant (*Ribes* spp.). The herbaceous layer here is dominated by a mix of graminoids and forbs including arctic rush (*Juncus balticus*), Canada reedgrass (*Calamagrostis canadensis*), field horsetail (*Equisetum arvense*), meadow rue (*Thalictrum fendleri*), and horsemint (*Agastache urticifolia*). In narrower canyons, woodlands are characterized by a tree layer that is dominated by conifers including Douglas-fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*) and ponderosa pine (*Pinus ponderosa*). The shrub understory includes river birch (*Betula occidentalis*), mountain maple (*Acer glabrum*), red-osier dogwood (*Cornus sericea*) and coyote willow (*Salix exigua*). Herbaceous cover in these moist canyons is a diverse mix of graminoids and forbs typical of those species found in the deciduous woodlands and shrublands. Wider, lower gradient reaches of the site where beaver have been active are characterized by willow carrs that are dominated by one or two willow species, non-willow shrublands and open water ponds. Dominant willow species include shining willow (*Salix lucida*), coyote willow (*Salix exigua*), Geyer willow (*Salix geyeriana*) and mountain willow (*Salix monticola*). Non-willow shrublands include associations of river birch with a variety of willow species and thinleaf alder. The shrub canopy is typically dense and the herbaceous understory is confined mostly to canopy openings where it is dominated by graminoids such as arctic rush (*Juncus balticus*), beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*) and cattail (*Typha*

angustifolia) with a few forbs including willowherb (*Epilobium* spp.) and northern green orchid (*Platanthera aquilonis*). Open water ponds often have a dense growth of water smartweed (*Polygonum natans*) interspersed with stands of cattail and bulrush (*Schoenoplectus acutus*).

Key Environmental Factors: Driving environmental factors that exert a major influence on biota at the site include geology, climate, hydrology and a keystone species, beaver (*Castor canadensis*). Topographic characteristics and climate have created arid upland ecosystems that are in stark contrast with the narrow bands of riparian and stream systems that drain the valleys and steep canyons. Geological activity that resulted in highly fractured granites also results in increased groundwater recharge that maintains stream flow. A natural flooding regime and out-of-bank flows are important to the maintenance of riparian communities, especially narrowleaf cottonwood (*Populus angustifolia*) woodlands. Beaver damming activity is especially important in this arid landscape to slowing stream flows, conserving water and increasing out of bank flows that help maintain high soil moisture in the riparian zone.

Climate Description: Climate in the foothills of the Mosquito Range is warmer and drier compared to the mountains in the Sawatch Range on the west side of the Arkansas River valley but is wetter and cooler than that of the valley floor. The Mosquitoes are in the rain shadow of the Sawatch Range but may intercept some Pacific moisture as storms track to the east but they also intercept moisture from the Gulf of Mexico that is flowing from the southeast to the west and intercept thunderstorms that come out of the west in the summer (Siemer 1977). So, although not as wet and cool as the Sawatch Range, the Mosquitoes are wetter and cooler than the river valley which is in the rain shadow of both the Sawatch and Mosquito mountains. Climate information for Buena Vista, which is on the valley floor, records a mean annual precipitation 9.79 inches; the wettest months are July and August with 1.7 and 1.65 inches of precipitation per month respectively; the driest month is January with 0.34 inches; the warmest month is July at 64 deg F and the coldest month is January at 24 deg F (Western Regional Climate Center 2009). In Antero, to the east of the Mosquitoes, at an elevation of 8,920 ft, records indicate that the wettest months are July and August with a mean precipitation of 2.30 inches, the driest is January at 0.21 inches; the warmest month is July at 76.2 deg F and the coldest is January at 32.5 deg F (Western Regional Climate Center 2009).

Land Use History: Historic agricultural uses of the site, including grazing, continue to impact biota and ecosystem function.

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Pseudotsuga menziesii* / *Betula occidentalis* montane riparian forest, a good (B-ranked) occurrence of a globally vulnerable (G3/S2) *Betula occidentalis* / mesic graminoids lower montane riparian shrubland, a good (B-ranked) occurrence of a globally vulnerable (G3/S3)

Salix geyeriana / mesic forbs montane willow carr, and a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Populus angustifolia* / *Salix (monticola, drummondiana, lucida)* montane riparian forest.

Natural Heritage element occurrences at the Sevenmile Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Betula occidentalis / Mesic Graminoids Shrubland	Lower Montane Riparian Shrublands	G3	S2				B	2008-08-11
Natural Communities	Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	Narrowleaf Cottonwood / Mixed Willows Montane Riparian Forest	G3	S3				B	2008-08-11
Natural Communities	Salix geyeriana / Mesic Forbs Shrubland	Montane Willow Carr	G3	S3				B	1998-06-15
Natural Communities	Pseudotsuga menziesii / Betula occidentalis Woodland	Montane Riparian Forest	G3?	S3				B	2008-08-10

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

Boundary Justification: Boundaries encompass the element occurrences and the immediate watershed to protect hydrological processes, especially shallow groundwater recharge, and physical characteristics including soil moisture and the ecological processes of energy flow and nutrient cycling that maintain riparian and stream ecosystems. They also provide a buffer against direct disturbance from recreation and grazing. The natural processes are not completely contained in the boundary and off-site activities, especially motorized recreation, within the larger watershed have the potential to impact the elements of biodiversity in the riparian area.

Protection Urgency Rank Comments (P3): The site is publicly owned but recreational development and grazing pressures are high.

Management Urgency Rank Comments (M2): A web of dirt roads and a very high motorized recreational use fragments the landscape, and disturbs upland and riparian soil resulting in vegetation damage, excessive soil erosion and creates routes for weed-invasion. Where weeds have invaded along stream banks, erosion is often excessive and banks are failing.

Exotic Species Comments: Exotic species are present throughout the understory and include cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium arvense*), clover (*Trifolium repens*), Kentucky bluegrass (*Poa pratensis*), houndstongue (*Cynoglossum officinale*) and, in the uplands, Russian thistle (*Salsola iberica*).

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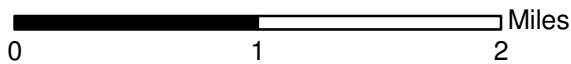
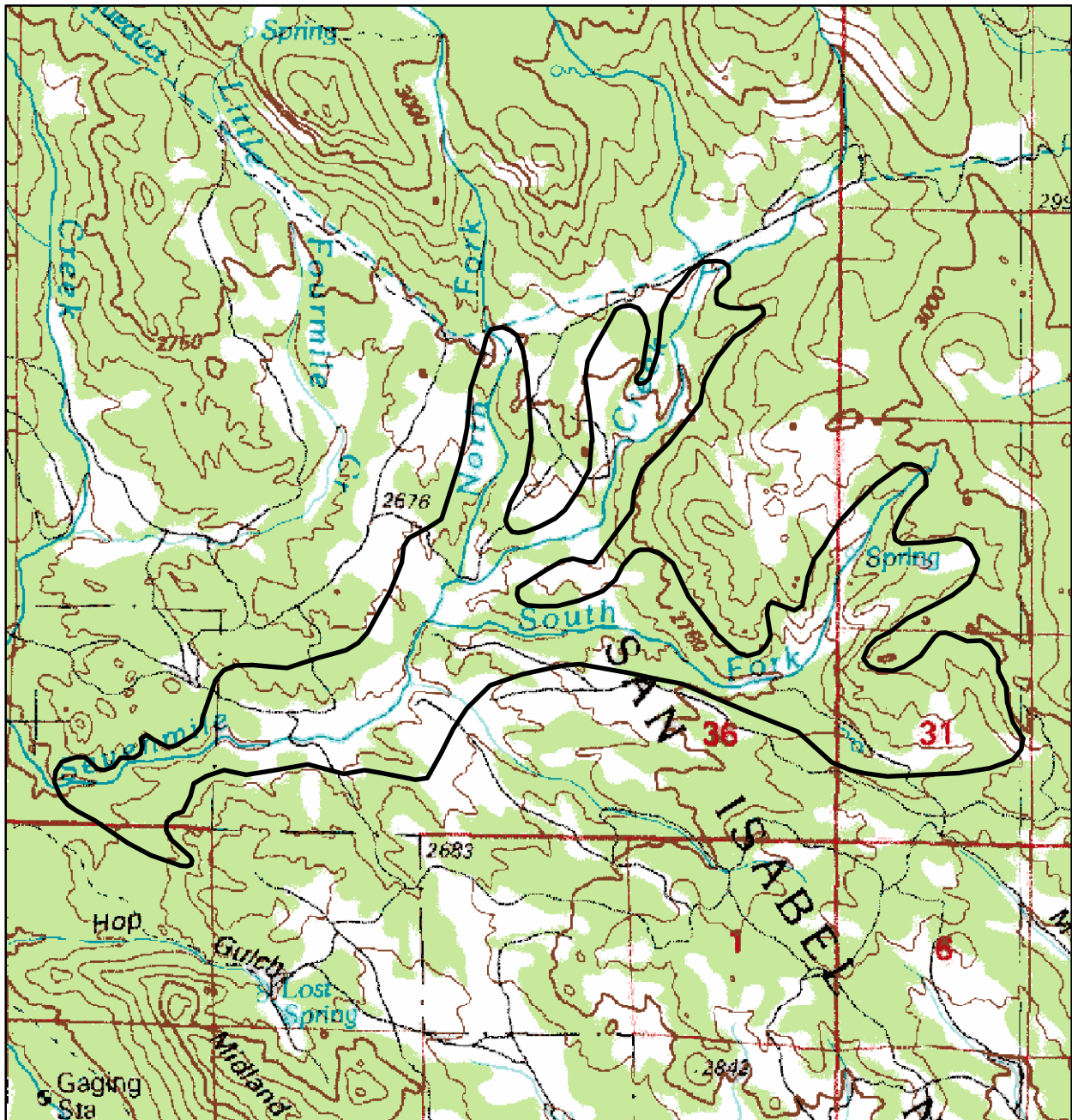
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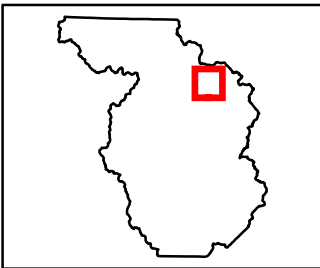
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<http://www.wrcc.dri.edu/Climsum.html>

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Sevenmile Creek Potential Conservation Area, B3: High Biodiversity Significance

Spout Lake

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

U.S.G.S. 7.5-minute quadrangles: Tincup

Size: 1,945 acres (787 ha)

Elevation: 11,800 - 13,100 ft. (3,597 - 3,993 m)

General Description: Spout Lake site is located along the Continental Divide between Cottonwood Pass and Mount Kreutzer, in the northern portion of the Sawatch Range. The Sawatch Range is composed primarily of coarse schists and gneisses intruded by Precambrian granites and of metamorphosed limestone and quartzite (Chronic and Williams 2002). Of special interest are the outcrops of limestone and dolomite exposures in the tundra (Weber and Wittman 1996). The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Key Environmental Factors: Solar radiation, heavy snow pack, and wind.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 60's to low 70's with evening temperatures in the high 30's and low 40's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April

Biodiversity Significance Rank Comments (B3): This site supports a concentration of rare alpine plants including an extant occurrence of the globally imperiled (G2G3/S2S3) Rothrock townsend-daisy (*Townsendia rothrockii*), extant occurrences of the state rare (G5/S2) woods draba (*Draba oligosperma*) and alpine braya (*Braya humilis*), and an extant occurrence of the state imperiled subspecies (G5TNR/S1) arctic braya (*Braya glabella* var. *glabella*). Imprecise or historical locations for the globally vulnerable (G3/S1) Wind River draba (*Draba ventosa*), the globally vulnerable (G3/S2) clawless draba (*Draba exunguicultata*), the globally vulnerable (G3/S3) Colorado Divide whitlow-grass (*Draba streptobrachia*), the globally vulnerable (G3G4/S1) Porsild's draba (*Draba porsildii*), the globally vulnerable (G3?/S3?) Colorado wood-rush (*Luzula subcapitata*), the state rare (G4/S2S3) arctic

draba (*Draba fladnizensis*) and the state rare (G5/S2) dwarf hawksbeard (*Askellia nana*) were documented in the late 80s, but more precise and current information is needed. Most of the elements are considered circumpolar and occur in Colorado only in the alpine zone.

Natural Heritage element occurrences at the Spout Lake 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	Townsendia rothrockii	Rothrock townsend - daisy	G2G3	S2S3				E	1989-06-27
Vascular Plants	Luzula subcapitata	Colorado wood - rush	G3?	S3?				H	1998-08-05
Vascular Plants	Braya humilis	alpine braya	G5	S2				E	2005-08-17
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2005-08-27
Vascular Plants	Braya glabella var. glabella	arctic braya	G5TNR	S1			USFS	E	2005-08-17

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

Boundary Justification: Boundary is drawn along the Continental Divide from Lost Lake to Mount Kreutzer to encompass the alpine plant occurrences. This should protect plants from direct impacts and provide potential habitat where additional individuals can become established over time.

Protection Urgency Rank Comments (P5): The site is located in the Collegiate Peaks Wilderness Area.

Management Urgency Rank Comments (M4): Protect rare plant species from recreational impacts such as off trail hiking and mountain biking.

Information Needs: Additional field surveys are need to document precise locations of rare plants and assess current quality of populations.

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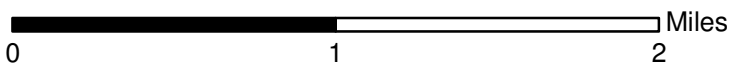
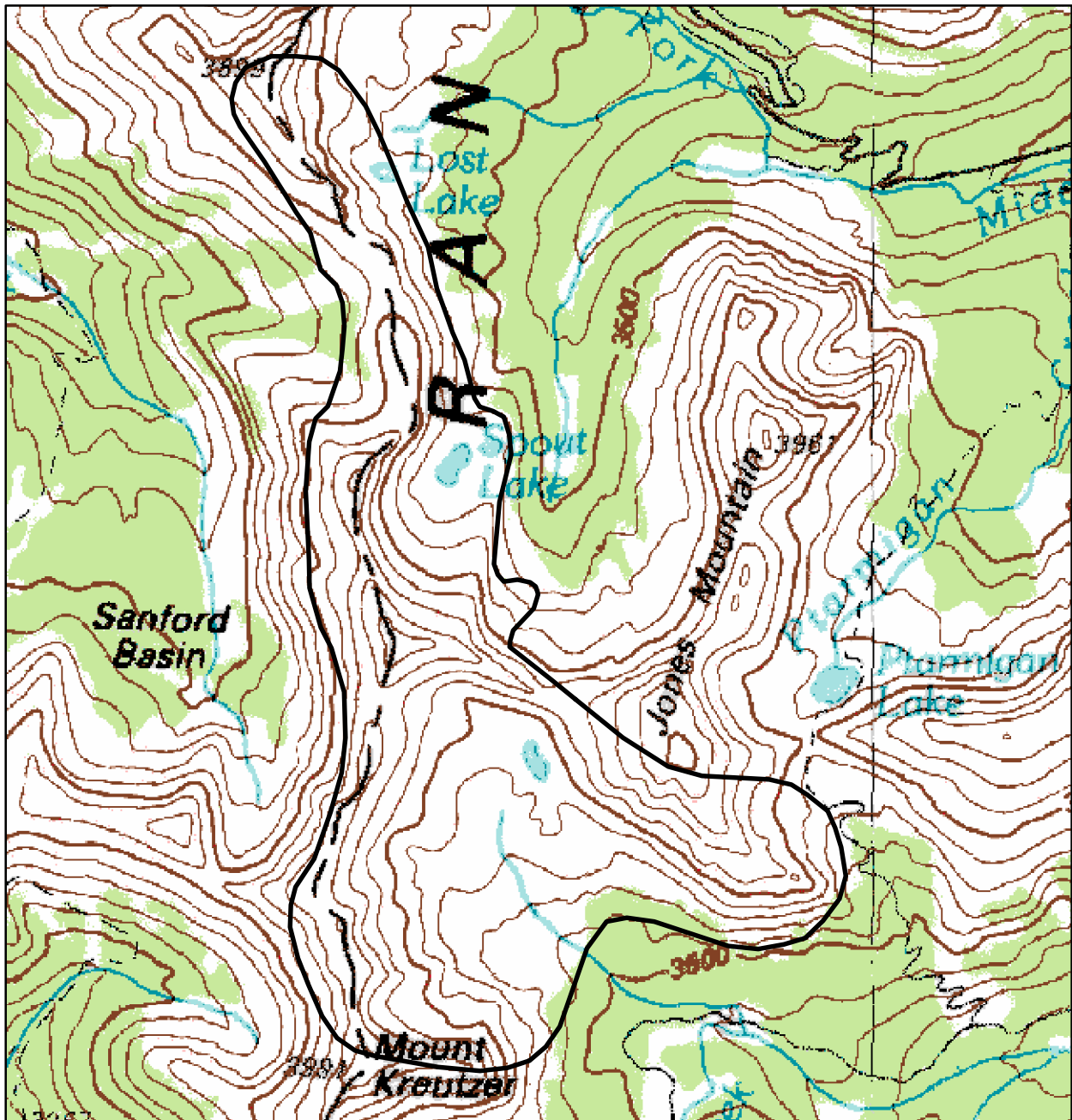
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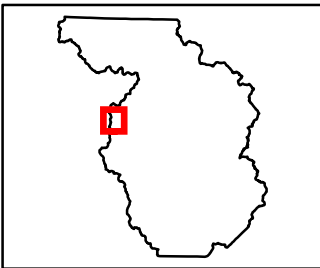
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Version Author: Culver, D.R.

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Spout Lake Potential Conservation Area, B3: High Biodiversity Significance

Upper Clear Creek Canyon

Biodiversity Rank - B3: High 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: Winfield

Size: 2,365 acres (957 ha)

Elevation: 10,081 - 10,860 ft. (3,073 - 3,310 m)

General Description: This high elevation subalpine wetland site is located in a wide, glacially sculpted valley in the upper reaches of the Clear Creek watershed. Clear Creek drains the eastern slope of the Sawatch Mountains and has its confluence with the Arkansas River approximately 2.5 miles below the town of Granite. Here the valley trends north-south and is surrounded by high, steep relief peaks, ridges and glacial cirques. The Continental Divide forms a semi-circle of high mountain ridges to the south that reaches 13,950 ft at The Three Apostles peaks. Huron Peak (14,003 ft) is on the eastern side of the valley, Virginia and Winfield Peaks (13,000 ft) are to the west and La Plata Peak (14,361 ft) lies to the north. Valley elevation at the upper reaches of the site ranges from 10,360 ft to 10,600 ft. Geology of the surrounding peaks typically consists of Laramide intrusive rocks (40-72 M.Y.) of mainly intermediate to felsic composition. The Clear Creek valley has been extensively sculpted by glaciation, and the valley floor is carpeted by glacial drift from the Pinedale and Bull Lake Glaciation that occurred during the Pleistocene (Tweto 1979). Clear Creek headwaters begin as several alpine lakes that lie just below the Continental Divide and it becomes a third order stream near the upstream end of this site. Snowmelt is the primary source for water in Clear Creek and is the source for the dozens of fens, tarns and lakes that are scattered on terraces and slopes at high elevations throughout the watershed. Snowmelt also creates copious amounts of surface and shallow groundwater that discharges into the valley below. Toeslopes and terraces at the base of steep valley walls are saturated with shallow groundwater and surface discharge that eventually flows into the stream. Beaver (*Castor canadensis*) activity is high and makes an essential contribution to hydrologic function by altering stream dynamics and flows. Valley sideslopes, toeslopes, terraces, and bottomlands are dominated by moisture-loving plant communities. Bottomland communities are characterized by a patchwork of willow and non-willow shrublands, interspersed with wet herbaceous meadows and open water ponds. Habitat in the valley bottom is maintained by beaver activity and is characterized by wide willow carrs interspersed with wet meadows and large open water ponds. Planeleaf willow (*Salix planifolia*) is the dominant shrub throughout the beaver controlled willow carrs. Other common shrubs include bog birch (*Betula nana*), Geyer willow (*Salix geyeriana*) and shrubby cinquefoil (*Dasiphora floribunda*). The herbaceous layer is dominated by graminoids such as water sedge (*Carex aquatilis*), bluejoint reedgrass (*Calamagrostis canadensis*), tufted hairgrass (*Deschampsia*

caespitosa) and alpine timothy (*Poa alpina*) with a few forbs including King's crown (*Rhodiola integrifolia*), elephant head (*Pedicularis groenlandica*), and tall fringed bluebells (*Mertensia ciliata*). Plant communities on moist sideslopes, toeslopes and terraces are characterized by a patchy distribution of dense, low-growing shrubs, wet meadows and open water ponds with a few scattered tree islands. Tree islands are dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). Bog birch dominates the shrub cover. Other commonly associated shrubs include planeleaf willow, wolf willow (*Salix wolfii*) and barren ground willow (*Salix brachycarpa*). Herbaceous cover is a diverse mix of forbs, graminoids and mosses. Although herbaceous cover is somewhat sparse under the shrub canopy, in openings herbaceous cover is dense. Soils are typically saturated and hummocky with deep peat formation. Hummocks are covered with mosses and forbs which are growing on the hummock tops while graminoids typically grow in the moister hummock depressions. Common forbs include alpine meadow rue (*Thalictrum alpinum*), elephant head, heartleaf bittercress (*Cardamine cordifolia*), marsh marigold (*Caltha leptosepala*), brook saxifrage (*Saxifraga odontoloma*), broad-lipped twayblade (*Listera convallarioides*), northern bog-orchid (*Limnorchis hyperborea*), viviparous bistort (*Bistorta vivipara*), saffron senecio (*Senecio crocatus*) and tall fringed bluebells. Common graminoids include water sedge, beaked sedge (*Carex utriculata*), super turf (*Kobresia myosuroides*), and mountain sedge (*Carex scopulorum*). Upland habitat is a complex mosaic of forests, shrublands and meadows interspersed with scree and talus fields and cut by steep avalanche chutes that are densely covered by willow and bog birch. West-facing slopes are dominated by spruce - fir forests that interfinger with the valley wetlands. East-facing slopes are characterized by a mosaic of aspen (*Populus tremuloides*) woodlands, spruce - fir forest, and, on alluvial fans, mesic and dry meadows and shrublands. Commonly observed birds include White-crowned Sparrow (*Zonotrichia leucophrys*), Swainson's Thrush (*Catharus ustulatus*), Hermit Thrush (*Catharus guttatus*), Wilson's Warbler (*Wilsonia pusilla*), Mountain Chickadee (*Poecile gambeli*), Lincoln's sparrow (*Melospiza lincolni*), Ruby-crowned Kinglet (*Regulus calendula*) and Golden-crowned Kinglet (*Regulus satrapa*).

Key Environmental Factors: Hydrology and soil characteristics are the key driving factors to exert a major influence on biota at the site. Abundant shallow groundwater and surface discharge maintain soil moisture that has enabled peat development and the development of the characteristic moisture-loving plant communities.

Climate Description: Climate records for Independence Pass, which is approximately 12 miles to the northwest and on the west side of the Continental Divide, indicate a mean annual precipitation of 29.82 inches; the wettest months are January and March with a mean precipitation of 3.51 inches and 3.97 inches per month respectively; the driest months are June and September with a mean precipitation of 1.11 inches and 1.70 inches per month respectively; the warmest

month is July with a mean temperature of 51.9 deg F and the coldest month is January at 12.7 deg F. Average annual snowfall is 335.9 inches with January and March having the greatest monthly snowfall with a mean of 50.1 inches and 58.8 inches respectively (Western Regional Climate Center 2009).

Land Use History: Hard rock mining was extensive throughout the site.

Cultural Features: The historic mining town of Winfield is located at the downstream end of the site.

Biodiversity Significance Rank Comments (B3): The site supports two excellent (A-ranked) occurrences of the globally vulnerable (G3G4/S3) *Betula nana* / mesic forbs - mesic graminoids subalpine riparian shrubland.

Natural Heritage element occurrences at the Upper Clear Creek Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Betula nana</i> / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	2008-07-15
Natural Communities	<i>Betula nana</i> / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				A	2008-07-17

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

Boundary Justification: The boundary encompasses the occurrences and the ecological processes essential to sustaining them. It also provides a buffer against direct disturbance. The primary ecological process essential to long-term community viability is hydrology, specifically shallow groundwater or surface flow with annual episodic flooding (Rondeau 2001 and NatureServe 2009). Snowmelt runoff from the surrounding watershed and/or beaver activity maintains this hydrologic system (Rondeau 2001 and NatureServe 2009) and are important processes to include in the boundary.

Protection Urgency Rank Comments (P2): Northwest-facing slopes are a patchwork of public and private lands with numerous mining claims and prospects.

Management Urgency Rank Comments (M2): Activities that alter groundwater flow or surface flow, increase erosion or impact beaver activity have the potential to negatively affect ecosystem processes and community viability. Alteration of the flooding regime may lead to alteration of the plant composition and community (Rondeau 2001). Off-road motorized recreation and recreational camping and hiking

is very high and has the potential to result in soil erosion and vegetation trampling or damage and disturbance with consequently deleterious effects to the community. Additionally, mining-associated impacts such as roads, fragment upland landscapes, altering groundwater flow, increasing soil erosion and providing off-road vehicle access into natural landscapes.

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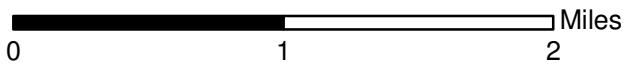
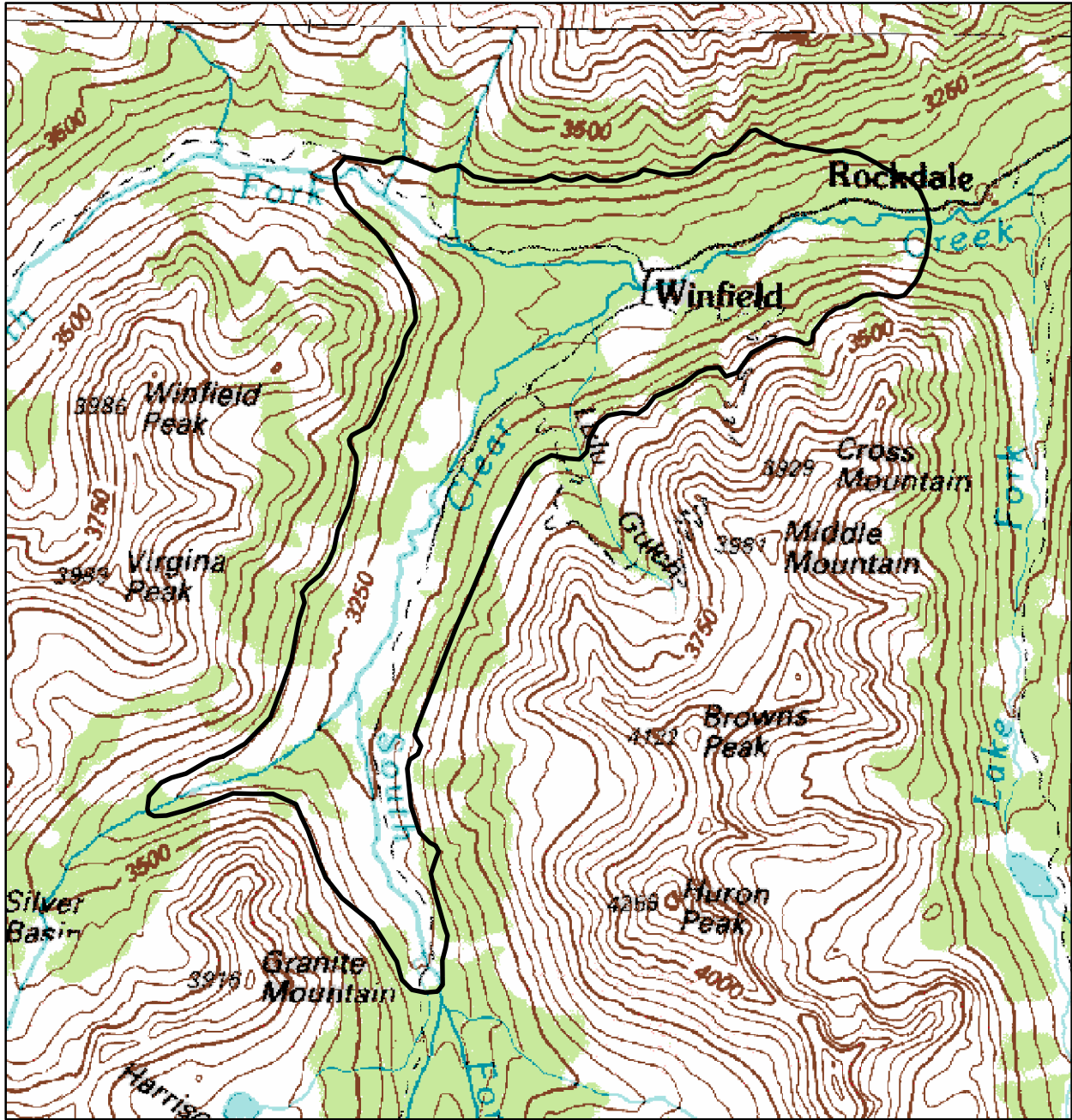
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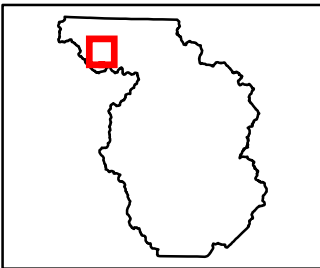
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Upper Clear Creek Canyon Potential Conservation Area, B3: High Biodiversity Significance

Collegiate Peaks View Area

Biodiversity Rank - B4: Moderate 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: Buena Vista East

Size: 112 acres (45 ha)

Elevation: 8,000 - 8,200 ft. (2,438 - 2,499 m)

General Description: The Collegiate Peaks View Area is located southeast of Buena Vista in the foothills of the Mosquito Range. It provides a very scenic overlook of several of the fourteeners that make up the Collegiate Peaks. There are roads, pullouts and restrooms located throughout the site. The vegetation is typical pinon pine (*Pinus edulis*) and one-seeded juniper (*Juniperus monosperma*). The soils are sandy loam derived from Precambrian granite.

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Biodiversity Significance Rank Comments (B4): The site supports a good to fair (BC-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*) and a fair (C-ranked) occurrence of the globally vulnerable (G3?/S3?) jeweled blazingstar (*Nuttallia speciosa*).

Natural Heritage element occurrences at the Collegiate Peaks View Area 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>Argyrochosma fendleri</i>	Fendler cloak - fern	G3	S3				BC	2008-06-14
Vascular Plants	<i>Nuttallia speciosa</i>	jeweled blazingstar	G3?	S3?				C	2006-06-27

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

Boundary Justification: The boundary encompasses the rare plant populations and includes a buffer of potential habitat for seed dispersal.

Protection Urgency Rank Comments (P3): The site is owned and managed by Bureau of Land Management.

Management Urgency Rank Comments (M3): The site has several roads that bisect it, the potential for loss of the jeweled blazingstar occurrence is high. There are several non native plants documented, Canada thistle (*Breca arvensis*) and Russian thistle (*Salsola australis*).

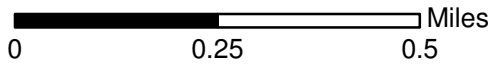
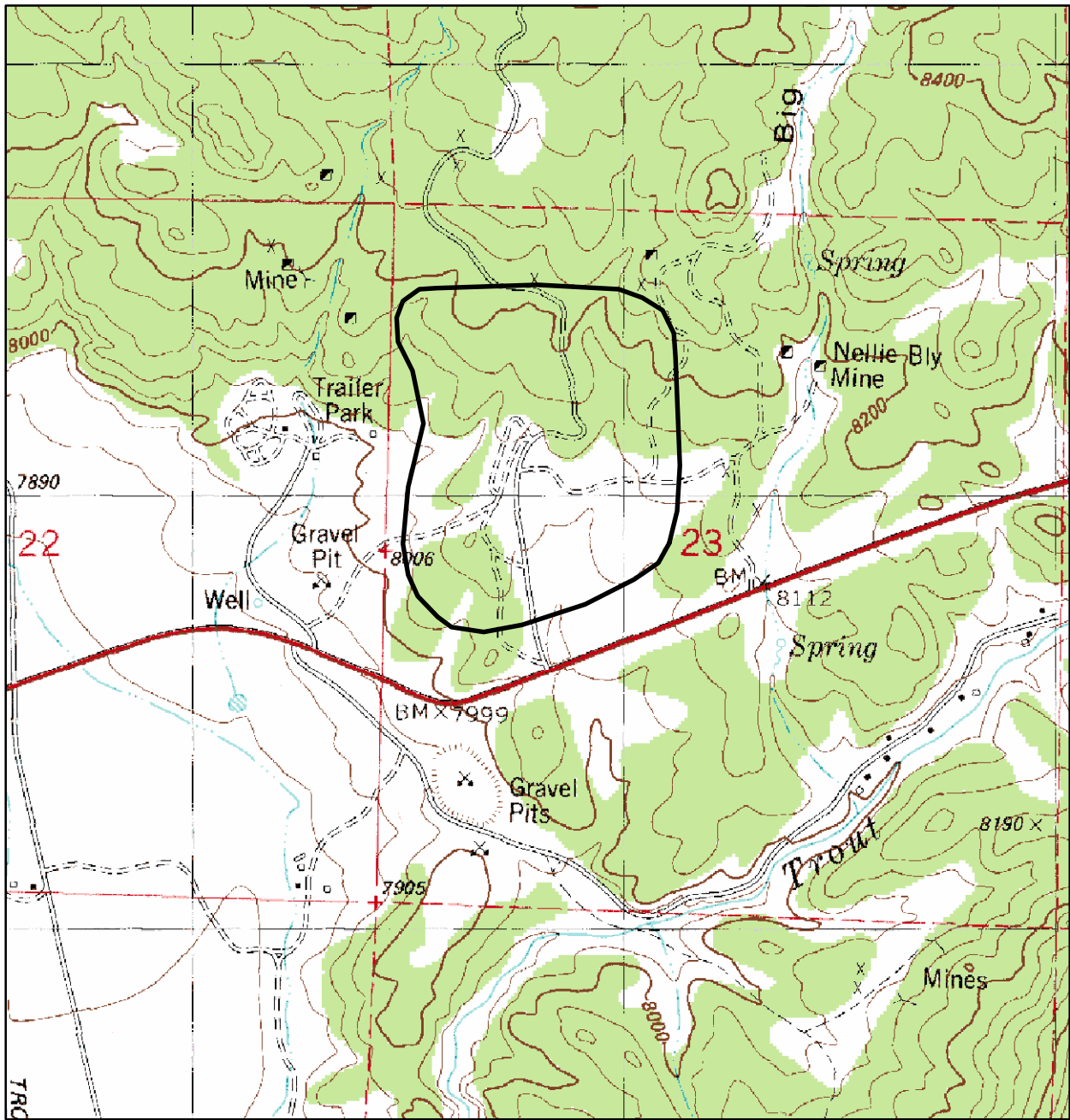
Exotic Species Comments: Canada thistle (*Cirium arvensis*) and Russian thistle (*Salsola australis*) have been documented.


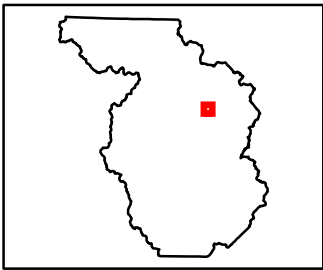
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Version Author: Culver, D.R.

Version Date: 03/05/2009



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Collegiate Peaks View Area Potential Conservation Area, B4: Moderate Biodiversity Significance

Limestone Ridge

Biodiversity Rank - B4: Moderate 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: Buena Vista East, Castle Rock Gulch

Size: 941 acres (381 ha) **Elevation:** 9,000 - 10,132 ft. (2,743 - 3,088 m)

General Description: The Limestone Ridge site is located within the Mosquito Range, above Highway 285 as it follows Trout Creek towards the Arkansas River valley. The Limestone Ridge is bordered by McGee Gulch to the west and Chubb Park to the east. The Ridge consists of metamorphic rocks of Mississippian Leadville limestone and Devonian Chaffee formation of light brown limestone (Chronic and Williams 2002). There is a limestone quarry located on the north side of the ridge. The vegetation on the south-facing slope is pinon pine (*Pinus ponderosa*) with one-seeded juniper (*Juniperus monosperma*) and scattered ponderosa pine (*Pinus ponderosa*). The north-facing slope is dominated by Douglas-fir (*Pseudotsuga menziesii*) and limber pine (*Pinus flexilis*).

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 70's to low 80's with evening temperatures in the high 40's and low 50's. Annual rainfall is 10.15" and annual snowfall is 30.4" with most snow occurring from the end of October through April.

Land Use History: A limestone quarry is located within the site.

Biodiversity Significance Rank Comments (B4): This site supports an extant occurrence of the Colorado endemic and globally vulnerable (G3/S3) Front Range alum-root (*Heuchera hallii*) that occurs from the Pikes Peak region southward (Weber and Wittman 2001).

Natural Heritage element occurrences at the Limestone Ridge 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>Heuchera hallii</i>	Front Range alum - root	G3	S3				E	2000-07-07

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

Boundary Justification: The boundary encompasses all of Limestone Ridge to capture the rare plant populations and potential habitat for seed dispersal.

Protection Urgency Rank Comments (P3): The majority of the site is owned and managed by Pike-San Isabel Forest. There is a private parcel located within the site.

Management Urgency Rank Comments (M3): The site is vulnerable to expansion of the limestone quarry.

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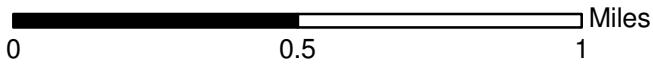
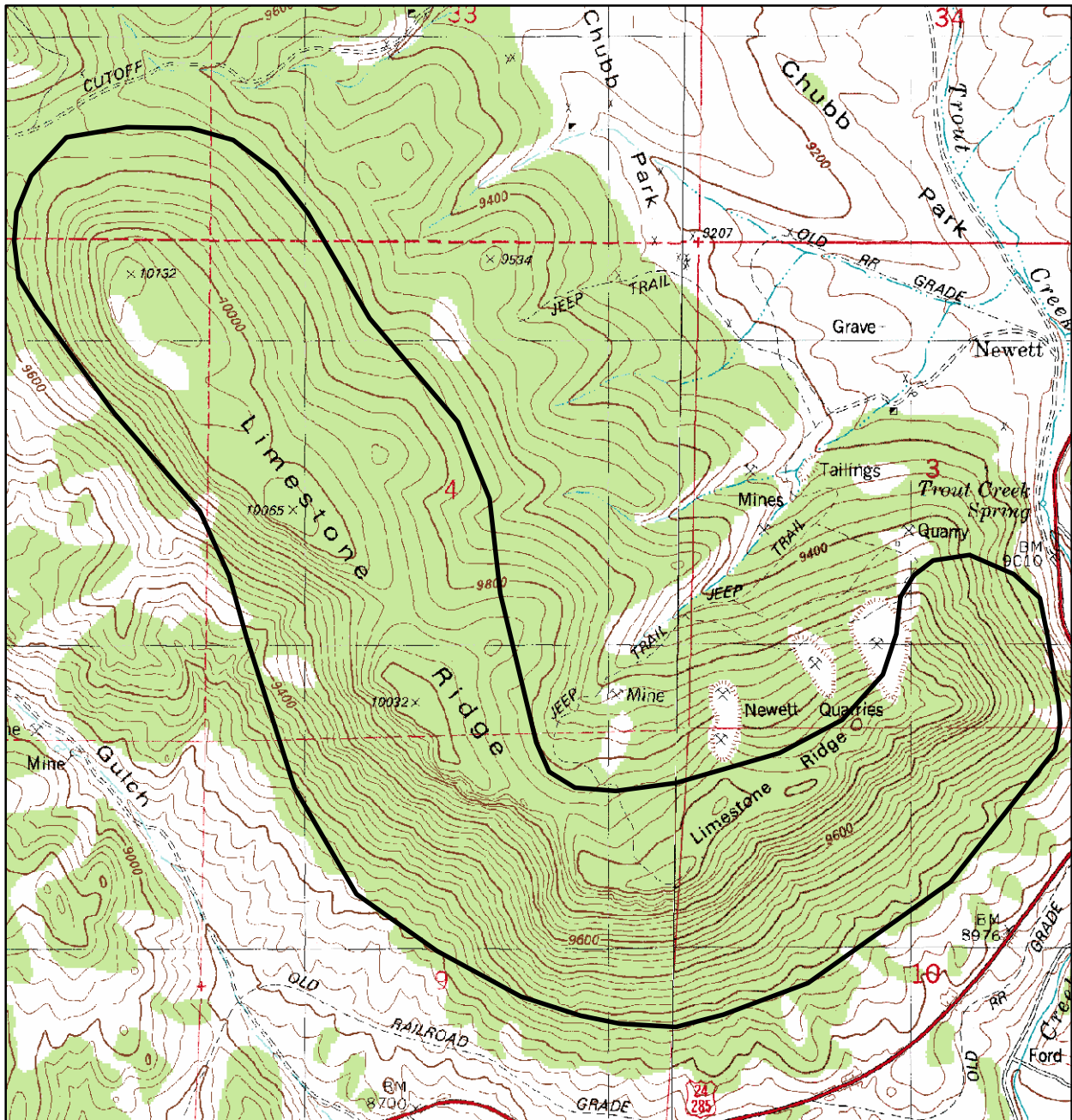
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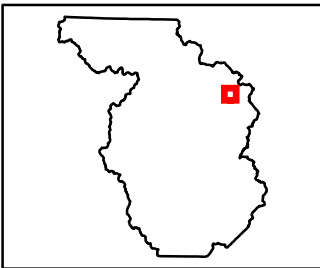
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Version Date: 03/05/2009



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Limestone Ridge Potential Conservation Area, B4: Moderate Biodiversity Significance

Little Cochetopa Creek

Biodiversity Rank - B4: Moderate 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: Mount Ouray

Size: 1,163 acres (471 ha)

Elevation: 11,020 - 12,685 ft. (3,359 - 3,866 m)

General Description: The site encompasses a wide glacial cirque on the northeast side of the Continental Divide in the Sawatch Mountain Range. It extends to the Continental Divide at 12,685 ft and lowers to 11,020 ft where the valley begins to narrow and steepen. Little Cochetopa Creek has its headwaters in this glacial cirque and flows to the northeast until its confluence with the South Arkansas River, approximately two miles west of Poncha Springs. Little Cochetopa Creek begins as snowmelt that gathers into rivulets and alpine tarns and then flow and coalesce into first order streams on the slopes of a glacial cirque around 12,000 ft. At their origins, the streams plunge down through steep talus and scree slopes. Several streams unite at 11,300 ft when they reach the valley bottom. There they meander widely across the broad, gently sloping, and glacially sculpted basin. Basin geology is Pleistocene aged glacial drift from the Pinedale and Bull Lake glaciation (Tweto 1979). Cirque walls are metamorphic rock, aged 1,700 to 1,800 M.Y., of felsic and hornblende gneisses. Soils are saturated to inundated and hummocky with peat formation to a depth greater than 20 inches that occurs as a patchy distribution throughout the site. Copious amounts of snowmelt from the high surrounding peaks and ridges maintain the lush wetland vegetation that characterizes the verdant valley floor habitat. Beaver activity is prolific and is important in conserving and maintaining flows and soil moisture. Stream sinuosity is moderate to high and the stream channel is a characteristic Rosgen type "E" channel. Out-of-bank flows are common and contribute to maintaining soil moisture. Valley bottom habitat is characterized by a mosaic of willow carrs and wet herbaceous meadows. Willow carrs occur as a patchy mosaic of willow species dominated by the planeleaf willow / bluejoint reedgrass - water sedge (*Salix planifolia* / *Calamagrostis canadensis* - *Carex aquatilis*) shrubland association. Other common shrubs include bareground willow (*Salix brachycarpa*) and shrubby cinquefoil (*Dasiphora floribunda*). Herbaceous wet meadows interfinger with the stands of willow forming a complex habitat mosaic. Graminoids and forbs are present but graminoids dominate herbaceous cover. Bluejoint reedgrass and water sedge dominate the herbaceous cover but numerous other graminoids are also present including Rocky Mountain sedge (*Carex scopulorum*), needle spike sedge (*Eleocharis acicularis*), tufted hairgrass (*Deschampsia caespitosa*), kobresia (*Kobresia myosuroides*), alpine timothy (*Poa alpina*), Drummond's rush (*Juncus drummondiana*) and subalpine rush (*Juncus mertensianus*). Forbs are diverse

but cover is typically much less than graminoid cover. Typical forb species include elephant head (*Pedicularis groenlandica*), star gentian (*Swertia perennis*), King's crown (*Rhodiola integrifolia*), alpine lousewort (*Pedicularis sudetica*), brook saxifrage (*Saxifraga odontoloma*), and triangular-leaf senecio (*Senecio triangularis*).

Key Environmental Factors: Hydrology and soils are the key driving factors that exert a major influence on biota at the site.

Climate Description: Climate records in the town of Pitkin, located approximately 21 miles to the northwest but on the west side of the Continental Divide, indicate winters are generally cold with abundant snowfall (114.2 inches annual average) and summers are mild and wet. Mean annual precipitation is 16.92 inches; the wettest months are July and August with an average precipitation of 2.17 and 2.05 inches respectively while the driest are November with 1.01 and June with 1.03 inches; the coldest month is January with an average temperature of 12 deg F and the warmest is July at 55 deg F (Western Regional Climate Center 2009).

Biodiversity Significance Rank Comments (B4): The site supports an excellent (A-ranked) example of a globally secure (G5/S4) *Salix planifolia* / *Carex aquatilis* subalpine riparian willow carr. Although this is plant association is known throughout the Rocky Mountains in Wyoming, Colorado and Utah, impacts from improper grazing, road improvements and heavy recreational use threaten its viability (NatureServe 2009).

Natural Heritage element occurrences at the Little Cochetopa Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	Subalpine Riparian Willow Carr	G5	S4				A	2008-09-11

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

Boundary Justification: The boundary encompasses the occurrence and includes a buffer to protect the ecological processes essential to sustaining the plant community. The primary ecological process essential to long-term community viability is hydrology, specifically shallow groundwater or surface flow with annual episodic flooding (Rondeau 2001 and NatureServe 2009). Snowmelt runoff from the surrounding watershed and/or beaver activity maintains this hydrologic system (Rondeau 2001 and NatureServe 2009) is integral to the sustainability of the site.

Protection Urgency Rank Comments (P4): The site is managed by the USFS. Recreational use is low and there is little sign of recreational impact.

Management Urgency Rank Comments (M4): Beaver are primary maintainers as

well as users of this system (Rondeau 2001) and their activity clearly benefits this ecological system whereas their absence often results in community alteration. Increased beaver activity would benefit the site as beaver populations appear to have recently declined. Elk populations are very high and the plant community would likely benefit by a decrease in the amount of elk browse.

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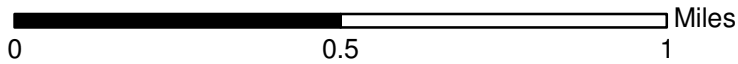
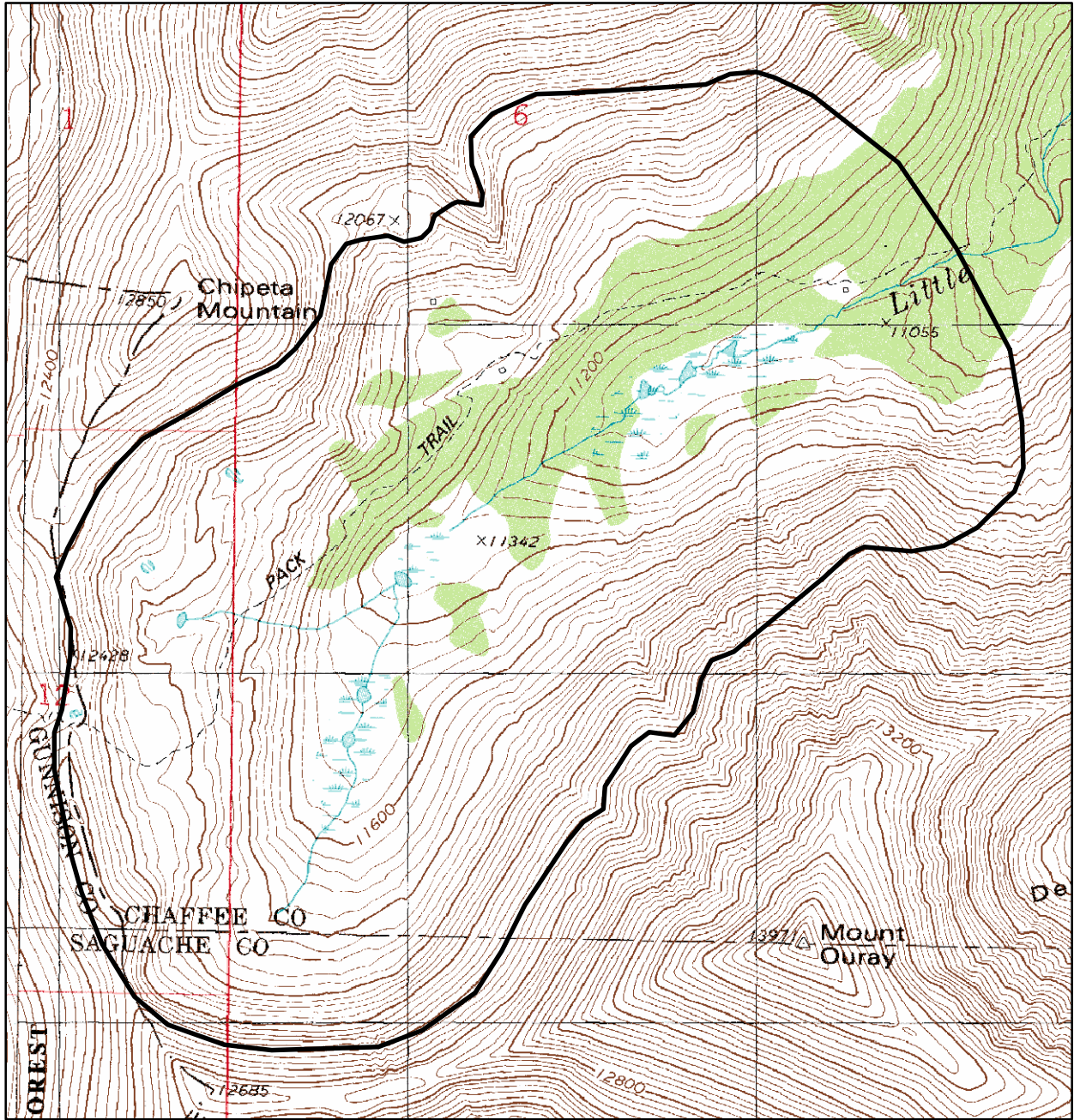
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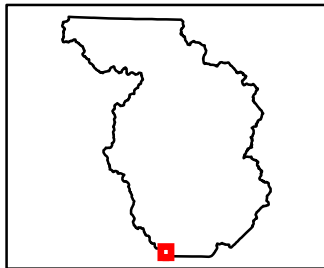
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Little Cochetopa Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

McGee Gulch

Biodiversity Rank - B4: Moderate 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: Buena Vista East, Marmot Peak

Size: 2,033 acres (823 ha)

General Description: The site is located on the west slope of the Mosquito Range in the montane zone of the Southern Rockies. McGee Gulch is a moderately wide, gently to moderately sloping valley that trends southeast. The sandy, valley bottom of McGee Gulch is drained by an ephemeral stream that has its confluence with Trout Creek approximately six miles upstream of Johnson Village. The landscape here is characterized by rounded ridges punctuated by granite outcrops that are weathered and smooth. Geology of adjacent surrounding hillslopes is Precambrian igneous granitic rocks of 1,700 M.Y. age group. Ridge tops on the western hillslopes are capped with sedimentary limestone rocks of pre-Pennsylvanian age (Tweto 1979). Surrounding uplands are well drained and support drought-tolerant plant communities. Habitat is characterized by a mosaic of mesic to dry woodlands, shrublands and herbaceous meadows. Drier sites support a mosaic of pinon - juniper (*Pinus edulis* - *Juniperus scopulorum*) and ponderosa (*Pinus ponderosa*) woodlands, herbaceous meadows and sage - rabbitbrush (*Artemisia tridentata* - *Chrysothamnus nauseosus*) shrublands. Herbaceous meadows are dominated by graminoids including blue gramma (*Chondrosum gracilis*), junegrass (*Koeleria macrantha*) and mountain muhly (*Muhlenbergia montana*). Douglas-fir (*Pseudotsuga menziesii*) forests inhabit moister, north-facing slopes. In moist ravines aspen (*Populus tremuloides*) forests dominate while at lower elevations moist valley bottoms are dominated by narrowleaf cottonwood (*Populus angustifolia*) forests. Riparian habitat has seasonally saturated soils and is characterized by a linear mosaic of shrublands, herbaceous wet meadows and woodlands. Shrublands occur as a patchy mosaic of stands of shrubs, herbaceous meadows and open water. Willow shrubland associations in the valley bottom include the Geyer willow (*Salix geyeriana*) / mesic graminoids association. Geyer willow dominates the shrub canopy in this association but other shrub species are also present including shrubby cinquefoil (*Dasiphora floribunda*), Drummond's willow (*Salix drummondiana*) and shining willow (*Salix lasiandra*). The herbaceous layer is dominated by a diverse mix of graminoid species with a high cover. Common graminoids include woolly sedge (*Carex pellita*), beaked sedge (*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), Kentucky bluegrass (*Poa pratensis*) and arctic rush (*Juncus balticus*). Common forbs include stinging nettle (*Urtica gracilis*), leafy polemonium (*Polemonium foliosissimum*) and checker mallow (*Sidalcea candida*). Other common shrubland communities in the valley bottom include mixed stands of mountain willow (*Salix monticola*), coyote

willow (*Salix exigua*), shining willow, Geyer willow, shrubby cinquefoil and Wood's rose (*Rosa woodsii*). The herbaceous understory is typically a patchy mosaic of forbs and graminoids with neither dominant over large areas. Common forbs include bee balm (*Monarda* spp.), willow herb (*Epilobium* spp.), geranium (*Geranium richardsonii*) and tall fringed bluebells (*Mertensia ciliata*). Common graminoids include arctic rush, Kentucky bluegrass, and fowl mannagrass (*Glyceria striata*). In the valley bottom aspen woodlands intervene between willow carrs and stands of shrubs creating a linear mosaic. The aspen shrub understory here is dominated by a mix of shrubby cinquefoil and Wood's rose with an herbaceous layer dominated by graminoids. Other shrub species include wax currant (*Ribes cereum*), gooseberry (*Ribes inerme*), and snowberry (*Symphoricarpos oreophilus*). Dominant graminoids include arctic rush, western wheatgrass (*Pascopyrum smithii*), fowl mannagrass, fringed brome (*Bromus ciliatus*) and Kentucky bluegrass. Common forbs include geranium, yarrow (*Achillea millefolium*), harebell (*Campanula rotundifolia*) and mountain lupine (*Lupinus argenteus*). Aspen forests also dominate along the ridge top and down into moist swales. Here small patches of willows, dominated by Drummond's willow, occur where the slope gradient lessens and groundwater discharges to the surface. Herbaceous cover in these small wetland patches is characterized by a mix of forbs and graminoids. Common forbs include fireweed (*Epilobium angustifolium*), golden banner (*Thermopsis montana*), geranium, harebell, and yarrow. Common graminoids include arctic rush, small-winged sedge (*Carex microptera*), fringed brome and orchard grass (*Dactylis glomerata*).

Key Environmental Factors: Hydrology, climate and disturbance are key driving factors that exert a major influence on biota at the site.

Climate Description: Climate records for Buena Vista, which is on the valley floor and approximately six miles to the west, indicate a mean annual precipitation 9.79 inches; the wettest months are July and August with 1.7 and 1.65 inches of precipitation per month respectively; the driest month is January with 0.34 inches; the warmest month is July at 64oF and the coldest month is January at 24 deg F (Western Regional Climate Center 2009). At Antero Reservoir, approximately 12 miles to the northeast, Climate Center records indicate that the wettest months are July and August with a mean precipitation of 2.30 inches, the driest is January at 0.21 inches; the warmest month is July at 76.2 deg F and the coldest is January at 32.5 deg F (Western Regional Climate Center 2009).

Land Use History: Mining was common as indicated by the numerous mine sites that are present on hillslopes. Domestic livestock grazing was also likely common as indicated by changes in the composition of native plant communities.

Biodiversity Significance Rank Comments (B4): The site supports a fair (C-ranked) occurrence of the globally vulnerable (G3?/S3) Geyer's willow (*Salix geyeriana*) / mesic graminoids shrubland. Although this association is widely distributed at mid to high elevations from the Great Basin to the Central Rockies and north to Idaho

and Wyoming, the total occurrence of stands with a native understory is probably less than 100 (NatureServe 2009).

Natural Heritage element occurrences at the McGee 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
Natural Communities	Salix geyeriana / Mesic Graminoids Shrubland	Geyer's Willow / Mesic Graminoid	G3?	S3				C	2008-08-08

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

Boundary Justification: The boundary was drawn to encompass the element occurrence and the ecological and hydrological processes that are essential to maintain viability. Hydrology, and specifically surface flow, is essential to maintain the ecological system (Rondeau 2001). Shallow groundwater and surface flow has been dramatically altered by roads that occur in the riparian zone and stream channel as well as by the numerous roads that fragment upland habitats. Additionally, historic overgrazing by livestock likely occurred, as indicated by the ubiquitous and abundant presence of non-native plant species and by plant community composition.

Protection Urgency Rank Comments (P2): This site is publicly owned and managed by the USFS.

Management Urgency Rank Comments (M2): The plant community would benefit by the management of non-native plant species. The element would also greatly benefit by the restoration of a natural hydrologic regime especially, the re-routing of roads away from the active stream channel and into more resilient habitats with less erosive soils. Hydrology, and specifically shallow groundwater and surface flow is essential to the viability of the element occurrence. A web of dirt roads fragments the landscape altering the natural pattern of shallow overland flow, disrupting hydrology, increasing soil erosion and impacting system viability. One consequence is that over much of the drainage the channel is severely downcut and eroding. Additionally, non-native weeds are ubiquitous which is likely a result of hydrologic alteration in combination with overgrazing.

Exotic Species Comments: Non-native weeds are ubiquitous throughout and include Kentucky bluegrass, orchard grass, plumeless thistle (*Carduus acanthoides*), yellow sweetclover (*Melilotus officinale*), squirrel tail (*Elymus elymoides*), goosefoot (*Chenopodium* spp.), field pepperweed (*Lepidium campestre*), Canada thistle (*Cirsium arvense*), and common burdock (*Arctium minus*).

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Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

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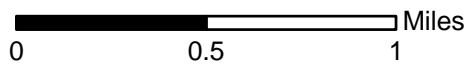
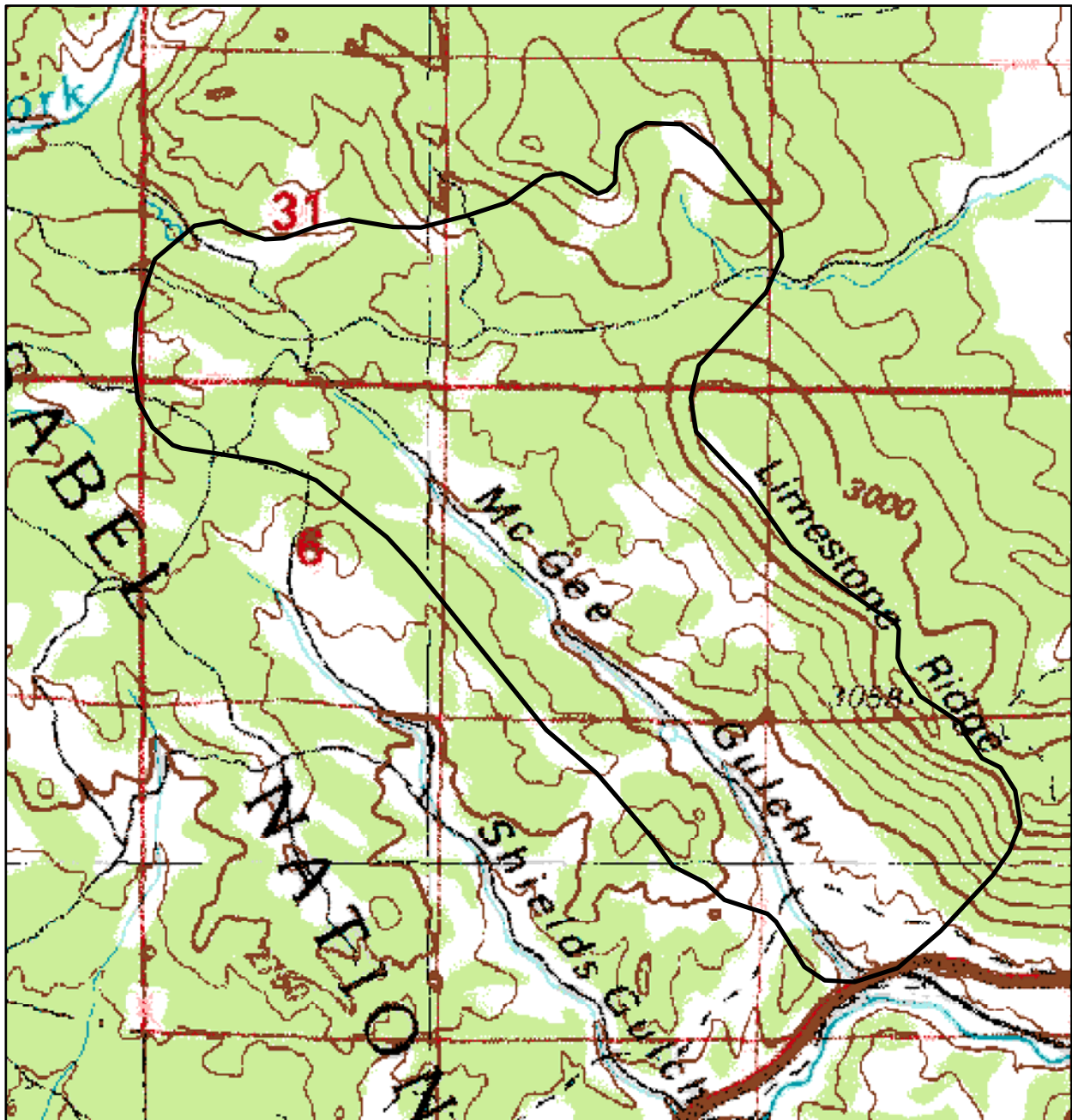
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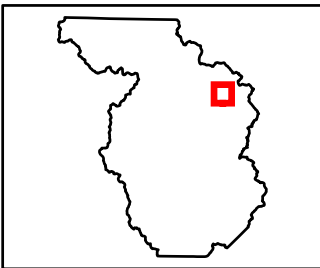
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Western Regional Climate Center. 2009. Period of Record Climate Summaries for Buena Vista and Antero stations. Accessed in 2009. <http://www.wrcc.dri.edu/Climsum.html>

Version Author: Malone, D.G

Version Date: 04/17/2009



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McGee Gulch Potential Conservation Area, B4: Moderate Biodiversity Significance

Poncha Hot Springs

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

U.S.G.S. 7.5-minute quadrangles: Salida West, Poncha Pass

Size: 186 acres (75 ha)

Elevation: 7,500 - 8,700 ft. (2,286 - 2,652 m)

General Description: The Poncha Hot Springs site is located on the hills above the Town of Poncha Springs. Historically, the hot springs were used by the Ute Indians and later early European travelers such as Zebulon Pike and Kit Carson, who supposedly named the hot springs. In 1935, the City of Salida purchased the hot springs and piped the thermal water to the city's pool. There are still a few seeps that support a small wetland dominated by common reed (*Phragmites australis*), stream orchid (*Epipactis gigantea*), dogbane (*Apocyonum cannabinum*), sunflower (*Helianthus nuttalli*), goldenrod (*Solidago canadensis*), and redtop grass (*Agrostis gigantea*). At the source of geothermal hot springs is a small alkaline wetland dominated by beaked spikerush (*Eleocharis rostellata*) and knotted rush (*Juncus nodosus*), both indicators of mineral deposits. Above the springs are remnants of travertine deposited before the springs was altered. The uplands consist of pinon pine (*Pinus edulis*), one-seeded Juniper (*Juniperus monosperma*), Gambels oak (*Quercus gambelii*), and Douglas-fir (*Pseudotsuga menziesii*).

Land Use History: During the 1870's the hot springs flourished. A hotel was built to accommodate the people among whom were such notables as the McGruder's of Civil War fame, Ulysses S. Grant and even H.A.W. Taylor and his wife. The hotel burned down in 1893. Another was built at the site, but it too ended in ashes in 1903. The Holman family came in 1904 to manage the springs. On their arrival, they found a large round swimming pool made of rock and completely plastered by hand. There were two cabins, two baths, and a sleeping room. In 1927, Donald Hartwich took over the springs and ran it until 1935 when the City of Salida had the water piped to the Salida pool (<http://www.ponchaspringscolorado.us/>).

Biodiversity Significance Rank Comments (B4): The site supports a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) narrowleaf cottonwood / river birch (*Populus angustifolia* / *Betula occidentalis*) riparian forest and a fair (C-ranked) occurrence of a globally vulnerable (G3/S2) narrowleaf cottonwood - Douglas-fir (*Populus angustifolia* - *Pseudotsuga menziesii*) riparian forest. A beaked spikerush (*Eleocharis rostellata*) wetland, in poor (D-ranked) condition, was documented at the discharge site of several seeps. This wetland plant association is uncommon (G3/S2) and is localized to calcareous wet meadows, seeps and mineral springs. There is also a fair (C-ranked) occurrence of a state rare (G4/S2) stream orchid, helleborine

(*Epipactis gigantea*), which is known from British Columbia and the western U.S. This is one of the few sites where over 5,000 stems were counted.

Natural Heritage element occurrences at the Poncha Hot Springs PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Eleocharis rostellata Herbaceous Vegetation	Emergent Wetland	G3	S2				D	2008-08-13
Natural Communities	Populus angustifolia - Pseudotsuga menziesii Woodland	Montane Riparian Forest	G3	S2				C	2008-08-09
Natural Communities	Populus angustifolia / Betula occidentalis Woodland	Montane Riparian Forest	G3	S3				C	2008-08-09
Vascular Plants	Epipactis gigantea	helleborine	G4	S2			USFS	C	2008-08-13

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

Boundary Justification: The boundary encompasses the wetland elements within the groundwater discharge area to provide a buffer for the stream orchid and beaked sedge wetland. The boundary is also drawn to capture the riparian forest below the groundwater discharge area. This includes Poncha Creek and several of its intermittent tributaries below Poncha Pass to the town of Poncha Springs.

Protection Urgency Rank Comments (P2): This site is owned by the City of Salida who also owns the water rights.

Management Urgency Rank Comments (M1): The area needs weed management, especially control of Canada thistle (*Cirsium arvensis*)

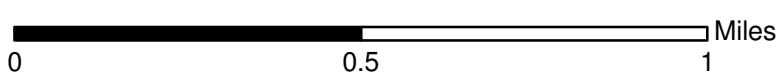
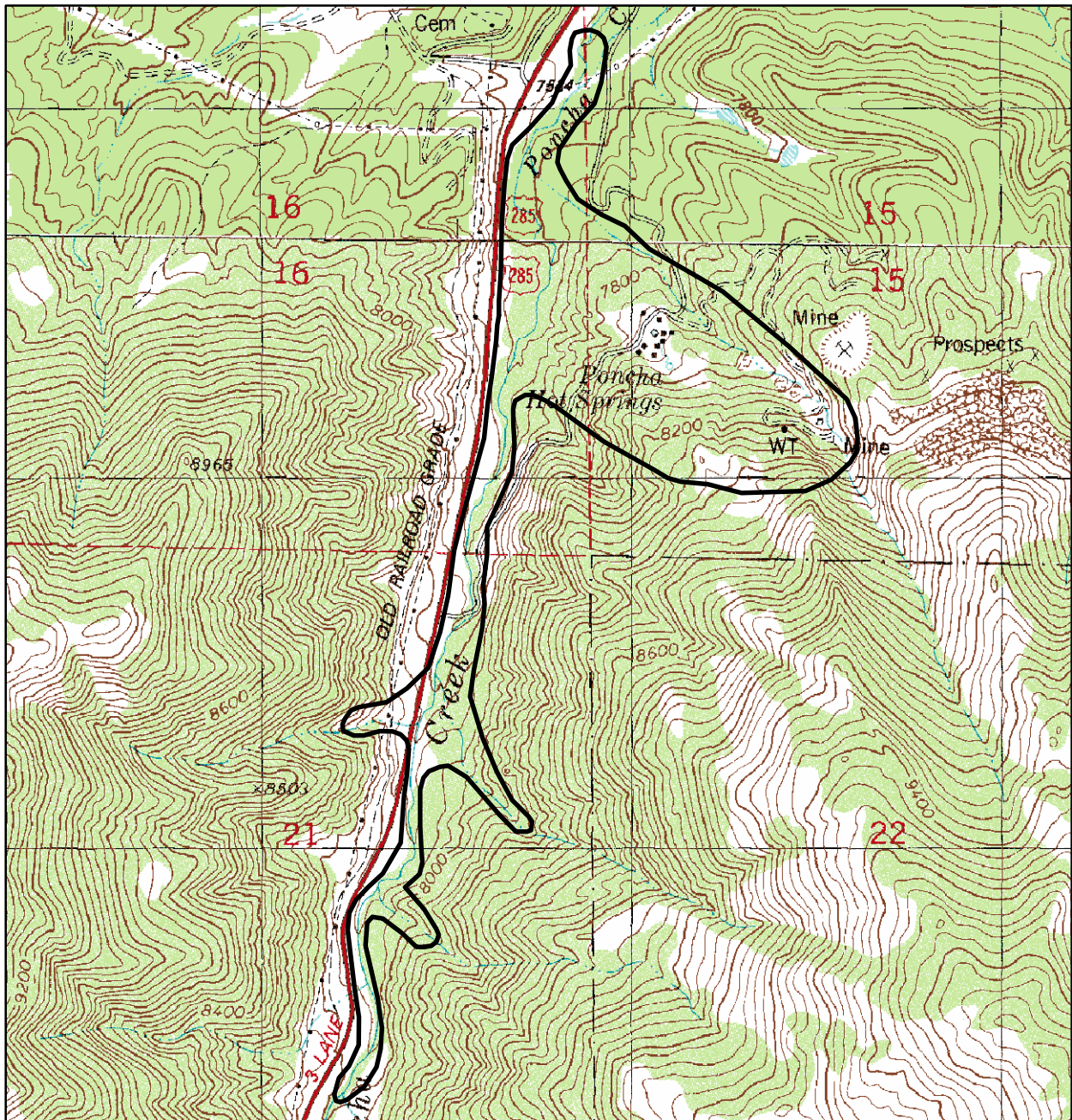
Exotic Species Comments: Large areas of Canada thistle were observed.


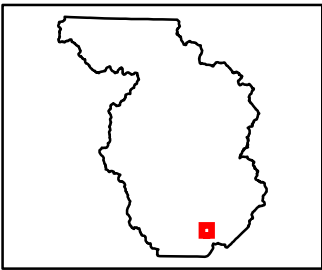
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 01/14/2009



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Poncha Hot Springs Potential Conservation Area, B4: Moderate Biodiversity Significance

Upper Morgans Gulch

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M5: Not Needed; No Threats Anticipated

U.S.G.S. 7.5-minute quadrangles: Cumberland Pass

Size: 502 acres (203 ha)

Elevation: 12,000 - 12,900 ft. (3,658 - 3,932 m)

General Description: Upper Morgans Gulch is located at the headwaters of Morgans Gulch just east of the Continental Divide and is typical of the Sawatch Range with shallow, granitic soils. Glacially carved lakes are scattered throughout. The site consists of typical alpine vegetation that has adapted to intense solar radiation, extreme cold, and dry, desiccating winds. The vegetation is dominated by Ross' avens (*Geum rossii*), boreal sagebrush (*Artemisia arctica*), dry sedges (*Carex elynoides*, *C. foena*, *C. rupestris*), alpine clovers (*Trifolium dasyphyllum*, *T. nanum*), and several alpine grasses (*Deschampsia cespitosa*, *Trisetum spicatum*, *Festuca brachyphyllum*). Animals that are known to utilize this site and other alpine areas include American Pipit (*Anthus rubescens*), Brown-capped Rosy Finch (*Leucosticte australis*), and White-tailed Ptarmigan (*Lagopus muta*).

Climate Description: The site receives an average of 300 days of sunshine each year. A typical summer day is sunny, in the high 60's to low 70's with evening temperatures in the 30's or 40's. Annual rainfall is 10 inches and snowfall 30 inches, with more in the higher elevations.

Biodiversity Significance Rank Comments (B4): This site supports a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) Colorado Divide whitlow-grass (*Draba streptobrachia*), a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) thick-leaf whitlow-grass (*Draba crassa*) and an extant occurrence of the state rare (G5/S2) woods draba (*Draba oligosperma*).

Natural Heritage element occurrences at the Upper Morgans 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>Draba crassa</i>	thick - leaf whitlow - grass	G3	S3				C	2005-08-28
Vascular Plants	<i>Draba streptobrachia</i>	Colorado Divide whitlow - grass	G3	S3				C	2005-08-28
Vascular Plants	<i>Draba oligosperma</i>	woods draba	G5	S2				E	2005-08-28

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

Boundary Justification: The boundary includes the occurrences and a buffer against direct disturbance. The natural processes are not completely contained in the boundary, and off-site activities within the larger area have the potential to impact the rare plant populations.

Protection Urgency Rank Comments (P4): The site is owned and managed by San Isabel National Forest, there is no special designation.

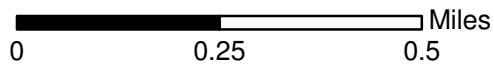
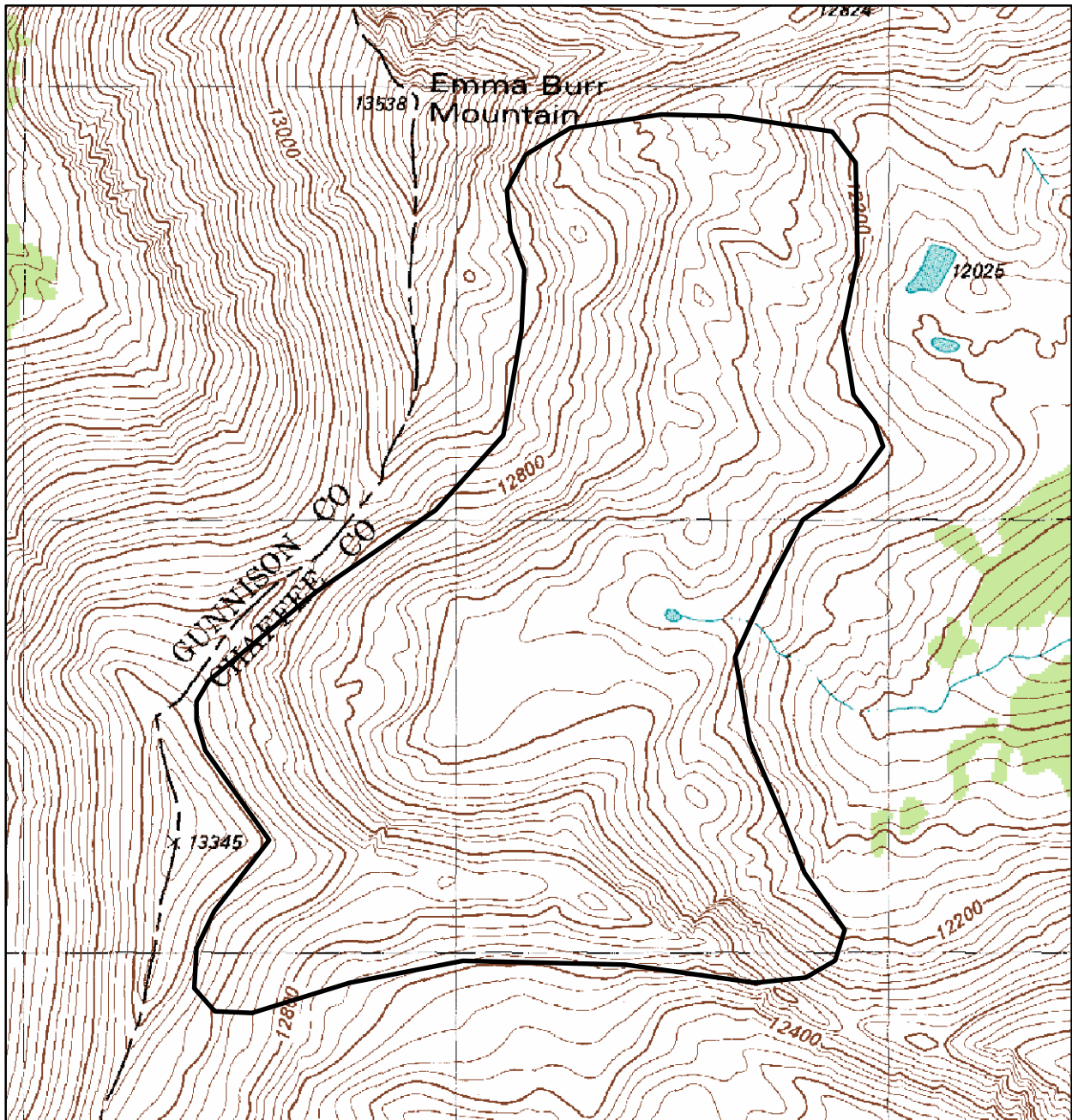
Management Urgency Rank Comments (M5): No management needs are anticipated at this time.


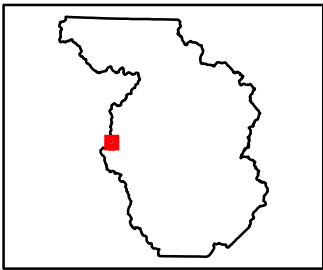
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Culver, D.R.

Version Date: 01/16/2009



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Upper Morgans Gulch Potential Conservation Area, B4: Moderate Biodiversity Significance

Cleora North

Biodiversity Rank - B5: General Biodiversity Interest

Protection Urgency Rank - P?: Unknown

Management Urgency Rank - M?: Unknown

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

Size: 224 acres (91 ha)

Elevation: 6,950 - 7,600 ft. (2,118 - 2,316 m)

General Description: This site is located in a sparse pinon - juniper community just upslope from the Arkansas River. A complex of mines and roads occur within the boundaries.

Biodiversity Significance Rank Comments (B5): This site supports an extant (E-ranked) occurrence of the state rare (G4T4/S2) Townsend's big-eared bat (*Plecotus townsendii pallescens*). The mine supports a maternity colony for this species, few of which are known in Colorado.

Natural Heritage element occurrences at the Cleora North PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Mammals	<i>Plecotus townsendii pallescens</i>	Townsend's Big-eared Bat Subsp	G4T4	S2		SC	BLM/USFS	E	2004-99-99

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

Boundary Justification: The boundary is drawn to encompass the occupied mine opening and other nearby mines. The mine opening is essential to this bat occurrence and the opening is the focus of this site. Additional area above and below the opening is also included to provide a small buffer around the mine to protect from direct disturbance.

Protection Urgency Rank Comments (P?): Protection urgency rank unknown.

Management Urgency Rank Comments (M?): Management urgency rank unknown.

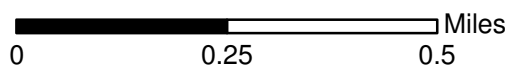
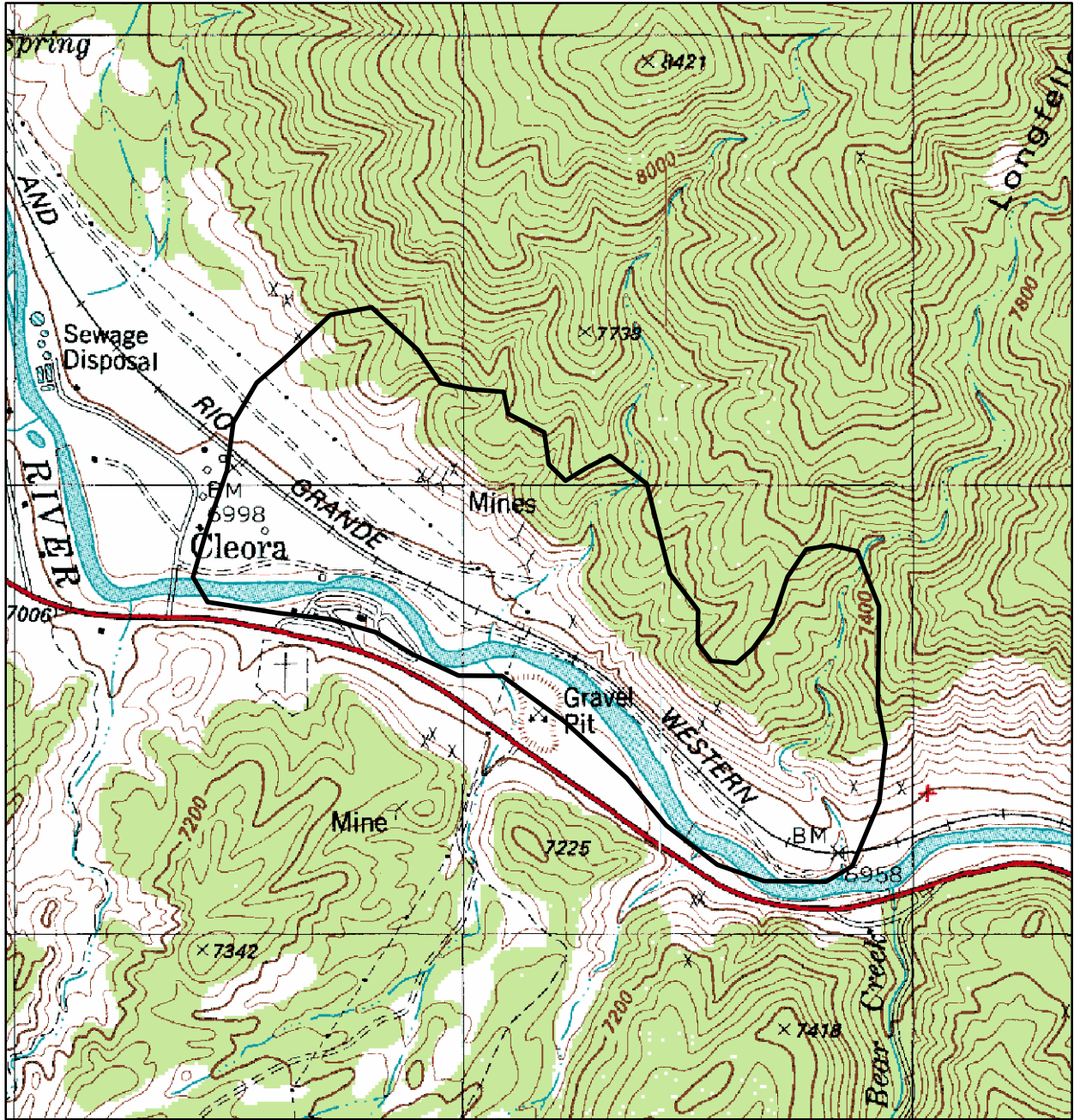
Information Needs: Current field surveys are needed to verify the site boundary and assess the quality of the bat population.


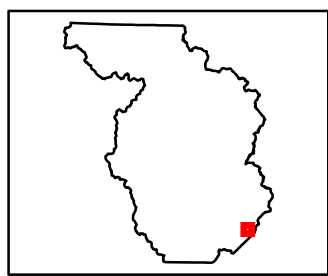
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A.

Version Date: 06/06/1995



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Cleora North Potential Conservation Area, B5: General Biodiversity Interest

Maxwell Park

Biodiversity Rank - B5: General Biodiversity Interest

Protection Urgency Rank - P?: Unknown

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

U.S.G.S. 7.5-minute quadrangles: Buena Vista East, Nathrop, Salida West, Mount Antero, Buena Vista West

Size: 44,448 acres (17,988 ha)

General Description: This site contains areas of montane grassland and some herbaceous/cultivated lands suitable for the Gunnison's prairie dog (*Cynomys gunnisoni*). Some areas of thin pinon - juniper and sagebrush are also included within the site boundary.

Biodiversity Significance Rank Comments (B5): This site is drawn for extant (E-ranked) occurrences of the globally secure (G5/S5) Gunnison's prairie dog (*Cynomys gunnisoni*).

Natural Heritage element occurrences at the Maxwell Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Mammals	<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	G5	S5	C		USFS	E	2008-99-99

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

Boundary Justification: Boundary of this site is drawn to encompass Gunnison's prairie dog occurrences in and near Maxwell Park. The site contains areas of montane grassland and some herbaceous/cultivated lands suitable for the prairie dog. Some areas of thin pinon - juniper and sagebrush are also included.

Protection Urgency Rank Comments (P?): Protection urgency rank unknown.

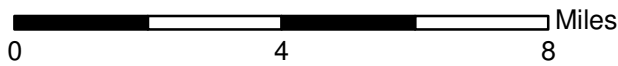
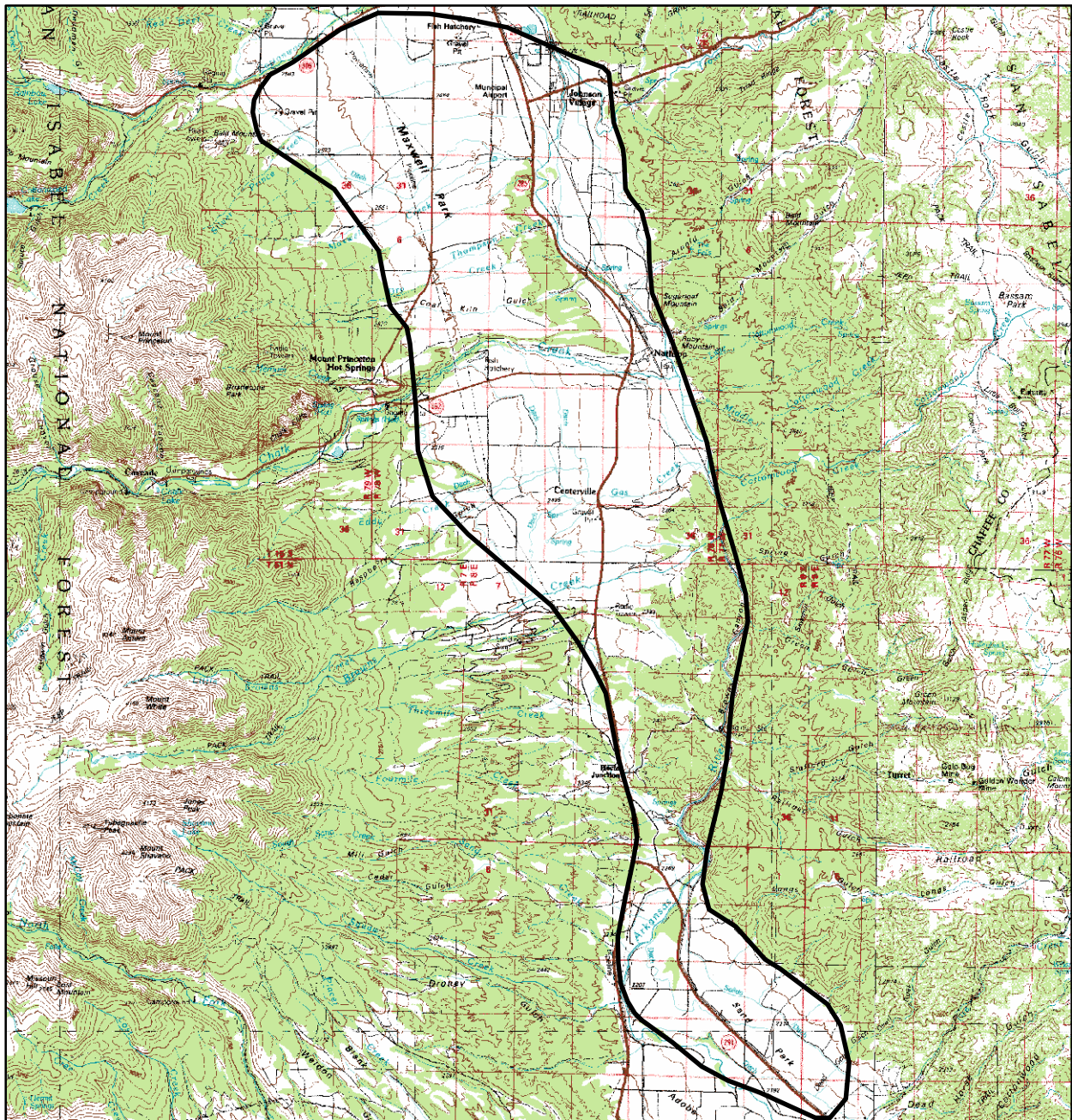
Management Urgency Rank Comments (M4): Management may be needed in the future to maintain the quality of the element occurrences. The effects of agricultural activities should be evaluated.


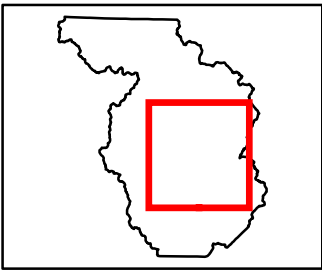
References

Culver, D.R., D. Malone, S.L. Neid, and J. Handwerk. 2009. Final Report: Survey of Critical Biological Resources in Chaffee County. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Siemers, J.L.

Version Date: 04/08/2009



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Maxwell Park Potential Conservation Area, B5: General Biodiversity Interest

Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Alnus incana* - *Salix drummondiana* Shrubland
State Common Name Montane Riparian Shrubland
Global Scientific Name: *Alnus incana* - *Salix drummondiana* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Speckled Alder Temporarily
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: The rank is based on recent field work and a community characterization assessment. It is known from 31 locations throughout southern Colorado. Stands are small and found in high-gradient stream valleys with fully functional hydrologic regimes. The association persists and re-establishes where landscape/watershed-scale hydrology remains intact and where grazing pressures are regulated. Declines are due to degradation by livestock, disruption of natural flooding regimes, invasion of exotics and, historically, by the lack of beaver. Most known occurrences are in good condition and appear generally stable, but will require monitoring for effects of roads, grazing and weeds. The invasion of exotics species is probably irreversible, but they are not likely to dominate a site to the exclusion of native species. Most stands are not threatened within 5 years under current management.

Subnational Rank: S3

Subnational Rank Reasons: The association is known from 31 locations throughout southern Colorado. A more complete inventory will most likely find many additional occurrences. Stands are small and found in high-gradient stream valleys with fully functional hydrologic regimes. The association persists and re-establishes where landscape/watershed-scale hydrology remains intact and where grazing pressures are regulated (NatureServe, 2009) .

General Description: This riparian shrubland association is common in mountains of

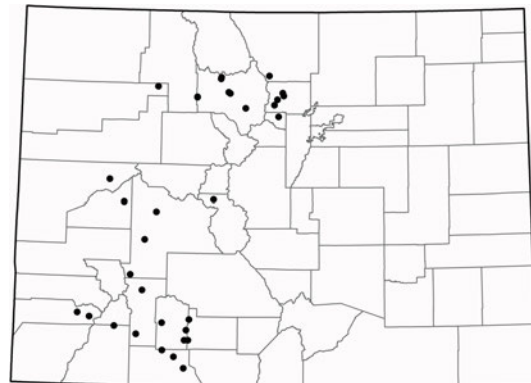
Colorado and western Wyoming and likely occurs in adjacent New Mexico. Stands are generally found along steep-gradient streams with stable, shaded streambanks between 2038 and 3000 m (6686-9835 feet) elevation. It is an early- to mid-seral community restricted to stream margins, alluvial surfaces, and coarse-textured cobble bars, rarely forming large or extensive stands. Vegetation is characterized by a dense, closed, tall-shrub canopy of 10-100% cover of *Alnus incana* and 10-60% cover of *Salix drummondiana*. Other shrubs occurring with greater than 25% frequency include *Salix monticola*, *Lonicera involucrata*, *Ribes inerme*, *Cornus sericea*, *Rosa woodsii*, and *Amelanchier utahensis*. Tree cover ranges from 0-20% dominated by *Picea pungens* (0-10%) and *Picea engelmannii* (0-23%). In some stands, heavy shading and recent flood scouring limit herbaceous growth (<10%). Other stands have a rich herbaceous understory that includes *Heracleum maximum*, *Equisetum pratense*, *Rudbeckia laciniata*, and *Angelica ampla*. Diagnostic of this shrubland association is the codominance of *Alnus incana* and *Salix drummondiana* on sites that are flooded for brief periods during the growing season.

Vegetation: This plant association is characterized by a dense, closed canopy of *Alnus incana* (thinleaf alder) (10-100% cover) and *Salix drummondiana* (10-60% cover) bordering the stream, sometimes with occasional emergent trees (*Picea pungens* and *Picea engelmannii*). Other willows that may be present include *Salix monticola*, *Salix boothii*, *Salix exigua*, *Salix lucida* (ssp. *caudata* or ssp. *lasiandra*), *Salix geyeriana*, *Salix monticola*, and *Salix planifolia*. Other shrubs occasionally present include *Acer glabrum*, *Amelanchier utahensis*, *Cornus sericea*, *Dasiphora fruticosa* ssp. *floribunda*, *Lonicera involucrata*, *Ribes inerme*, *Rosa woodsii*, *Symphoricarpos rotundifolius*, and *Ribes montigenum* (Kittel et al. 1999b, Carsey et al. 2003a). A moderately dense to dense herbaceous layer is usually present and composed of a mixture of mesic graminoids and forbs, including *Angelica ampla*, *Cardamine cordifolia*, *Carex aquatilis*, *Carex utriculata*, *Calamagrostis canadensis*, *Elymus glaucus*, *Equisetum* spp., *Erigeron peregrinus*, *Galium triflorum*, *Glyceria striata*, *Heracleum maximum*, *Leersia oryzoides*, *Mertensia ciliata*, *Osmorhiza berteroi*, *Oxypolis fendleri*, *Rudbeckia* spp., *Senecio triangularis*, and *Thalictrum* spp. However, in some stands, the herbaceous undergrowth is sparse (less than 10% cover) due to shading and flood-scouring. Introduced forage species, such as *Agrostis stolonifera*, *Bromus inermis*, *Poa pratensis*, may degrade stands (Kittel et al. 1999b, Carsey et al. 2003a).

Similar Communities: *Alnus incana* / *Equisetum arvense* Shrubland is a closely related community, but does not necessarily have *Salix drummondiana* in the shrub canopy (NatureServe, 2009).

Regional Distribution: This montane to subalpine riparian shrubland association is common in the mountains of Colorado and western Wyoming and likely occurs in adjacent New Mexico. In Colorado it is commonly found in the Rio Grande, Gunnison, Saint Vrain and Arkansas river basins.

Colorado Distribution: In Colorado the *Alnus incana*-*Salix drummondiana* shrubland is distributed throughout the Southern Rocky Mountains from Grand County in



the north to Archuleta County in the south
and from Boulder County to the east and
Delta County to the west.

Elevation Range in Colorado: 7,760.00 - 9,660.00 ft / 2,365.25 - 2,944.37 m

Site Geomorphology: This association occurs along fast-moving streams in sheer-walled confined canyons and also in slightly to moderately entrenched channels in wider valleys. Stream channel characteristics where this association is found vary from steep and rocky to less steep with limited floodplains and gravel and cobble bottoms to wide and sinuous channels (Carsey et al. 2003).

Soil: Soils are highly variable but most are stratified alluvium with buried A horizons (Carsey et al. 2003). Stands with a rich, herbaceous undergrowth have a thick layer, 10-30 cm (5-10 inches) of fine sandy loam and sandy clay loam over a coarse alluvial deposit; stands with little shrub cover and herbaceous growth have coarse, skeletal soils without an accumulated fine layer at the surface (Carsey et al. 2003).

Successional and Ecological Processes: The *Alnus incana* - *Salix drummondiana* (thinleaf alder - Drummond willow) plant association is an early to midseral community restricted to stream margins, rarely forming large, extensive stands. Both species are prolific seed producers and are the first to colonize cobble bars and recently scoured alluvial surfaces. Young-aged individuals are flexible, able to withstand flood events and readily resprout. Over time *Salix drummondiana* may become more abundant by taking advantage of the nitrogen-rich soil associated with *Alnus incana* (Carsey et al. 2003)

Adjacent Vegetation: Adjacent riparian vegetation: *Populus angustifolia* or *Picea pungens* (blue spruce) woodlands occur on adjacent streambanks and floodplains. *Salix exigua* shrublands occur along adjacent gravel bars and streambanks. *Carex utriculata* wetlands occur in low-lying swales on wider floodplains. Adjacent upland vegetation: *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir -Engelmann spruce) and *Populus tremuloides* (quaking aspen) forests occur on adjacent hillslopes. At lower elevations, *Quercus gambelii* (Gambel oak) shrublands, *Pinus ponderosa* (ponderosa pine), and *Pseudotsuga menziesii* (Douglas-fir) forests are present (Kittel et al. 1999b, Carsey et al. 2003a).

Management: Declines are due to degradation by livestock, disruption of natural flooding regimes, invasion of exotics and, historically, by the lack of beaver (NatureServe, 2009). Because annual and episodic flooding is important in maintaining this system alteration of the flooding regime due to water impoundment, diversions etc. may produce changes in plant and community composition (Rondeau 2001). This association would also benefit by beaver activity, sustainable livestock management and management of exotic plant species.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Betula nana* / Mesic Forbs - Mesic Graminoids Shrubland
State Common Name Subalpine Riparian Shrubland
Global Scientific Name: *Betula nana* / Mesic Forbs - Mesic Graminoids Shrubland
Global Common Name: -

Community Classification

System: International Vegetation Classification
Class: Shrubland
Subclass: Deciduous shrubland
Group: Cold-deciduous shrubland
Subgroup: Natural/Semi-natural cold-deciduous shrubland
Formation: Seasonally flooded cold-deciduous shrubland
Alliance: Swamp Birch Seasonally Flooded Shrubland Alliance



Global Rank: G3G4
Global Rank Reasons: -

Subnational Rank: S3
Subnational Rank Reasons: -

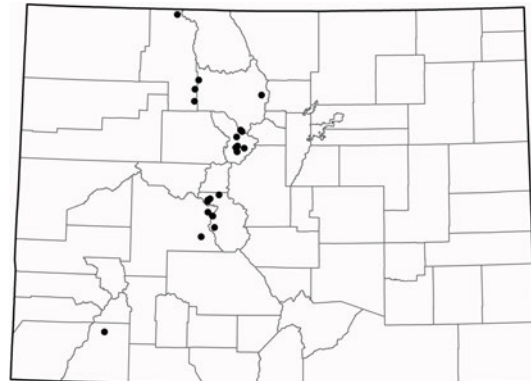
General Description: Stands of *Betula nana* / Mesic forb - Mesic graminoid shrublands occur in subalpine to lower alpine elevation ecosystems. The association grows in areas where soils are saturated from snowmelt runoff for a significant part of the growing season, often on fens or bogs, or occur as groundwater-fed fens where the vegetation receives water from seeps and springs. Most stands occur in a mosaic of subalpine meadows and willow communities with *Betula nana* patches often intergrading with surrounding *Salix* (willow) shrublands and *Carex* (sedge) meadows, forming complex wetland mosaics (NatureServe, 2009). Other shrubs present include 0-20% cover each of *Salix planifolia*, *Salix monticola*, *Salix wolfii*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and 0-10% cover each of *Salix brachycarpa* and *Lonicera involucreta*. Herbaceous undergrowth typically occurs on small hummocks and is

usually dominated by a dense mixture of mesic forbs and mesic graminoids. Mesic graminoids include *Calamagrostis canadensis*, *Carex aquatilis*, *Carex norvegica*, *Carex utriculata*, and *Deschampsia caespitosa*. Forb species with lower cover include *Chamerion angustifolium* (= *Epilobium angustifolium*), *Caltha leptosepala*, *Conioselinum scopulorum*, *Ligusticum filicinum*, *Angelica pinnata*, *Mertensia ciliata*, and *Thalictrum alpinum* (Carsey et al. 2003).

Vegetation: This wetland association is characterized by a moderately dense to dense low-shrub canopy dominated by *Betula nana* with 20-80% cover which is clearly the dominant shrub in the canopy. Several other shrubs may also be present but none are as abundant as *Betula*. Shrubs occasionally present include *Salix monticola*, *Salix planifolia*, *Salix wolfii*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Lonicera involucrata*, and *Salix brachycarpa*. Occasional trees and shrubs of *Picea engelmannii* may be present in some stands. The herbaceous undergrowth grows on small hummocks and is usually dominated by a dense and often diverse mixture of mesic forbs and mesic graminoids (Carsey et al. 2003). Mesic graminoids include *Calamagrostis canadensis*, *Carex aquatilis*, *Carex norvegica*, *Deschampsia caespitosa*, and *Phleum alpinum*. Forb species may include *Achillea millefolium* var. *occidentalis*, *Angelica pinnata*, *Caltha leptosepala*, *Galium boreale*, *Epilobium angustifolium*, *Conioselinum scopulorum*, *Ligusticum tenuifolium*, *Mertensia ciliata*, *Pedicularis groenlandica*, *Polygonum viviparum*, *Rhodiola rhodantha* and *Thalictrum alpinum* (Carsey et al. 2003).

Similar Communities: -

Regional Distribution: This shrubland association is found in the upper subalpine and lower alpine zones in the southern Rocky Mountains and Teton Range from central Colorado to northwestern Wyoming.



Colorado Distribution: This association is documented throughout high mountain ranges of Colorado, although typically occurring only in small stands (Carsey et al. 2003). Extent of the documented distribution reaches north to Routt County and south to Chaffee County, east to Grand County and west to Gunnison County.

Elevation Range in Colorado: 2,500.00 - 3,520.00 ft / 762.00 - 1,072.90 m

Site Geomorphology: Stands are found on flat to moderate sloping mountain valleys, bottomlands, benches, and low slopes, but also on steep, north-facing avalanche chutes (NatureServe, 2009).

Soil: Soils are deep peats and moderately deep (9-12 in, 23-30 cm) silty clay loams over gravels with a water table 10-48 inches (25-120 cm) deep (Carsey et al. 2003).

Successional and Ecological Processes: Bog birch is shade intolerant and establishes from seed or, more commonly, by sprouting after fire and other disturbances and in

many communities persists through subsequent successional stages. Because of its' growth form erosion control potential for bog birch is high. In Montana, the dense underground network formed by bog birch and rhizomatous sedges help stabilize streambanks (Tollefson, 2007). This plant association appears to be a long-lived mid- to late-seral community. As peatland hummocks develop or become more pronounced the habitat may become more heavily dominated by willow species (Carsey et al. 2003).

Adjacent Vegetation: *Salix* (willow) and herbaceous wet meadows typically occur intermixed with and adjacent to bog birch stands. Upslope vegetation varies from conifer forests including *Picea engelmannii*-*Abies lasiocarpa* (spruce-fir) to mesic shrub and herbaceous meadows.

Management: The primary abiotic ecologic process necessary to maintain this system is hydrology and specifically surface flow. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau, 2001). Numerous wildlife species eat bog birch, including moose, mule deer, white-tailed deer, Rocky Mountain elk, mountain goats, caribou, grizzly bears, American black bears, small mammals, birds, and insects. American beavers eat bog birch and bog birch is a preferred winter food of snowshoe hares in the southwestern Yukon and in western Montana it provides overhanging shade and cover for fish along low-gradient streams (Tollefson, 2007).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Betula occidentalis* / *Maianthemum stellatum* Shrubland
State Common Name Foothills Riparian Shrubland
Global Scientific Name: *Betula occidentalis* / *Maianthemum stellatum* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification
Class: Shrubland
Subclass: Deciduous shrubland
Group: Cold-deciduous shrubland
Subgroup: Natural/Semi-natural
cold-deciduous shrubland
Formation: Temporarily flooded
cold-deciduous shrubland
Alliance: Water Birch Temporarily
Flooded Shrubland Alliance



Global Rank: G4?

Global Rank Reasons: Throughout the association's range, fewer than 30 stands are documented. While more occurrences are known, good-condition occurrences are difficult to find at the lower elevational habitats where this community typically is found. This association is highly threatened by development, road building, recreation, stream modifications, and other similar human impacts. It appears to be relatively common in Nevada, so the Global rank is lower than might otherwise be indicated by the threats. Future inventory and ranking of occurrences may result in raising the rank.

Subnational Rank: S2

Subnational Rank Reasons: In Colorado, fewer than thirty stands are documented. While more are estimated to occur, this association is highly threatened by development, road and railroad improvements and maintenance, heavy recreational use and stream-flow alterations.

General Description: This association is characterized by a tall, narrow band of shrubs lining the stream channel. The undergrowth can be sparse or a thick carpet of grasses and forbs. In undisturbed stands, forb species richness can be high. This association occupies moderately wide stream benches and floodplains in narrow to moderately wide valleys and on hillside seeps. At lower elevations along sunny valley bottoms, well-developed, large occurrences occupy relatively flat stream benches and often extend away from the channel edge. Stream channels are wide, rocky/cobble-bottomed,

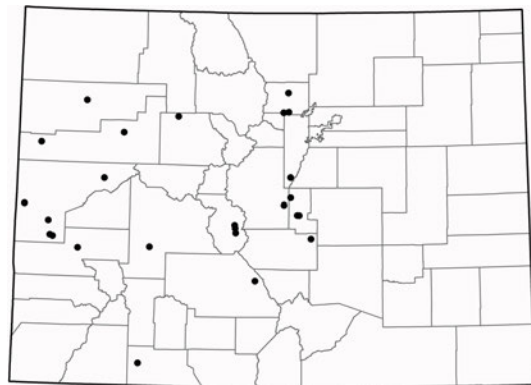
moderately steep, and sinuous, wide, cobble-bottomed, less steep, and highly sinuous, or braided from beaver activity. This association also occurs along small floodplains of steep-gradient, narrow streams where the valley side slope meets the stream edge. In such settings *Betula occidentalis* (river birch) is squeezed between large boulders and herbaceous growth is limited to small pockets, or is found around seeps adjacent to the stream channel and along isolated springs on hillslopes away from the valley bottom (these may be in different HGM subclasses).

Vegetation: *Betula occidentalis* (river birch) forms a nearly continuous tall-shrub to small-tree canopy along the stream bank. Other shrubs may include *Alnus incana* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Salix exigua* (sandbar willow), *Jamesia americana* (cliffbush), *Amelanchier utahensis* (Utah serviceberry), *Prunus virginiana* (chokecherry), and *Salix monticola* (mountain willow). Along narrow valleys at higher elevations, conifers may overhang the stream edge. Conifer species include *Pseudotsuga menziesii* (Douglas-fir), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Pinus ponderosa* (ponderosa pine). Although some stands have considerable herbaceous cover, herbaceous undergrowth is usually limited due to the dense shrub canopy. Forb cover can include *Maianthemum stellatum* (starry false Solomon seal), *Heracleum maximum* (common cowparsnip), *Thalictrum fendleri* (Fendler meadowrue) and *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower). Graminoid cover is usually low, but can include *Poa pratensis* (Kentucky bluegrass), *Carex utriculata* (beaked sedge), *Juncus balticus* var. *montanus* (mountain rush), *Calamagrostis canadensis* (bluejoint reedgrass), and *Agrostis stolonifera* (creeping bentgrass). *Equisetum arvense* (field horsetail) may also be present.

Similar Communities: Closely related communities include: 1) the *Betula occidentalis* - *Cornus sericea* (water birch - red-osier dogwood) community type (Padgett *et al.* 1989), 2) the *Betula occidentalis* (water birch) community type (Hansen *et al.* 1995) of degraded stands with abundant non-native grasses, 3) the *Alnus incana* - *Betula occidentalis* (thinleaf alder - water birch) community type (Kittel 1994), and 4) the *Alnus incana* - *Betula fontinalis* / *Salix* spp. (thinleaf alder - water birch/willow) plant association (Johnston 1987). *Betula fontinalis* is a synonym for *Betula occidentalis* (Kartesz 1994).

Regional Distribution: This plant association occurs in many western states but is restricted to the banks and floodplains of relatively small streams. It is rare on the Colorado Plateau.

Colorado Distribution: Found on west and east slopes of Colorado. Documented in 16 counties.



Elevation Range in Colorado: 6,300.00 - 8,800.00 ft / 1,920.24 - 2,682.24 m

Site Geomorphology: This plant association occupies moderately wide stream benches and floodplains in narrow to moderately wide valleys and on hillside seeps. At lower elevations along sunny valley bottoms, well-developed, large occurrences occupy relatively flat stream benches and often extend away from the channel edge. Streams

were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are typically wide, rocky/cobble-bottomed, moderately steep and sinuous (Rosgen's Channel Type: B2, B3, B4), wide, cobble-bottomed, less steep and highly sinuous (Rosgen's Channel Type: C3), or braided from beaver activity (Rosgen's Channel Type: D6). This association also occurs along small floodplains of steep-gradient, narrow streams where the valley side slope meets the stream edge (Rosgen's Channel Type: A2). In these stands, *Betula occidentalis* (water birch) is squeezed between large boulders and herbaceous growth is limited to small pockets. This association also occurs around seeps adjacent to the stream channel and along isolated springs on hillslopes away from the valley bottom.

Soil: Soils are fairly shallow, ranging from 12 to 25+ inches (30-60+ cm) and have a surface layer of 50-90% organic matter. Subsurface layers are clay loams, sandy clays, and sandy loams. Stands along narrow, steep stream channels occur between large alluvial and colluvial boulders and have almost no soil development.

Successional and Ecological Processes: This association is considered a mid-seral type. With prolonged heavy grazing, it may succeed to a *Salix* (willow) dominated association. It may also be an early successional stage for conifer-dominated associations. *Betula occidentalis* can tolerate flooding, but not permanent inundation. *Betula occidentalis* occurs at slightly lower elevations and on lower-gradient stream reaches than *Alnus incana* (thinleaf alder). Because *Betula occidentalis* communities occupy low elevation, foothill habitats in Colorado, they are more threatened by development and stream impoundments than *Alnus incana* or *Cornus sericea* (red-osier dogwood) riparian communities.

Adjacent Vegetation: Adjacent riparian vegetation: the *Betula occidentalis* / Mesic Forbs (water birch/mesic forbs) plant association is often the only association along narrow steams. However, *Populus angustifolia* (narrowleaf cottonwood) and *Populus tremuloides* (quaking aspen) woodlands occur on adjacent floodplains. *Cornus sericea* (redosier dogwood) and *Salix monticola* (mountain willow) shrublands occur on adjacent wider floodplains. *Salix exigua* (coyote willow) shrublands occur on nearby sandbars while open hay meadows occur on adjacent cultivated floodplains. Adjacent upland vegetation: adjacent upland communities include *Pinus edulis* - *Juniperus osteosperma* or *J. monosperma* (two needle pinyon - Utah or oneseed juniper) and *Pinus ponderosa* (ponderosa pine) woodlands on south-facing slopes. *Pseudotsuga menziesii* (Douglas-fir) and mixed *Abies* - *Pinus* (fir-pine) forests are present on north-facing slopes.

Management: Due to the dense shrub cover, stands of this plant association may hinder livestock access. In the Arkansas River Basin, this plant association has a lush undergrowth dominated by native grasses and forbs in areas where livestock grazing is minimal. With season-long grazing, however, non-native grasses, such as *Poa pratensis* (Kentucky bluegrass) and *Agrostis stolonifera* (creeping bentgrass), may begin to dominate the undergrowth. Livestock grazing can also reduce streambank stability and cause sloughing. *Betula occidentalis* (water birch) provides shade, organic matter and overhanging banks for fish habitat (Hansen *et al.* 1988). *Betula occidentalis* (water birch) is an effective streambank stabilizer. Nursery grown seedlings can be successfully transplanted and will typically grow quickly (Hansen *et al.* 1988). Fire can easily kill *Betula occidentalis* shoots due to the shrub's thin bark. However, new shoots will sprout from uninjured basal buds (Hansen *et al.* 1988).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Betula occidentalis* / Mesic Graminoids Shrubland
State Common Name Lower Montane Riparian Shrublands
Global Scientific Name: *Betula occidentalis* / Mesic Graminoids Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Seasonally flooded
cold-deciduous shrubland

Alliance: Water Birch Seasonally
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: Although the association occurs across a large distributional range, it remains threatened by improper livestock grazing, streamflow alterations, heavy recreational use, and invasion by exotics. 17 stands have been documented in Colorado, with 10-20 more estimated to occur. Few high-quality sites exist in Colorado. The number and condition of occurrences in Nevada and Utah are unknown, but most low- to moderate-elevation riparian areas have been damaged by the same impacts as those in Colorado.

Subnational Rank: S2

Subnational Rank Reasons: In Colorado, near-pristine stands of this association are rare (Carsey et al. 2003) and only 17 stands have been documented. While more stands are estimated to occur, because this association occupies lower elevation habitat it is more threatened by development, and stream impoundments than *Alnus incana* (thinleaf alder) or *Cornus sericea* (red-osier dogwood) communities. Consequently, few undisturbed and unaltered stands exist today (Carsey et al. 2003).

General Description: The *Betula occidentalis* / mesic graminoid shrubland association is a tall (1.5-2.5m, 5-8 ft) narrow to wide band of shrubs lining a stream channel with moderately wide to wide floodplains. Stands also occur in small patches at higher elevations and around seeps and isolated springs on hillslopes away from the valley

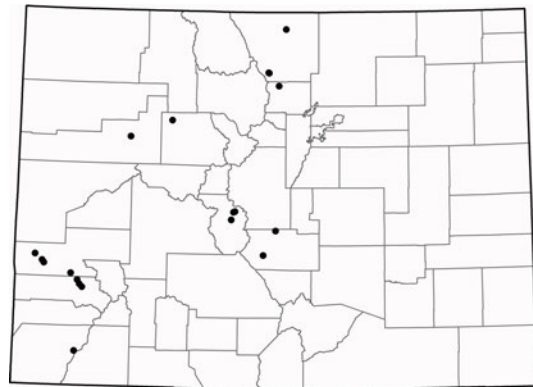
bottom. This association may also extend well away from the channel edge in deep pockets of sandy loam soils. Undergrowth varies from a sparse to thick carpet of grasses and grass-like plants with only a few forbs present (Carsey et al. 2003). This association occupies wetter sites than the *Betula occidentalis* / mesic forb (water birch / mesic forb) plant association.

Vegetation: *Betula occidentalis* (river birch) is the diagnostic species although it may be co-dominant with *Alnus incana* (thinleaf alder) or a variety of *Salix* spp. (willows). *Betula occidentalis* forms a dense canopy of 40-75% cover (Carsey et al. 2003). Other shrubs that may be present include *Acer glabrum* (Rocky mountain maple), *Ribes inerme* (mountain gooseberry), *Rosa woodsii* (Wood's rose), *Rhus trilobata* (skunkbush sumac), *Salix bebbiana* (Bebb willow), and *Salix exigua* (Sandbar willow). Tree species including *Picea pungens* (blue spruce), *Populus angustifolia* (narrowleaf cottonwood), and *Juniperus scopulorum* (Rocky mountain juniper) may also be present but usually with low cover; the presence of coniferous trees in the stand may indicate that the stand will become a tree-dominated type. Herbaceous undergrowth may be limited in cover due to the dense shrub canopy but contains a diversity of species with total graminoid cover typically exceeding forb cover. Graminoid species that may be present include *Agrostis gigantea* (redtop), *Carex pellita* (wooly sedge), *Carex deweyana* (Dewey sedge), and *Carex utriculata* (beaked sedge). Forb species that may be present include *Achillea millefolium* var. *occidentalis* (western yarrow), *Cardamine cordifolia* (heartleaf bittercress), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Mimulus guttatus* (monkey flower), *Rudbeckia laciniata* (goldenglow), and *Vicia americana* (American vetch). Scouring rushes (*Equisetum arvense*, *Equisetum laevigatum*, *Equisetum hyemale*) may also have significant cover. The introduced grasses and forbs *Agrostis stolonifera* (creeping bentgrass), *Phleum pratense* (common timothy), *Poa pratensis* (Kentucky bluegrass), and *Taraxacum officinale* (dandelion) are common in disturbed stands. Large, near-pristine stands are rare (NatureServe 2009, Carsey et al. 2003).

Similar Communities: -

Regional Distribution: This shrubland association often occurs as dense bands along moderately wide to wide floodplains in mountain valleys of Colorado, Nevada, and Utah.

Colorado Distribution: In Colorado this association is found in low elevation, foothills habitat along streams that are characteristically wide, meandering and cobble-bottomed (NatureServe 2009). Occurrences are documented as far north as Larimer County, to the south and west in Montrose and San Miguel Counties and to the east in Fremont County.



Elevation Range in Colorado: 5,100.00 - 8,400.00 ft / 1,554.48 - 2,560.32 m

Site Geomorphology: This association occurs in mountain valleys and canyons with moderately wide to wide floodplains. Streams draining these valleys and canyons were

typically classified as a wide, meandering, and cobble-bottomed (Rosgen's Channel Type: C) (NatureServe 2009).

Soil: Soils are deep pockets of sandy loams with signs of mottling within the top 12 inches (30 cm) (Carsey et al. 2003) and soils are saturated all or most of the growing season (NatureServe 2009).

Successional and Ecological Processes: Although water birch communities are often restricted to streambanks which receive seasonal flooding, most communities appear to be stable, with little changes in the vegetation due to flooding (Uchytel 1989). However, because this association requires a high water table throughout the growing season in order to persist, alteration of the flooding regime can result in changes to the plant community (Rondeau 2001, NatureServe 2009). In stands where the water table has dropped or the stream has incised, the understory becomes less dense and shifts from wetland species-dominated to mesic species such as *Mainantheum stellatum* (starry false Solomon seal) and *Clematis ligusticifolia* (virgin's bower) (NatureServe 2009). Grazing pressure can eliminate native sedges, which are then replaced by non-native grasses, including *Agrostis stolonifera* (creeping bentgrass) and *Poa pratensis* (Kentucky bluegrass) (Carsey et al. 2003). *Betula occidentalis* (river birch) provides wildlife value. River birch often occurs in dense stands which provide excellent thermal and hiding cover for many wildlife species. A member of woodland riparian communities, river birch contributes to structural diversity which is an important habitat requirement of many avian species. Grouse often winter in these riparian habitats and use river birch for cover and food. Cavity-nesting birds utilize mature trees. Plants overhanging streambanks provide shade and organic matter important for fish habitat (Uchytel 1989). Additionally river birch is well-adapted for revegetating disturbed riparian sites and the dense root system of river birch effectively stabilizes streambanks (Uchytel 1989).

Adjacent Vegetation: Adjacent riparian systems range from herbaceous dominated communities to tree dominated communities (Rondeau 2001). Generally the upland vegetation surrounding this riparian system is of either conifer or aspen forests (Rondeau 2001).

Management: The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant species and community composition (Rondeau 2001). Beaver (*Castor canadensis*) are primary users as well as maintainers of this system (Rondeau 2001). By virtue of their streamflow and channel-altering activities beaver change the discharge regime and increase the area of flooded soil and because of these impacts they are now being used to rehabilitate streams (Mason 1995). This wetland plant association would benefit by the presence of beaver as well as by the maintenance of a natural flooding regime.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Carex simulata* Herbaceous Vegetation
State Common Name Wet Meadow
Global Scientific Name: *Carex simulata* Herbaceous Vegetation
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Herbaceous Vegetation

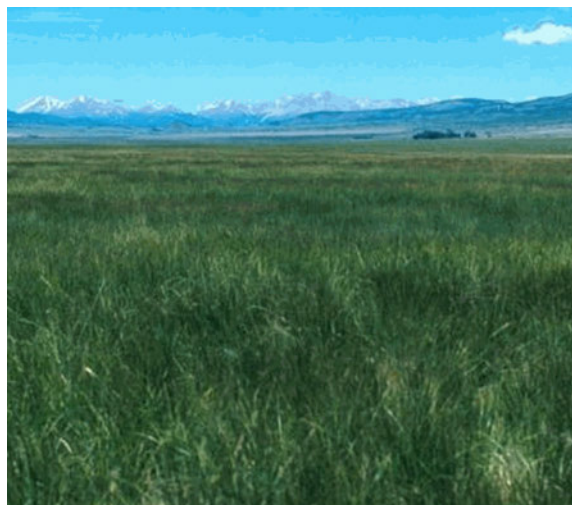
Subclass: Perennial graminoid
vegetation

Group: Temperate or subpolar
grassland

Subgroup: Natural/Semi-natural
temperate or subpolar grassland

Formation: Saturated temperate or
subpolar grassland

Alliance: Analogue Sedge Saturated
Herbaceous Alliance



Global Rank: G4

Global Rank Reasons: -

Subnational Rank: S3

Subnational Rank Reasons: The *Carex simulata* Herbaceous Vegetation is known from 16 locations in Colorado. A natural hydrologic regime is essential to maintain this system.

General Description: In Colorado *Carex simulata* (analogue sedge) is found only on quaking fens but occasionally may persist on drying fens. Presence is associated with deep organic soils and a perennially high water table. Soil surface is hummocky and "quakes" when walked or jumped on. *Carex simulata* may, or may not be the most abundant herb and many other sedge species are often found within this association. No trees and only a few scattered shrubs, usually in stunted form, are present and contribute only little cover when present. Stands may intergrade with *Eleocharis quinqueflora* (few-flower spikerush) and *Carex limosa* associations that often have similar sparse vegetation and sloppy substrate (Carsey et al. 2003, NatureServe 2009).

Vegetation: Graminoids dominate this meadow association with 90-100% cover. Although *Carex simulata* (analogue sedge) may not be the most abundant species it is always present and is the indicator species for this association. A variety of other *Carex* (sedge) species may be present and with greater abundance, including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), and *Carex nebrascensis* (Nebraska sedge). Other graminoids may also be present including *Juncus balticus* var. *montanus*

(mountain rush) and *Deschampsia caespitosa* (tufted hairgrass). A variety of forbs may be inconspicuously present. Shrub cover is usually absent, but if present, is stunted in height. Shrub species that may be present include *Salix geeyeriana* (Geyer willow), *Salix monticola* (mountain willow), and *Dasiphora floribunda* (shrubby cinquefoil).

Similar Communities: -

Regional Distribution: This association is known from Idaho, Montana, Nevada, Oregon, Utah, Wyoming and Colorado, and may possibly occur in California and Washington.

Colorado Distribution: This system is widely distributed both in elevation and latitude and is confined to specific environments defined primarily by hydrology (Rondeau, 2001). In Colorado the *Carex simulata* Herbaceous Vegetation association is more or less restricted to the high mountain valleys in the central part of Colorado. These *Carex simulata* (analogue sedge) fens are known from Larimer County in the north down to Conejos County in the south.



Elevation Range in Colorado: 6,000.00 - 9,560.00 ft / 1,828.80 - 2,913.89 m

Site Geomorphology: This community occurs in moderate to wide valleys on saturated soils that are drained by low gradient, highly sinuous (Rosgen Channel Type:E4) streams to slightly steeper streams (Rosgen Channel Type: B3).

Soil: Soils are deep, dark brown to black, 100% peat, and saturated to the surface.

Successional and Ecological Processes: Little is known about the successional processes of this plant association however deep accumulations of peat suggest long-term stability (Carsey et al. 2003). Water levels in this system are often at or near the ground surface for much or all of the growing season but may fluctuate considerably through the year (Rondeau 2001).

Adjacent Vegetation: Adjacent riparian associations: A variety of other wetland systems are adjacent to or intergrade with this association such as riparian shrublands or herbaceous wet meadows (Rondeau, 2001, NatureServe 2009). Adjacent upland associations: Adjacent upland systems vary from grasslands to forest (Rondeau 2001).

Management: The hydrologic system and the surrounding landscape are primary environmental characteristics that determine the ecological condition of the *Carex simulata* community (Rondeau 2001). Changes in the natural hydrologic regime have the potential to greatly affect the composition of this association (Carsey et al. 2003). Threats to the system include hydrologic alteration, livestock grazing, and exotic species (Rondeau 2001).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Eleocharis rostellata* Herbaceous Vegetation
State Common Name Emergent Wetland
Global Scientific Name: *Eleocharis rostellata* Herbaceous Vegetation
Global Common Name: -

Community Classification

System: International Vegetation Classification
Class: Herbaceous Vegetation
Subclass: Perennial graminoid vegetation
Group: Temperate or subpolar grassland
Subgroup: Natural/Semi-natural temperate or subpolar grassland
Formation: Saturated temperate or subpolar grassland
Alliance: (Few-flower Spikerush, Beaked Spikerush) Saturated Herbaceous Alliance



Global Rank: G3

Global Rank Reasons: This association is restricted to habitats with perennially saturated or inundated hydrologic conditions. It has high affinity with warm springs, as well as fens and cool springs with alkaline or calcareous soils. Stands are most frequently observed in southern and central Idaho, but the association is also known from geothermally influenced areas of south-central Montana and Yellowstone National Park. The association is suspected to occur, but poorly documented from, a much wider range (e.g., the Great Basin, Colorado, and the Pacific Northwest). In general, this association is not frequently observed and is probably rare across the landscape because hydrologically functioning warm springs and rich fens are relatively uncommon. The association is relatively well-represented in protected areas due to the uniqueness and highly valued habitats (e.g., warm springs), but other stands can be threatened by hydrologic alterations, livestock grazing, and exotic species invasion. The association was formerly ranked G2, but the number of occurrences (over 25 estimated), combined with its relatively wide range and resistance to minor disturbances, does not justify this rank. Until further inventory confirms the occurrence of many more *Eleocharis rostellata* stands, the association is best ranked as G3.

Subnational Rank: S2

Subnational Rank Reasons: There are six documented occurrences of this plant community in Colorado. However, this association may be more prevalent and the rank will be re-evaluated after further inventories.

General Description: This association is known from low to mid elevations in widely scattered intermontane basins and plains of the West. It is documented to occur in Idaho, Montana, Oregon, Wyoming, and Colorado. Unconfirmed stands have been reported from Washington and California, and it is suspected to occur in similar habitats in Nevada and British Columbia. This association forms sharply delineated, near-monocultural stands in areas with perennially saturated or inundated hydrologic conditions. *Eleocharis rostellata* Herbaceous Vegetation often occurs in association with warm springs or fens with alkaline or calcareous soils at the northern limits of its range, but it is also known from cold springs in desert canyons. There are two distinct phases of this association: a dense phase with 90% cover of *Eleocharis rostellata*, occurring on relatively deep organic soils that sometimes form a quaking mat, and an open phase with less than 70% *Eleocharis rostellata* cover. The open phase has considerable areas of exposed soil, gravel, rock, and water and appears restricted to mineral substrates on gentle to steep slopes. Low species diversity is characteristic of the *Eleocharis rostellata* association, and woody vegetation is lacking, or if present is only as a very minor component (NatureServe 2009).

Vegetation: *Eleocharis rostellata* (beaked spikerush) is an obligate wetland species (Carey 1994) and observations in Montana indicate that the association is at least partially thermophilic (NatureServe 2009). Species diversity of this plant association is low and the community forms near monocultures. Other herbaceous species that may be present with low cover include *Scirpus acutus* (hardstem bulrush), *Symphyotrichum eatonii* (Eaton aster), *Polypogon monspeliensis* (annual rabbits foot grass), *Berula erecta* (Coville cutleaf waterparsnip), *Castilleja minor* ssp. *minor* (lesser indian paintbrush), *Carex simulata* (analogue sedge), *Carex nebrascensis* (Nebraska sedge), *Carex scirpoidea* (western singlespike sedge), *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Deschampsia caespitosa* (tufted hairgrass), *Juncus balticus* (mountain rush), *Juncus torreyi* (Torey rush), *Mimulus guttatus* (monkeyflower), *Muhlenbergia asperifolia* (scratchgrass), *Schoenoplectus americanus* (chairmaker's bulrush), and *Triglochin maritima* (seaside arrowgrass). In Colorado documented stands included *Carex raynoldsii* (Raynolds' sedge), *Juncus balticus* var. *montanus* (mountain rush), *Schoenoplectus pungens* (threesquare bulrush) and *Equisetum hyemale* (scouringrush horsetail) (NatureServe 2009, Carsey et al. 2003).

Similar Communities: -

Regional Distribution: This association is documented in Idaho, Montana, Oregon, and Colorado. Unconfirmed stands have been reported from Washington and California. It is suspected to occur in similar habitats in Nevada and British Columbia.

Colorado Distribution: In Colorado the association has been documented on the western slope in Mesa, Garfield and Montrose counties.



Elevation Range in Colorado: 5,600.00 - 5,880.00 ft / 1,706.88 - 1,792.22 m

Site Geomorphology: The association occurs on well-watered gentle to steep slopes in low to mid-elevation intermontane basins and plains (NatureServe 2009).

Soil: This association forms on soils ranging from relatively deep organic soils, to alkaline and calcareous soils (e.g., travertine), to coarse mineral soils that are directly in contact with springs or thermal waters (NatureServe 2009). Overlying the travertine substrate there is typically a dense layer of green algae which precipitates a calcium carbonate deposit (Carsey et al. 2003).

Successional and Ecological Processes: Because of its stoloniferous growth habit, *Eleocharis rostellata* (beaked spikerush) forms dense patches that are resistant to disturbance and are stable unless water tables are altered. However, prolonged disturbance or hydrologic changes may result in loss of this community (Carsey et al. 2003). Springs, rich fens, and thermal areas supporting *Eleocharis rostellata* are heavily impacted by human recreation, livestock grazing, water diversions and wild ungulate use. Some areas that once had the potential to support this association have been completely de-watered or otherwise eliminated from the landscape. However, *Eleocharis rostellata* is reported to be an early colonizer of bare substrates with proper chemical and hydrological conditions. At Ohanacaposh Hot Spring (Mount Rainier National Park) this association has apparently expanded and colonized the lower springs after removal of water developments over 50 years ago (NatureServe 2009). Large occurrences are considered a valuable source of food and cover for waterfowl (Hansen, et al. 1995). Waterfowl eat the stems, roots and achenes of *Eleocharis rostellata*, however palatability for livestock and other wildlife is low (Carey 1994, Carsey et al. 2003)).

Adjacent Vegetation: Adjacent riparian systems include riparian shrublands (Rondeau 2001) and herbaceous wet meadows. Surrounding uplands are characterized by a variety of systems from grasslands to forests (Rondeau 2001).

Management: *Eleocharis rostellata* (beaked spikerush) is considered threatened and endangered in a number of states mostly in the midwest and northeast, and it is uncommon to rare in Colorado (Carsey et al. 2003). Beaked spikerush habitat is threatened by development of thermal areas and livestock damage the narrow spikerush zone at stream margins while drinking and feeding (Carey 1994). This ecological system is defined primarily by hydrology with water levels or near the ground surface for much (or all) of the growing season and are impacted by physical disturbance during inundation which may be significant for the structure and composition of these systems. (Rondeau 2001). Thus, maintenance of the natural hydrologic regime is important to system viability. Additionally, the system would benefit from grazing management and management of exotic species.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Picea pungens* / *Alnus incana* Woodland
State Common Name Montane Riparian Forests
Global Scientific Name: *Picea pungens* / *Alnus incana* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

Subclass: Evergreen woodland

Group: Temperate or subpolar
needle-leaved evergreen woodland

Subgroup: Natural/Semi-natural
temperate or subpolar needle-leaved
evergreen woodland

Formation: Temporarily flooded
temperate or subpolar needle-leaved
evergreen woodland

Alliance: Blue Spruce Temporarily
Flooded Woodland Alliance



Global Rank: G3

Global Rank Reasons: This riparian plant association is somewhat widespread on the western slope of Colorado, and may also occur in Wyoming and New Mexico. In Colorado, it has been found in the Routt National Forest, south to the Rio Grande and San Juan National Forests. This association occurs along narrow to moderately wide floodplains and stream benches in narrow canyons subject to cold air drainage and limited sunlight, typically in small patches and scattered locations. Recent inventory efforts by the Colorado Natural Heritage Program have found this association to be more common in Colorado than previously thought. While many stands have been negatively impacted by livestock grazing, and dams or hydrologic alterations are threats, the association does not appear to be rare or severely threatened. Therefore the global rank has been lowered to G3.

Subnational Rank: S3

Subnational Rank Reasons: Fewer than 100 stands are documented in Colorado, and very few of these are in pristine condition. This association is threatened by development, road building and maintenance, heavy recreational use, improper livestock grazing, and stream flow alterations.

General Description: The *Picea pungens* / *Alnus incana* (blue spruce / thinleaf alder) plant association occurs in montane riparian areas in Colorado. It occurs in deep, shaded canyons and narrow valleys along relatively straight stream reaches. It generally forms small patches, but can be continuous for several river miles. This plant association occurs along narrow to moderately wide floodplains and stream benches in canyons

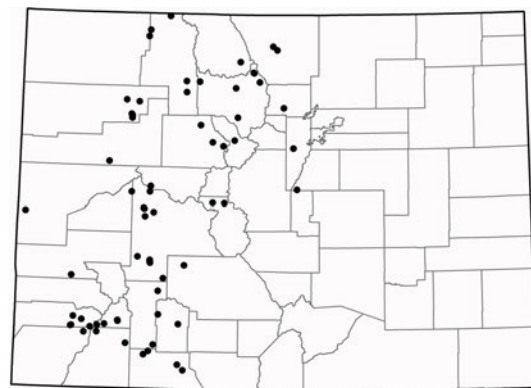
subject to cold air drainage and limited sunlight. Stream channels are steep and narrow, moderately broad and slightly sinuous, or broad and highly sinuous.

Vegetation: *Picea pungens* (blue spruce) dominates the overstory with 1-70% cover. There are typically many seedling and saplings as well as mature trees. *Abies lasiocarpa* (subalpine fir) is usually present with up to 50% cover. Other tree species that occurred in half or fewer of the stands sampled include *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine) and *Pinus ponderosa* (ponderosa pine). The thick shrub understory is confined to a narrow band lining the stream channel. *Alnus incana* (thinleaf alder) was present in all stands sampled, and ranged in cover from 1 to 80%. Other shrub species present were highly variable, with constancy of less than 40%, but often appearing with abundant cover when present. These shrubs include *Salix drummondiana* (Drummond willow), *Cornus sericea* (redosier dogwood), *Ribes lacustre* (current), *Acer glabrum* (Rocky Mountain maple), *Vaccinium* spp. (whortleberry), *Salix boothii* (Booth willow), and *Salix wolfii* (Wolf willow). The forb canopy layer is thick, up to 50% total cover and species-rich, often with more than 40 species represented in one stand. Species include *Actaea rubra* (red baneberry), *Conioselinum scopulorum* (Rocky Mountain hemlock parsley), *Oxypolis fendleri* (cowbane), *Geranium richardsonii* (Richardson geranium), *Heracleum maximum* (common cowparsnip), *Maianthemum stellatum* (starry false Solomon seal), *Mertensia ciliata* (tall fringed bluebells), *Rudbeckia laciniata* var. *ampla* (cutleaf cornflower), and *Equisetum arvense* (field horsetail).

Similar Communities: A closely related community, the *Picea pungens* / *Alnus incana* (blue spruce/thinleaf alder) plant association (Johnston 1987), includes some New Mexico stands containing significant amounts of *Abies concolor* (white fir). Other similar associations include *Picea pungens*/*Cornus sericea* (blue spruce/red-osier dogwood) Woodland and *Picea engelmannii*/*Equisetum arvense* (blue spruce/field horsetail) Forest.

Regional Distribution: Reported from scattered locations from northwestern Wyoming to northern New Mexico, although only Colorado actually has documented occurrences. In Colorado, it has been found in the Routt National Forest, south to the Rio Grande and San Juan national forests.

Colorado Distribution: From Steamboat Springs south to the San Juan mountains, the Flat Tops to the Front Range.



Elevation Range in Colorado: 6,100.00 - 10,650.00 ft / 1,859.28 - 3,246.12 m

Site Geomorphology: This plant association occurs along narrow to moderately wide floodplains (7-17 ft, 25-55 m) and stream benches in canyons subject to cold air drainage and limited sunlight. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are steep and narrow (Rosgen's Channel Type: A3, A4), moderately broad and slightly sinuous (Rosgen's Channel Type: B3, B4), or broad and highly sinuous (Rosgen's Channel Type: C3, C4).

Soil: Soils are generally shallow and range from loamy sand to silty clay loams with heavy organic matter content over gravel, cobbles, and boulders.

Successional and Ecological Processes: Thinleaf alder is an early seral species and seasonal disturbances from flooding provide suitable seedbeds for establishment of new plants (Uchytal 1989). Blue spruce occurs in various seral stages from pioneer to climax. Its successional status depends on location and associated species. Blue spruce is a pioneer species in riparian communities that are subject to periodic disturbances, such as scouring and flooding. It is present in all size classes along the riparian systems and on the lower slopes in the southwestern United States, where it may be a topoedaphic climax species (Pavek 1993). In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species, and will remain until removed or damaged by a catastrophic flood (Carsey et al. 2003). In Colorado, the closely related *Picea pungens* / *Equisetum arvense* (blue spruce / field horsetail) plant association is considered an indicator of frequent flooding. With less frequent flooding, this association may gradually change to a *Picea pungens* / *Alnus incana* (blue spruce / thinleaf alder) plant association (Carsey et al. 2003). Although neither blue spruce nor thinleaf alder are a highly preferred food for either wildlife or domestic animals blue spruce does provide resources and cover for a variety of bird and animal species. Big game forage is good throughout blue spruce habitat types in northern New Mexico and southern Colorado, numerous birds eat blue spruce seeds and cones are cached by red squirrels in Utah. Additionally blue spruce provides good environmental protection for elk, mule deer, white-tailed deer, small mammals, and small nongame and upland game birds in Colorado, Utah, and Wyoming (Pavek 1993). Sensitive and endangered species use mixed-conifer stands in which blue spruce occurs. Such species include flammulated owls in Colorado, Jemez Mountain salamander of New Mexico, and northern goshawks in Arizona. Bald eagle breeding areas at intermediate elevation in Wyoming are dominated by blue spruce and narrowleaf cottonwood. In the Snake River Unit, 28 percent of the nests were in blue spruce trees (Pavek 1993). Thinleaf alder communities provide hiding and thermal cover for big game animals such as white-tailed and mule deer and often serve as travel corridors for these and other big game animals. Many bird species use thinleaf alder communities for nesting and brood rearing and when thinleaf alder overhangs a streambank, plants provide cover and shade for salmonids (Uchytal 1989). Thinleaf alder is eaten to varying degrees by cattle, sheep, and goats all eat thinleaf with utilization by livestock dependant on stand accessibility, stand density, and the palatability of other browse species present (Uchytal 1989). For instance, in Montana, dense stands of alder hinder access and are of limited value for livestock and cattle tend to avoid thinleaf alder stands found on the mucky soils associated with mountain springs (Uchytal 1989). The twigs and leaves of younger thinleaf alder plants are eaten by deer, elk, and moose. Light to moderate use by elk was observed primarily in summer and fall in portions of the Rocky Mountains and moderate use of thinleaf alder by moose occurred during late winter in Montana, and is a moderately important browse for Rocky Mountain mule deer. Muskrats, beavers, cottontails, and snowshoe hares all eat alder twigs and leaves; beavers eat the bark and build dams and lodges with the stems; and alder seeds, buds, and catkins are eaten by redpolls, siskins, chickadees, and goldfinches and are considered to be an important winter food source (Uchytal 1989).

Adjacent Vegetation: Adjacent riparian vegetation: this plant association is often the only community along narrow streams. However, adjacent riparian communities can include *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir -Engelmann spruce), or *Populus angustifolia* (narrowleaf cottonwood) forests; and *Alnus incana* (thinleaf alder), *Salix geyeriana* (Geyer's willow), or *Salix boothii* (Booth's willow) shrublands. Adjacent upland vegetation: at higher altitudes, *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir - Engelmann spruce) and *Populus tremuloides* (quaking aspen) forests often occur on adjacent hill slopes. At lower altitudes, *Populus tremuloides*, *Pseudotsuga menziesii* (Douglas-fir), and *Pinus ponderosa* (ponderosa pine) forests; and *Pinus edulis* - *Juniperus osteosperma* or *J. monosperma* (two needle pinyon - Utah (or one seed) juniper) and *Quercus gambelii* (Gambel's oak) woodlands often occur on adjacent hill slopes.

Management: Long-term viability of the *Picea pungens*/*Alnus incana* (blue spruce/thinleaf alder) community would benefit by the maintenance of a natural hydrologic regime complete with annual episodic flooding, and by instituting sustainable grazing management practices and a historically natural fire regime. The primary ecological process necessary to maintain this ecological system is hydrology including surface flow and ground water. Annual and episodic flooding is important in maintaining this system and alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant species and community composition (Rondeau 2001). Additionally upstream activities that effect water quality such as mining may be important to the vertebrates and invertebrate species that use this system (Rondeau 2001) and which are essential to ecosystem function. *Alnus incana* (thinleaf alder) is an excellent stream bank stabilizer (USDA 2004). Streambanks anchored by thinleaf alder are stable and can withstand relatively severe spring runoff, however, overgrazing and excessive trampling by livestock can seriously reduce thinleaf alder's ability to maintain streambank stability during spring runoff and flooding. However, because alder is easy to establish on disturbed sites and has a rapid growth rate it can quickly restabilize disturbed streambanks. Additionally, thinleaf alder improves soil fertility through the addition of nitrogen to the soil from nitrogen-fixing root nodules and a nitrogen-rich leaf litter (Uchytal 1989). Low-intensity fires compared to severe, high-intensity fires affect this community differently. Following low-intensity fire thinleaf alder generally has the ability to sprout from its root crown whereas severe fires can completely remove organic soil layers, leaving alder roots exposed and charred and thus eliminating basal sprouting. After low-intensity fire several new sprouts may arise from each burned plant, thus increasing stand density (Uchytal 1989). Blue spruce is easily killed by fire. In riparian areas where blue spruce occurs, intervals between fires are about 350 to 400 years. Severe fires occur infrequently, and succession back to the original community is often relatively rapid (15 to 35 years) (Pavek 1993).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Picea pungens* / *Equisetum arvense* Woodland
State Common Name Montane Riparian Forest
Global Scientific Name: *Picea pungens* / *Equisetum arvense* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

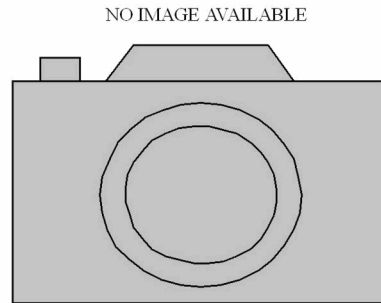
Subclass: Evergreen woodland

Group: Temperate or subpolar
needle-leaved evergreen woodland

Subgroup: Natural/Semi-natural
temperate or subpolar needle-leaved
evergreen woodland

Formation: Temporarily flooded
temperate or subpolar needle-leaved
evergreen woodland

Alliance: Blue Spruce Temporarily
Flooded Woodland Alliance



Global Rank: G3?

Global Rank Reasons: This minor riparian association is known from Colorado, Utah, and Wyoming. Less than 100 occurrences are estimated to exist. Threats are imposed by overuse from recreation and livestock, and alteration of flood regimes from dams and diversions. Soils are often wet and easily compacted by livestock, and frequent flooding appears important to maintain the dominance of *Equisetum arvense*, at least in stands in Colorado. The question mark in the rank indicates the uncertainty of how many occurrences exist in Utah. Classification clarification of similar stands in Utah and Wyoming is needed to know the extent of this type.

Subnational Rank: S2?

Subnational Rank Reasons: The *Picea pungens* / *Equisetum arvense* woodland is known from two locations in Colorado. One of these sites is threatened by impacts from mining, roads and development.

General Description: This association tends to be limited to narrow canyons and cool ravines on stream benches and streambanks that are frequently flooded. Stream channels dominated by *Picea pungens* (blue spruce) are generally wide with narrow, developed floodplains. Streambed material is coarse (boulders and cobbles) (Carsey et al 2003, NatureServe 2009). Stands occur in Colorado, Utah, and Wyoming at elevations of 2135-2745 m (7000-9000 feet) and are characterized by dominance of *Picea pungens* with a thick understory of *Equisetum arvense* and few shrubs. Other tree species possibly present include *Pseudotsuga menziesii*, *Pinus contorta*, and *Picea engelmannii*. Shrub cover is minor, yet diverse. The herbaceous undergrowth typically consists of few species

including *Equisetum arvense*, *Carex aquatilis*, and *Juncus balticus* var. *montanus*. Frequent flooding appears important to maintaining the species in the herbaceous layer.

Vegetation: The overstory is a dense canopy of *Picea pungens* (blue spruce). Other tree species also sometimes occur including *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), *Pseudotsuga menziesii* (Douglas-fir), *Pinus contorta* (lodgepole pine) and *Populus tremuloides* (quaking aspen). Shrub cover is minor, yet diverse. Shrub species with at least 1% cover each include *Betula nana* (= *glandulosa*) (bog birch), *Salix geyeriana* (Geyer willow), *Salix monticola* (Rocky Mountain willow), and *Rosa woodsii* (Woods rose). The herbaceous layer can be monotypic with *Equisetum arvense* (field horsetail) the sole dominant. Other herbaceous species that may be present include *Carex aquatilis* (water sedge), *Carex disperma* (softleaf sedge), and *Juncus balticus* var. *montanus* (mountain rush), *Elymus glaucus* (wild rye), *Glyceria striata* (fowl mannagrass), *Geranium richardsonii* (Richardson geranium), *Senecio triangularis* (arrowleaf ragwort), *Galium boreale* (northern bedstraw), *Orthilia secunda* (sidebells wintergreen), and *Maianthemum stellatum* (starry false Solomon plume).

Similar Communities: *Acer negundo* / *Equisetum arvense* Forest (box elder / field horsetail), *Picea pungens* / *Betula occidentalis* (blue spruce/river birch) Woodland, *Picea engelmannii* / *Equisetum arvense* (Engelmann spruce / field horsetail) Forest (NatureServe 2009).

Regional Distribution: This minor association is known from Colorado and Utah, and likely occurs in southwestern Wyoming and southeastern Idaho.

Colorado Distribution: This association is known from two sites, each located in the south-central mountains of Colorado.



Elevation Range in Colorado: 9,120.00 - ? ft / 2,779.78 - ? m

Site Geomorphology: This plant association occurs in narrow, V-shaped valleys with cold-air drainage, forming small bands along narrow benches and floodplains (Carsey et al. 2003).

Soil: Soils are continually saturated or moderately well-drained. The water table is within 50 cm of the surface (NatureServe 2009). Soil textures are clay loams and silty clay loams with alternating layers of sandy loams (Carsey et al. 2003).

Successional and Ecological Processes: In deep, narrow canyons with swift-moving streams and narrow floodplains and benches, *Picea pungens* (blue spruce) appears to be a climax riparian species. *Picea pungens* will remain until removed or damaged by a catastrophic flood. A closely related community, the *Picea* / *Equisetum arvense* (spruce/field horsetail), reported from Montana, Wyoming, Idaho, and Utah, is considered a late-seral to near climax riparian type. In Colorado, the *Picea pungens* / *Equisetum arvense* (blue

spruce/field horsetail) plant association is considered an indicator of frequent flooding. While many of the trees are fairly large, the understory of *Equisetum arvense* (field horsetail) indicates frequent flooding. Some stands remain undisturbed and occur in persistently wet areas of the floodplain. With less frequent flooding, this association may gradually change to a *Picea pungens* / *Alnus incana* (blue spruce/thinleaf alder) plant association (Carsey et al 2003). Blue spruce provides valuable forage and cover resources for a variety of native wildlife. Big game forage is good throughout blue spruce habitat types in northern New Mexico and southern Colorado. Numerous birds eat blue spruce seeds. Blue spruce cones are cached by red squirrels in Utah. Blue spruce also provides good environmental protection for elk, mule deer, white-tailed deer, small mammals, and small nongame and upland game birds in Colorado, Utah, and Wyoming. Sensitive and endangered species use mixed-conifer stands in which blue spruce occurs. Such species include flammulated owls in Colorado, Jemez Mountain salamander of New Mexico, and northern goshawks in Arizona. Bald eagle breeding areas at intermediate elevation in Wyoming are dominated by blue spruce and narrowleaf cottonwood. In the Snake River (forest) Unit, 28 percent of the nests were in blue spruce trees (Pavek 1993).

Adjacent Vegetation: Adjacent riparian vegetation: occurrences often contain a mosaic of one or two communities dominated by one of the following trees: *Abies concolor*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea pungens*, or *Populus tremuloides* (Rondeau 2001). Adjacent upslope vegetation: generally the vegetation surrounding these riparian systems are dominated by the same trees that dominate in the riparian area.

Management: The primary ecological process necessary to maintain this ecological systems is hydrology including surface flow and groundwater. Annual and episodic flooding is important to maintaining the natural hydrologic regime (Rondeau 2001) especially in this environmental setting. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to the plant and community composition. Barriers to natural processes or species movement may also threaten longterm viability and include habitat alterations such as such as highways, urban development, cultural vegetation, stream channelization and hydrologic alteration (Rondeau 2001). Additionally, upstream activities that effect water quality, such as mining, may be important to the vertebrates and invertebrates that use this system (Rondeau 2001) and that are essential to ecosystem function.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Pinus aristata* / *Trifolium dasyphyllum* Woodland
State Common Name Upper Montane Woodlands
Global Scientific Name: *Pinus aristata* / *Trifolium dasyphyllum* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

Subclass: Evergreen woodland

Group: Temperate or subpolar
needle-leaved evergreen woodland

Subgroup: Natural/Semi-natural
temperate or subpolar needle-leaved
evergreen woodland

Formation: Rounded-crowned
temperate or subpolar needle-leaved
evergreen woodland

Alliance: Bristlecone Pine Woodland
Alliance



Global Rank: G2

Global Rank Reasons: There are 11 recorded locations for this association in the southern Rockies of Colorado. This type is a regional endemic with only a few recorded occurrences within its potential range. It requires relatively xeric subalpine slopes between 11,250 and 11,645 feet (just below timberline) with skeletal mineral soils and adequate drainage. Stands are threatened by recreational use, mining, and possibly effects of atmospheric deposition of pollutants. Recovery of these communities from anthropogenic disturbance is severely limited by the extreme environmental conditions under which they occur (Hess 1981).

Subnational Rank: S2

Subnational Rank Reasons: There are estimated to be at least 20-30 stands of this community in Colorado. Most stands are currently in good condition and no threats have yet been documented. However, white pine blister rust has been documented to occur in Colorado in *Pinus aristata* (bristlecone) (Blodgett and Sullivan 2004) and poses a significant threat to the viability of bristlecone pine communities in Colorado. Bristlecone pine are are forecast to decline due to the recent spread of white pine blister rust (*Cronartium ribicola*) into Colorado (Schoettle and Sniezko 2007).

General Description: This is a woodland association dominated by the evergreen needle-leaved tree *Pinus aristata* (bristlecone pine), averaging 40-50% cover. *Picea engelmannii* (Engelmann spruce), another coniferous tree, is present as scattered individuals. Seedlings and saplings of either species are infrequent, and shrubs are absent from most stands. The herbaceous understory layer is moderately sparse, with

total cover averaging <20%. The perennial forb *Trifolium dasyphyllum* (Uinta clover) clearly dominates, with 10-12% cover. The remaining herbaceous species are a mix of perennial graminoids and forbs; important species include the graminoids *Calamagrostis purpurascens* (purple reedgrass), *Carex siccata* (= *Carex foenea*) (dryspike sedge), *Festuca brachyphylla* (Colorado fescue), and *Trisetum spicatum* (spike trisetum), and the forbs *Achillea millefolium* (western yarrow), *Arenaria fendleri* (Fendler's sandwort), *Penstemon whippleanus* (Whipple's penstemon), *Polemonium pulcherrimum* ssp. *delicatum* (= *Polemonium delicatum*) (Jacob's ladder), and *Solidago simplex* (goldenrod) (NatureServe 2009).

Vegetation: This is a woodland association dominated by the evergreen needle-leaved tree *Pinus aristata* (bristlecone pine), averaging 40-50% cover. *Picea engelmannii* (Engelmann spruce), another coniferous tree, is present as scattered individuals. Seedlings and saplings of either species are infrequent, and shrubs are absent from most stands. The herbaceous understory layer is moderately sparse, with total cover averaging <20%. The perennial forb *Trifolium dasyphyllum* (Uinta clover) clearly dominates, with 10-12% cover. The remaining herbaceous species are a mix of perennial graminoids and forbs; important species include the graminoids *Calamagrostis purpurascens* (purple reedgrass), *Carex siccata* (= *Carex foenea*) (dryspike sedge), *Festuca brachyphylla* (Colorado fescue), and *Trisetum spicatum* (spike trisetum), and the forbs *Achillea millefolium* (western yarrow), *Arenaria fendleri* (Fendler's sandwort), *Penstemon whippleanus* (Whipple's penstemon), *Polemonium pulcherrimum* ssp. *delicatum* (= *Polemonium delicatum*) (Jacob's ladder), and *Solidago simplex* (goldenrod) (NatureServe 2009).

Similar Communities: -

Regional Distribution: This association is limited to the higher slopes of the southern Rockies in Colorado.

Colorado Distribution: Documented stands occur in Park and Clear Counties.



Elevation Range in Colorado: 11,240.00 - 11,645.00 ft / 3,425.95 - 3,549.40 m

Site Geomorphology: The association occurs on high elevation (11,240-11,645 feet) moderate to steep, dry, windswept ridges slopes of varying, but primarily south-facing aspects, with geology that is characterized by a mosaic of vault-bounded and uplifted blocks of Pre-Cambrian granites, schists and gneisses (NatureServe 2009, Rondeau 2001).

Soil: Soils are derived primarily from granitic parent materials. They are minimally developed Typic Cryorthents: shallow, coarse-textured (sandy loams), and with rocks on the surface (NatureServe 2009).

Successional and Ecological Processes: *Pinus aristata* (bristlecone pine) occurs in early seral and old-growth stages. It usually dominates both new and old-growth forests and woodlands at high elevations (Howard 2004). Fire may be the primary disturbance in bristlecone pine-dominated forests. As suggested by the unimodal distribution of size classes in most mature stands of bristlecone pine and the near absence of seedlings in these stands, together with abundant seedlings in recently burned stands, suggests that bristlecone pine regenerates primarily following fires (Rondeau 2001). *Pinus aristata* (bristlecone pine) reproduces from seed. Regeneration requirements for successful bristlecone pine establishment are rarely met, but as an extremely long-lived species, bristlecone pine has centuries to millennia to wait for favorable regeneration conditions (Howard 2004). Importantly for regeneration, although seeds of the bristlecone are mostly dispersed by the wind, some seeds are dispersed by Clark's nutcrackers (*Nucifraga columbiana*). Clark's nutcrackers, besides utilizing the large, wingless seeds of the nutcracker pines, also frequently consume and cache winged-seeded species that grow close to stands of their preferred species, such as limber pine (*Pinus flexilis*), including species such as *Pinus aristata* (McMurray 2008). Clark's nutcrackers are most likely to cache bristlecone pine seeds when seed crops of preferred species are poor (McMurray 2008). Pines benefit from the scatter-hoarding behavior of the Clark's nutcracker, ultimately gaining both consistent seed dispersal to sites favorable for seedling establishment and seed concealment from predators (McMurray 2008). *Pinus aristata* (bristlecone pine) provides watershed and erosion protection on high-elevation sites. Among subalpine communities of the Southwest, snowpack in open, bristlecone pine-dominated communities is usually the last to melt in spring (Howard 2004). *Pinus aristata* is damaged by Western spruce dwarf mistletoe (*Arceuthobium microcarpum*) and by blister rust. Blister rust has already infected mature bristlecone pines in northern Colorado and infection is always fatal (Howard 2004).

Adjacent Vegetation: Adjacent upslope vegetation includes *Pinus flexilis* (limber pine), *Pseudotsuga menziesii* (Douglas fir), *Picea engelmannii* (Engelmann spruce), *Pinus contorta* (lodgepole pine).

Management: Management essential to the long-term viability of the *Pinus aristata* / *Trifolium dasphyllum* (bristlecone pine / Uinta clover) Woodland include blister rust eradication and prevention and maintenance of a historically natural fire regime. Additional threats to system viability include barriers to natural processes or species movement, such as cultural vegetation greater than one mile wide, major highways or urban development and recreational fragmentation (Rondeau 2001). To promote the evolution of rust resistance and to maintain functioning of five-needle pine ecosystems, Schoettle and Sniezko (2007) proposed proactive land management strategies that include the outplanting of rust-resistant seedlings and silvicultural treatments that increase natural establishment before pathogen invasion. Potentially useful strategies include outplantings of rust-resistant seedlings and silvicultural treatments that maintain or boost populations and diversify age-class structure (primarily via increases in younger cohorts) prior to rust outbreaks (Schoettle and Sniezko, 2007). Clark's nutcrackers are highly dependent on habitat shaped by fire at intervals ranging from 50 to 300 years, especially at subalpine elevations where whitebark pine and limber pine are primary food sources. Fire initially creates caching habitat for Clark's nutcrackers on many sites. If a seed crop is available, Clark's nutcrackers cache in burned areas almost immediately following burning. Caching may continue for decades, sometimes

extending into late-seral stages if burned sites remain relatively open (McMurray 2008). Climate change is generally regarded as a major influence driving recent increases in wildfire frequency, severity, size, and duration in the western United States. Many high-elevation forests of nutcracker pines have been shaped by mixed-severity fires that created complex mosaics of live and dead trees across the landscape, a situation conducive to Clark's nutcracker foraging and caching habits. This mosaic may be eliminated as wildfires increase in size and severity. Extensive fires may also spread into climax stands of nutcracker pines, which historically experienced long fire-return intervals of 400 years or more (McMurray 2008). Fire is used as a management tool to promote whitebark pine (*Pinus albicaulis*), a related 5-needle white pine (Strobus), in blister rust-infected areas. Fire management strategies used on whitebark pine can be applied to *Pinus aristata* (bristlecone pine). Fire-created openings provide establishment sites for natural regeneration of early successional white pines including bristlecone pine. Most importantly, fire-created openings can provide opportunities for natural and artificial regeneration of genetically blister rust-resistant bristlecone pine. Protecting blister rust-resistant parent trees from fire, while encouraging natural selection of blister rust-resistant seedlings by providing a suitable open, mineral soil seedbed, is the best hope for restoring bristlecone pine communities in the long term (Howard 2004).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Pinus ponderosa* / *Alnus incana* Woodland
State Common Name Ponderosa Pine/Thin Leaf Alder
Global Scientific Name: *Pinus ponderosa* / *Alnus incana* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

Subclass: Evergreen woodland

Group: Temperate or subpolar
needle-leaved evergreen woodland

Subgroup: Natural/Semi-natural
temperate or subpolar needle-leaved
evergreen woodland

Formation: Temporarily flooded
temperate or subpolar needle-leaved
evergreen woodland

Alliance: Ponderosa Pine Temporarily
Flooded Woodland Alliance



Global Rank: G2

Global Rank Reasons: This association is known only from the Front Range of Colorado. Stands occur along foothill and montane streambanks on the southern aspects of canyons that are otherwise too dry for conifers. Streamflow alteration, development and heavy recreational use threaten this plant community. The major species have large ecological amplitudes, and the re-introduction of appropriate streamflows and rest from overuse will likely result in the re-establishment of healthy communities. Additional survey is needed for similar woodlands in New Mexico, Arizona and elsewhere in Colorado.

Subnational Rank: S2

Subnational Rank Reasons: *Pinus ponderosa* / *Alnus incana* woodland have been documented from only three sites in Colorado. Impacts from channelization, invasion of non-native plant species, recreation and hydrologic alteration threaten these communities.

General Description: This coniferous riparian woodland is found along foothill and lower montane canyon bottoms of the southern Rocky Mountains along the Colorado Front Range and may occur in similar habitats in New Mexico and Arizona. Stands occur along rivers and streams on southern aspects that would be too dry for *Pinus ponderosa*, except for the stream moisture. Sites are flooded for brief periods during the growing season, and the shrubs and trees have access to the water table (NatureServe 2009).

Vegetation: Diagnostic of this riparian woodland association is the dominance of *Pinus ponderosa* in the tree layer with a shrub layer dominated by *Alnus incana* and other mesic shrubs. Large, mature *Pinus ponderosa* (ponderosa pine) trees provide an open overstory canopy (25-70% cover) with a narrow band of *Alnus incana* (thinleaf alder) (10-30% cover) overhanging the generally narrow and steep stream channel. Older *Pinus ponderosa* (ponderosa pine) trees are usually rooted in well-drained locations at the top of the streambank or farther from the edge of the channel. The shrub layer is dominated by *Alnus incana* (thinleaf alder) but other shrubs are also often present including *Betula occidentalis* (river birch) with 5-35% cover, *Prunus virginiana* (choke cherry), *Salix bebbiana* (Bebb willow), and *Salix ligulifolia* (strapleaf willow). *Toxicodendron rydbergii* (western poison ivy) may also be present. The herbaceous undergrowth is usually sparse because of the droughty soils.

Similar Communities: -

Regional Distribution: Currently known only from the Colorado Front Range, though it is expected to occur in New Mexico and Arizona.

Colorado Distribution: This association has been documented in three counties in Colorado, Jefferson, Larimer and Chaffee.



Elevation Range in Colorado: 5,760.00 - 8,800.00 ft / 1,755.65 - 2,682.24 m

Site Geomorphology: Canyon bottoms in the foothills and lower montane life zones (NatureServe 2009).

Soil: Substrates are well-drained, coarse alluvium (NatureServe 2009).

Successional and Ecological Processes: -

Adjacent Vegetation: -

Management: Ponderosa pine ecosystems are under considerable stress, both from natural and anthropogenic factors including past management practices (Howard 2003). Essential to the long-term viability of the ponderosa pine/thinleaf alder woodland is the maintenance of natural ecosystem processes including hydrology and fire, employing sustainable grazing management, eradication of non-native plant species and recreation management.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus angustifolia* - *Juniperus scopulorum* Woodland
State Common Name Montane Riparian Forest
Global Scientific Name: *Populus angustifolia* - *Juniperus scopulorum* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification
Class: Woodland
Subclass: Deciduous woodland
Group: Cold-deciduous woodland
Subgroup: Natural/Semi-natural
cold-deciduous woodland
Formation: Temporarily flooded
cold-deciduous woodland
Alliance: Narrowleaf Cottonwood
Temporarily Flooded Woodland
Alliance



Global Rank: G2G3

Global Rank Reasons: Lower montane riparian woodland ecological systems are confined to specific environments on floodplains or terraces of rivers and streams and occupy less than 1% of the Southern Rocky Mountain ecoregion (Rondeau 2001).

Subnational Rank: S2S3

Subnational Rank Reasons: This association is documented from 37 locations in Colorado.

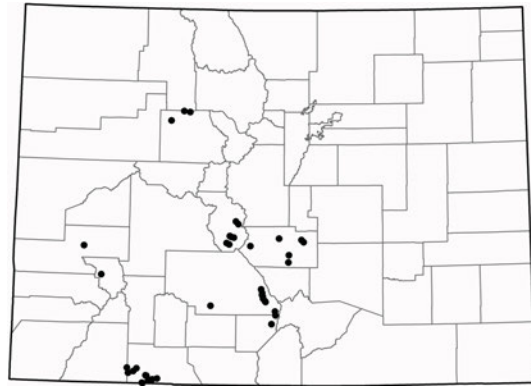
General Description: *Populus angustifolia* - *Juniperus scopulorum* (narrowleaf cottonwood - Rocky Mountain juniper) dominated riparian areas are uncommon. The community occurs along lower foothill streams with perennial to intermittent stream flows (Carsey et al. 2003). These mature riparian forests occupy some of the driest sites in the floodplain. Stands are usually located on high, dry stream terraces with level slopes and sandy surface soil texture and are infrequently flooded (10-100-yr recurrence intervals) (NatureServe 2009). Stream channels along which the association occurs are steep and narrow with rocky to sandy bottoms but the association can also occur on upper terraces and elevated islands of wide, meandering river reaches such as those found along the Arkansas and Colorado Rivers (Carsey et al. 2003). Often *Juniperus scopulorum* (Rocky Mountain juniper) is situated at the high water line and above, while the *Populus angustifolia* (narrowleaf cottonwood) grades into the active floodplain area (Carsey et al.

2003). Some stands may be directly adjacent to the stream but still situated several meters above it due to downcut streambanks, or they may be dry because the stream only flows intermittently. In these stands, the cottonwoods have limited self-sustaining capabilities except vegetatively by root sprouts. Many of the trees are often decadent or dying, and junipers are commonly growing up under them, colonizing the drying terraces. Further, the presence of juniper in these and other floodplain communities is often considered invasive. Juniper, as a codominant in these communities, is at least viewed as an indicator that flooding occurs infrequently. Only the largest of floods will remove these communities (NatureServe 2009).

Vegetation: The species composition and percent cover in this association are variable and depend on aspect, elevation, and streamflow, in addition to the degree of disturbance by recreational use and livestock grazing. Total biomass and canopy cover are often low. Vegetation is characterized by an open to closed canopy (25-60% cover) of *Populus angustifolia* (narrowleaf cottonwood) and scattered to abundant *Juniperus scopulorum* (Rocky Mountain juniper) or occasionally *Juniperus monosperma* (oneseed juniper), *Betula occidentalis* (river birch) or *Pinus edulis* (pinon pine) in the subcanopy, often with little else growing in the understory. Stands with northern aspects may include *Pseudotsuga menziesii* (Douglas-fir) or *Populus tremuloides* (quaking aspen). Two stands in the lower San Juan watershed occur with *Juniperus osteosperma* (Utah juniper), rather than *J. scopulorum* (Rocky Mountain juniper), and are included in this association type (Carsey et al. 2003, NatureServe 2009). There is very little shrub canopy and little to no herbaceous undergrowth due to dry conditions. If present, the shrub canopy may include a wide variety of species, although none is present in every stand and those that are present often reflect the open, drier site conditions. Shrub species may include *Artemisia tridentata* (mountain big sagebrush), *Mahonia repens* (creeping barberry), *Purshia tridentata* (antelope bitterbrush), *Rosa woodsii* (Wood's rose), *Clematis ligusticifolia* (western white clematis), *Acer glabrum* (Rocky Mountain maple), *Rhus trilobata* (skunkbush sumac), *Symphoricarpos oreophilus* (mountain snowberry), *Quercus gambelii* (Gambel oak) and *Berberis fendleri* (Colorado barberry) (Carsey et al 2003, NatureServe 2009). An open grassy understory is characteristic with species such as *Sporobolus cryptandrus* (sand dropseed), *Carex geyeri* (Geyer sedge), *Juncus balticus* (mountain rush), *Leymus cinereus* (basin wildrye) and *Poa fendleriana* (muttongrass). In disturbed stands native grasses may have been replaced by non-native species including *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Agrostis stolonifera* (creeping bentgrass), *Bromus inermis* (cheatgrass) and *Melilotus officinalis* (sweet clover) (Carsey et al. 2003, NatureServe 2009). Regardless of the drier conditions, a variety of native wetland indicators can occur: *Juncus effusus* (common rush), *Glyceria striata* (fowl mannagrass), *Muhlenbergia racemosa* (marsh muhly), *Carex nebrascensis* (Nebraska sedge), *Agrostis exarata* (spike bentgrass), *Rudbeckia laciniata* (cutleaf coneflower), *Equisetum arvense* (field horsetail), *Epilobium ciliatum* (fringed willowherb), *Mertensia ciliata* (tall fringed bluebells), *Lycopus asper* (rough bugleweed), *Equisetum laevigatum* (smooth horsetail), and *Asclepias incarnata* (swamp milkweed) (NatureServe 2009).

Similar Communities: -

Regional Distribution: This semi-riparian woodland association has been documented to occur in north-central Wyoming, western Colorado and northern New Mexico on terraces or slopes of gorges, ravines, and moderate-sized intermittent or perennial drainages between 1740 and 2400m (5725-7875 feet) elevation and it may occur in Utah (NatureServe 2009).



Colorado Distribution: This association is known primarily from the south central and south west regions of Colorado including Chaffee, Fremont, Saguache, and Archuleta counties. However stands have been documented as far north as Eagle County and as far west as Montrose County.

Elevation Range in Colorado: 5,900.00 - 8,520.00 ft / 1,798.32 - 2,596.90 m

Site Geomorphology: The association typically occurs on high, dry stream terraces with level slopes and a sandy surface soil texture (NatureServe 2009). Valley widths are 700 feet (200 m) or less and stream gradients are generally low to moderate (0.5 to 2.5%) (Carsey et al. 2003).

Soil: Soils of this plant association are derived from alluvial deposits. Surface soils consist of loamy sand, clay loams, silty clays or organic matter. Subsurface layers range from sandy loams and loamy sands to clay loams and sandy clay loams with 20-50% gravel and cobbles. Soil depth ranges from 15 to 25 inches (40 to 65 cm). (Carsey et al. 2003). Soils at some of the lower terraces may be very moist at depths within the rooting zone, particularly during seasonal high water events (NatureServe 2009).

Successional and Ecological Processes: As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats (Carsey et al. 2003). Many stands have decadent *Populus angustifolia* (narrowleaf cottonwood) trees that are being replaced by *Juniperus scopulorum* (Rocky Mountain juniper). Other stands periodically flood and retain a large amount of woody debris. In all cases the vegetation and topographic position indicate a community that is becoming isolated from the water table. As the water table drops, the facultative and obligate wetland plants will be replaced by upland species (NatureServe 2009)

Adjacent Vegetation: The system often occurs as a mosaic of multiple plant communities that are tree dominated with a diverse shrub component. The variety of plant associations connected to this system reflect elevation, stream gradient, floodplain width, and flooding events. Other dominant trees may include *Acer negundo* (box elder), *Populus balsamifera* (balsam poplar), *Pseudotsuga menziesii* (Douglas-fir), or *Picea pungens* (blue spruce). Other dominant shrubs may include *Alnus incana* (thinleaf alder), *Betula occidentalis* (river birch), *Cornus sericea* (red-osier dogwood), *Crataegus rivularis* (river hawthorn), *Prunus virginiana* (chokecherry), *Salix monticola* (mountain willow), *S. drummondiana* (Drummond's willow), *S. exigua* (sandbar willow), *S. lucida* (shining willow), *Shepherdia argentea* (silver buffaloberry), or *Symphoricarpos* (snowberry) spp. Upland vegetation surrounding this association generally ranges from grassland to forests (Rondeau 2001).

Management: Maintaining a natural hydrologic regime is essential to the long-term viability of the *Populus angustifolia* - *Juniperus scopulorum* (narrowleaf cottonwood - Rocky Mountain juniper) association. Also important to the viability of this association is the maintenance of a natural channel shape with streambanks that are not oversteepened or downcut and a channel width that is not overwidened. Sustainable grazing management and eradication of non-native plant species will also benefit this plant community (Rondeau 2001). The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Annual and episodic flooding is extremely important for maintaining a diversity of age classes of *Populus angustifolia* (narrowleaf cottonwood) as well as a mosaic of plant associations within the floodplain. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001) with consequences that may include streambank destabilization, and channel downcutting, widening and braiding.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus angustifolia* - *Pseudotsuga menziesii* Woodland
State Common Name Montane Riparian Forest
Global Scientific Name: *Populus angustifolia* - *Pseudotsuga menziesii* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

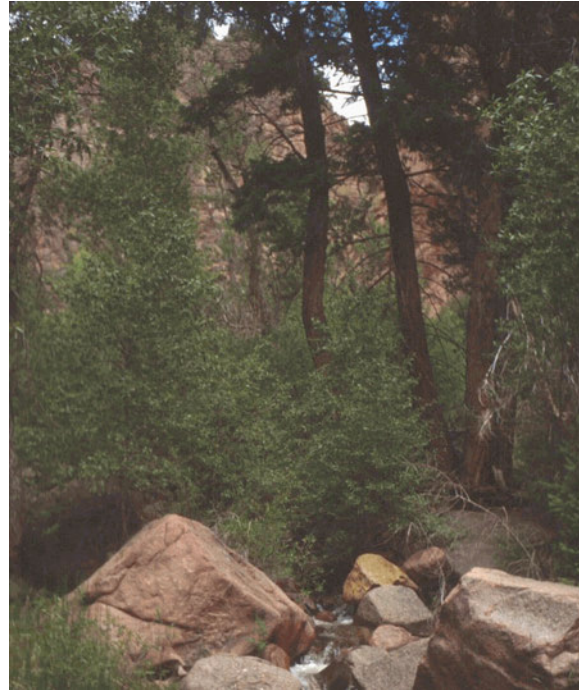
Subclass: Deciduous woodland

Group: Cold-deciduous woodland

Subgroup: Natural/Semi-natural
cold-deciduous woodland

Formation: Temporarily flooded
cold-deciduous woodland

Alliance: Narrowleaf Cottonwood
Temporarily Flooded Woodland
Alliance



Global Rank: G3

Global Rank Reasons: This association is reported in Utah, Nevada, and Colorado. Although it is relatively widespread, occurrences are small and patchy, and it is easily degraded and exists only where accessibility limits anthropogenic alteration. Stands are threatened by invasion of exotic plant species, improper livestock grazing, streamflow alterations, heavy recreational use, and development. Even where inaccessible by livestock and recreationists, stands are still threatened by establishment of pasture grasses. Aggressive weed control is necessary to protect many of the good condition occurrences.

Subnational Rank: S2

Subnational Rank Reasons: Lower montane riparian woodlands, such as this one, are linear systems confined to specific environments occurring on floodplains or terraces of rivers and streams and altogether occupy less than 1% of the southern rocky Mountain ecoregion (Rondeau 2001). In Colorado this association is documented from only 15 sites and many of these are impacted by non-native plant species, grazing and stream diversions.

General Description: The *Populus angustifolia* - *Pseudotsuga menziesii* (narrowleaf

cottonwood - Douglas-fir) plant association is limited to narrow canyon bottoms and V-shaped valleys where a northern or protected aspect creates cool micro-environments. This riparian woodland association is found along small active streams in rocky, cool canyons and valleys between 2000-2700 m in Colorado, Utah, and Nevada. This association represents a transition from lower montane to upper montane habitats. Nearly all stands observed have an adjacent north-facing slope with *Pseudotsuga menziesii* (Douglas-fir) forests (NatureServe 2009, Carsey et al 2003). A mix of *Pseudotsuga menziesii* (10-40% cover) and *Populus angustifolia* (10-60% cover) in the upper canopy is diagnostic, though they may be joined by other conifer species. Shrub cover is typically low, but highly variable and diverse. Herbaceous cover can be sparse and usually limited by heavy shade (NatureServe 2009).

Vegetation: *Pseudotsuga menziesii* (Douglas-fir) and *Populus angustifolia* (narrowleaf cottonwood) dominates the upper tree canopy of this plant association. The mix of these two species as mature trees in the overstory canopy is the diagnostic characteristic for this plant association. *Juniperus scopulorum* (Rocky Mountain juniper) or *Abies concolor* (white fir) may also be present. Several other conifer tree species may be present, but with less than 1% cover. Shrub cover is typically low, but is highly variable and diverse. No single species was present in all stands sampled. Shrub species include *Acer glabrum* (Rocky Mountain maple), *Salix exigua* (sandbar willow), *Betula occidentalis* (river birch), *Alnus incana* (thinleaf alder), *Quercus gambelii* (Gambel oak), *Salix lucida* ssp. *caudata* (shining willow), *Clematis ligusticifolia* (western white clematis), and *Ribes cereum* (wax currant). The herbaceous undergrowth can be sparse and is usually limited by heavy shade and dry soil conditions. Herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Achillea millefolium* var. *occidentalis* (western yarrow), *Trifolium repens* (white clover), and *Agrostis stolonifera* (creeping bentgrass) (Carsey et al. 2003).

Similar Communities: -

Regional Distribution: Known to occur in the mountainous regions of Colorado, Utah and Nevada.

Colorado Distribution: This plant association is documented in the Southern Rocky mountains of Colorado as far north as Grand County and as far south as Mineral County. This association is also expected to occur in narrow foothill canyons of the Colorado Front Range.



Elevation Range in Colorado: 6,600.00 - 8,720.00 ft / 2,011.68 - 2,657.86 m

Site Geomorphology: *Populus angustifolia* - *Pseudotsuga menziesii* woodlands grow in wash bottoms and on immediate stream banks, cobble bars, and terraces and also occurs on slightly meandering floodplains of broad reaches with coarse channel bed material. Stream channels are steep and narrow with streambeds of bedrock, sand, or silt (Carsey et al. 2003).

Soil: Soils are derived from alluvial and colluvial deposits and are fairly shallow, 10-30

inches (25-75 cm) thick. Soils become skeletal with depth. Surface layers are sandy loams, clay loams, and loams. Subsurface layers are sandy loams with 10-30% cobbles and gravels. Organic matter from accumulated litter is concentrated in the upper layers (Carsey et al 2003).

Successional and Ecological Processes: -

Adjacent Vegetation: Adjacent riparian vegetation: this system occurs as a mosaic of multiple communities that are tree dominated with a diverse shrub component (Rondeau 2001). Adjacent upland vegetation: generally the upland vegetation surrounding this riparian system ranges from grasslands to forests (Rondeau 2001).

Management: These woodlands are dependent upon flooding disturbance for regeneration of *Populus angustifolia* (NatureServe 2009) and maintaining a natural hydrologic regime complete with flooding flows of a sufficient duration and magnitude are essential for the long-term viability of these woodlands.. The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Annual and episodic flooding is extremely important for maintaining a diversity of age classes of *Populus angustifolia* (narrowleaf cottonwood) as well as a mosaic of plant associations with the floodplain (Rondeau 2001). The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats (Carsey et al. 2003). Narrowleaf cottonwood provides essential habitat structure to riparian ecosystems and is high quality streambank stabilizer (USDA 2004). However, anthropogenic modification of riparian systems may adversely affect ecosystem health and channel stability. Drastic declines in the reproductive ability of cottonwoods and other native species is common. Disturbances such as irrigation diversions, reservoirs, farming, and grazing have profoundly altered natural stream ecology. Dams alter annual water table fluctuations by reducing downstream flow, altering sediment transport, decreasing organic matter transport, and decreasing sediment deposition and generally have negative impacts on downstream narrowleaf cottonwood communities. Annual spring flooding is a controlling factor behind species composition and population dynamics of narrowleaf cottonwood communities - narrowleaf cottonwood seeds possess a small window of viability, generally 2 days - and seedlings require wet alluvium in full sunlight. Damming however generally reduces the number and quality of narrowleaf cottonwood regeneration sites. Additionally dams that decrease summer water tables affect narrowleaf cottonwood establishment by exposing seedlings to artificial drought (Simonin 2001).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus angustifolia* / *Alnus incana* Woodland
State Common Name Montane Riparian Forest
Global Scientific Name: *Populus angustifolia* / *Alnus incana* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification
Class: Woodland
Subclass: Deciduous woodland
Group: Cold-deciduous woodland
Subgroup: Natural/Semi-natural
cold-deciduous woodland
Formation: Temporarily flooded
cold-deciduous woodland
Alliance: Narrowleaf Cottonwood
Temporarily Flooded Woodland
Alliance



Global Rank: G3

Global Rank Reasons: This association is known from New Mexico and Colorado. Although not documented from other states, it is expected to occur throughout the range of *Populus angustifolia* (narrowleaf cottonwood) in the Rocky Mountains (NatureServe 2009). Although the system is widely distributed throughout the region it occupies less than 1% of the Southern Rocky Mountain ecoregion.

Subnational Rank: S3

Subnational Rank Reasons: This is a common community along montane streams on the eastern and western slopes, however only a few high quality associations exist. This association is highly threatened by improper livestock grazing, development, roads, recreation and streamflow alteration. Over half of the 56 known occurrences in Colorado are impacted by livestock grazing and the majority are threatened by a variety of additional impacts such as invasion of non-native species, development and hydrologic modification.

General Description: The *Populus angustifolia* / *Alnus incana* ssp. *tenuifolia* (narrowleaf cottonwood/thinleaf alder) plant association is characterized by a narrow, dense stand of *Alnus incana* lining the stream bank and an open to nearly closed canopy of *Populus angustifolia*. Other shrubs may occur but *Alnus incana* (thinleaf alder) usually has at least 10-20% cover and is the most abundant of all other shrubs within the stand (Carsey et al. 2003). This plant association occurs on banks and benches of narrow, fast-moving streams with active floodplains in montane ecosystems (Carsey et al. 2003, NatureServe 2009). Stream gradient and channel width where this association occurs are highly variable. Stands occur along steep, narrow reaches with little sinuosity as well as along

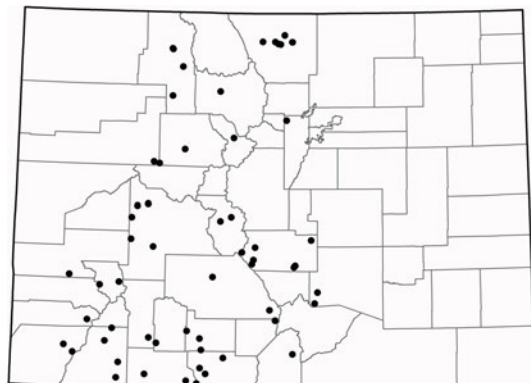
low gradient, moderately sinuous broad channel reaches, along low gradient, highly sinuous reaches and along very narrow and highly sinuous stream reaches (Carsey et al. 2003).

Vegetation: Key diagnostic characteristics of this association are the dominance of *Populus angustifolia* (narrowleaf cottonwood) and *Alnus incana* (thinleaf alder). Although several other tree and shrub species may be present they rarely equal the abundance of the diagnostic species (Carsey et al. 2003). Vegetation is characterized by an open to nearly closed deciduous tree canopy of *Populus angustifolia* with a dense layer of *Alnus incana* lining the streambanks. *Populus angustifolia* is always present, although sometimes only as a saplings (NatureServe 2009). A variety of riparian and upland tree species may also be present, including *Salix amygdaloides* (peachleaf willow), *Populus X acuminata* (lanceleaf cottonwood), *Populus tremuloides* (quaking aspen), *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper), *Pinus ponderosa* (Ponderosa pine), *Abies concolor* (white fir), or *Picea pungens* (blue spruce) (Carsey et al. 2003, NatureServe 2009). The shrub understory is dominated by a dense band of *Alnus incana* (thinleaf alder) lining the stream banks. A variety of other shrubs may be present intermingling with the alder but usually providing less than the total alder cover. Other shrub species commonly present include *Salix bebbiana* (Bebb willow), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond's willow), *Salix ligulifolia* (strapleaf willow), *Salix lucida* ssp. *caudata* (shining willow), *Salix exigua* (sandbar willow), *Cornus sericea* (red-osier dogwood), *Rosa woodsii* (Wood's rose), *Rubus idaeus* (red raspberry), *Acer glabrum* (Rocky Mountain maple), and *Betula occidentalis* (river birch) (NatureServe 2009). Herbaceous undergrowth is generally a sparse mixture of mesic and wetland graminoids and forbs. Herbaceous species include *Calamagrostis canadensis* (bluejoint reedgrass), *Cardamine cordifolia* (heartleaf bittercress), *Carex rossii* (Ross' sedge), *Carex praegracilis* (clustered field sedge), *Carex nebrascensis* (Nebraska sedge), *Equisetum arvense* (field horsetail), *Heraclium maximum* (common cowparsnip), *Juncus balticus* (mountain rush), *Maianthemum stellatum* (starry false Solomon seal), *Phalaris arundinacea* (reed canarygrass), *Rudbeckia laciniata* (cutleaf coneflower), *Thermopsis montana* (golden banner), and introduced species, such as *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (creeping bentgrass), *Agrostis gigantea* (redtop), *Bromus inermis* (smooth brome), *Dactylis glomerata* (orchardgrass), *Phleum pratense* (common timothy), *Poa palustris* (fowl bluegrass), and *Taraxacum officinale* (dandelion) (NatureServe 2009).

Similar Communities: *Populus angustifolia/Salix exigua* (narrowleaf cottonwood/sandbar willow) woodland and *Populus angustifolia/Cornus sericea* (narrowleaf cottonwood/red-osier dogwood) woodland.

Regional Distribution: This riparian forest association occurs in the southern Rocky Mountains of Colorado and New Mexico. It has been reported from western Wyoming and Oregon.

Colorado Distribution: *Populus angustifolia* / *Alnus incana* (narrowleaf cottonwood / thinleaf alder) woodlands are widely distributed from the northernmost to the southernmost counties throughout the



central part of the State.

Elevation Range in Colorado: 6,060.00 - 9,600.00 ft / 1,847.09 - 2,926.08 m

Site Geomorphology: Stands occur on banks and benches along both narrow and broad streams with active floodplains in both broad valleys and narrow canyons (NatureServe 2009).

Soil: Soils are mostly coarse textured ranging from deep sands to shallow sandy loams. Some profiles show stratification with loams to clay loams alternating with sands. Most soil profiles become skeletal at an average depth of 12 inches (30 cm) (Carsey et al. 2003).

Successional and Ecological Processes: *Populus angustifolia* / *Alnus incana* (narrowleaf cottonwood / thinleaf alder) associations are considered a mid-seral community (not the youngest and not the oldest stands of cottonwoods with a reach). With time, and without flooding disturbance, stands may become dominated by invading conifers from adjacent upland communities such as *Pseudotsuga menziesii* (Douglas-fir), *Juniperus* spp. (juniper) or *Picea engelmannii* (Engelmann spruce). Riparian habitats are sites for many migratory and non-migratory wildlife species. *Populus angustifolia* (narrowleaf cottonwood) is a dominant species of Central Colorado riparian areas of upper foothills and lower montane zones and provides important wildlife cover and resources (Simonin 2001). Immature cottonwood is highly palatable to ungulates (Beschta 2004) and although mature narrowleaf cottonwood is relatively unpalatable it provides excellent cover (Simonin 2001). Even where narrowleaf cottonwood communities do not directly benefit specific species, indirect benefits occur through maintenance of healthy streamside habitats. Narrowleaf cottonwood is an excellent bank stabilizing species, contributing to the development of stable riparian communities for use by wildlife. The clonal reproduction of established narrowleaf cottonwood stands leads to heterogeneous trunk size and spatial clumping, increasing habitat richness for wildlife. Narrowleaf cottonwood and other *Populus* species community types in Colorado provide habitat for over 200 species of vertebrates. Riparian habitats are sites for many migratory and non-migratory wildlife species. Narrowleaf cottonwood provides good avian nesting and breeding habitat for the greater pewee, sharp-shinned hawk, and bald eagle. Narrowleaf cottonwood is a major food plant of beaver and is most commonly harvested when greater than 1 inch (3 cm) d.b.h. (Simonin 2001). Thinleaf alder is an early seral species and seasonal disturbances from flooding provide suitable seedbeds for establishment of new plants (Uchytal 1989). Although thinleaf alder is not a highly preferred food for either wildlife or domestic animals it does provide resources and cover for a variety of bird and animal species. Thinleaf alder communities provide hiding and thermal cover for big game animals such as white-tailed and mule deer and often serve as travel corridors for these and other big game animals. Many bird species use thinleaf alder communities for nesting and brood rearing and when thinleaf alder overhangs a streambank, plants provide cover and shade for salmonids (Uchytal 1989). Thinleaf alder is eaten to varying degrees by cattle, sheep, and goats all eat thinleaf with utilization by livestock dependant on stand accessibility, stand density, and the palatability of other browse species present (Uchytal 1989). For instance, in Montana, dense stands of alder hinder access and are of limited value for livestock and cattle tend to avoid thinleaf alder stands found on the mucky soils associated with mountain springs (Uchytal 1989). The twigs and leaves of younger thinleaf alder plants are eaten

by deer, elk, and moose. Light to moderate use by elk was observed primarily in summer and fall in portions of the Rocky Mountains and moderate use of thinleaf alder by moose occurred during late winter in Montana, and is a moderately important browse for Rocky Mountain mule deer. Muskrats, beavers, cottontails, and snowshoe hares all eat alder twigs and leaves; beavers eat the bark and build dams and lodges with the stems; and alder seeds, buds, and catkins are eaten by redpolls, siskins, chickadees, and goldfinches and are considered to be an important winter food source (Uchytal 1989).

Adjacent Vegetation: The system often occurs as a mosaic of multiple plant communities that are tree dominated with a diverse shrub component. The variety of plant associations connected to this system reflect elevation, stream gradient, floodplain width, and flooding events. Dominant trees may also include *Acer negundo* (box elder), *Populus balsamifera* (balsam poplar), *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper) or *Picea pungens* (blue spruce). Dominant shrubs may also include *Betula occidentalis* (river birch), *Cornus sericea* (red-osier dogwood), *Crataegus rivularis* (river hawthorn), *Prunus virginiana* (chokecherry), *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond's willow), *Salix exigua* (sandbar willow), *Salix lucida* (shining willow), *Shepherdia argentea* (silver buffaloberry), or *Symphoricarpos* (snowberry) spp. Upland vegetation surrounding this association generally ranges from grassland to forests (Rondeau 2001).

Management: Maintaining a natural hydrologic regime is essential to the long-term viability of the *Populus angustifolia* / *Alnus incana* (narrowleaf cottonwood/thinleaf alder) association. Also important to the viability of this association is the maintenance of a natural channel shape with streambanks that are not oversteepened or downcut and a channel width that is not overwidened. Sustainable grazing management and eradication of non-native plant species will also greatly benefit this plant community (Rondeau 2001). The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Annual and episodic flooding is extremely important for maintaining a diversity of age classes of *Populus angustifolia* (narrowleaf cottonwood) as well as a mosaic of plant associations within the floodplain. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001) with consequences that may include streambank destabilization, and channel downcutting, widening and braiding. Narrowleaf cottonwood provides essential habitat structure to riparian ecosystems and is high quality streambank stabilizer (USDA 2004). However, anthropogenic modification of riparian systems may adversely affect ecosystem health and channel stability. Drastic declines in the reproductive ability of cottonwoods and other native species is common. Disturbances such as irrigation diversions, reservoirs, farming, and grazing have profoundly altered natural stream ecology. Dams alter annual water table fluctuations by reducing downstream flow, altering sediment transport, decreasing organic matter transport, and decreasing sediment deposition and generally have negative impacts on downstream narrowleaf cottonwood communities. Annual spring flooding is a controlling factor behind species composition and population dynamics of narrowleaf cottonwood communities - Narrowleaf cottonwood seeds possess a small window of viability, generally 2 days - and seedlings require wet alluvium in full sunlight. Damming however generally reduces the number and quality of narrowleaf cottonwood regeneration sites. Additionally dams that decrease summer water tables affect narrowleaf cottonwood establishment by exposing seedlings to

artificial drought (Simonin 2001). Damage to narrowleaf cottonwood from livestock grazing (defoliation, soil compaction, or floodplain water table subsidence due to channel widening or downcutting) has decreased cottonwood (*Populus* spp.) populations. Grazing disturbance may initiate stable communities of invasive species such as Kentucky bluegrass, smooth brome (*Bromus inermis*), dandelion, and white clover (Simonin 2001). *Alnus incana* (thinleaf alder) is also an excellent stream bank stabilizer (USDA 2004). Streambanks anchored by thinleaf alder are stable and can withstand relatively severe spring runoff, however, overgrazing and excessive trampling by livestock can seriously reduce thinleaf alder's ability to maintain streambank stability during spring runoff and flooding. However, because alder is easy to establish on disturbed sites and has a rapid growth rate it can quickly restabilize disturbed streambanks. Additionally, thinleaf alder improves soil fertility through the addition of nitrogen to the soil from nitrogen-fixing root nodules and a nitrogen-rich leaf litter (Uchytal 1989).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus angustifolia* / *Betula occidentalis* Woodland

State Common Name Montane Riparian Forest

Global Scientific Name: *Populus angustifolia* / *Betula occidentalis* Woodland

Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

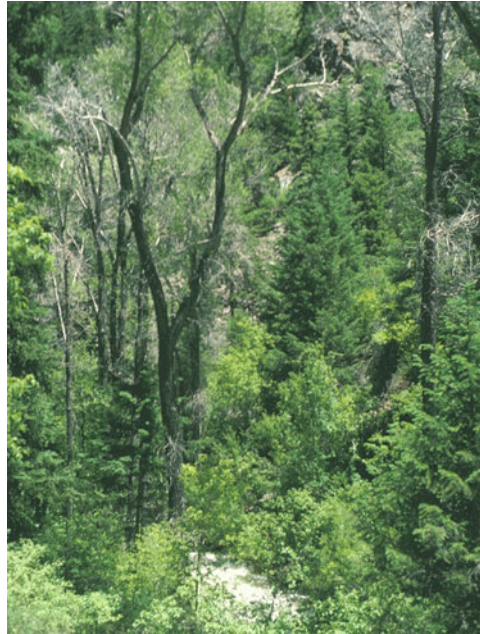
Subclass: Deciduous woodland

Group: Cold-deciduous woodland

Subgroup: Natural/Semi-natural
cold-deciduous woodland

Formation: Temporarily flooded
cold-deciduous woodland

Alliance: Narrowleaf Cottonwood
Temporarily Flooded Woodland
Alliance



Global Rank: G3

Global Rank Reasons: This riparian woodland is uncommon and occurs locally throughout much of its range. Although this association appears stable, the condition of high-quality occurrences is extremely threatened because of easy access to this relatively low-elevation community. Development, heavy recreational use, expansion and maintenance of roads and railroads, improper grazing, and modification of hydrologic processes threaten this community with the introduction of non-native species, accelerated erosion, and damage to native vegetation. Hydrologically modified streams may lack the processes necessary to regenerate the *Populus angustifolia* tree canopy.

Subnational Rank: S3

Subnational Rank Reasons: Threatened by development, stream flow alterations, road/bridge building and maintenance, improper grazing, and heavy recreational use.

General Description: This plant association is a lush deciduous community of *Populus angustifolia* (narrowleaf cottonwood) and *Betula occidentalis* (river birch) growing in a thick band along the stream banks. The community is one of the wetter *Populus angustifolia* plant associations, which indicates a perennial source of water and possibly lateral seepage to the channel. Some stands occur on hillside seeps. This plant

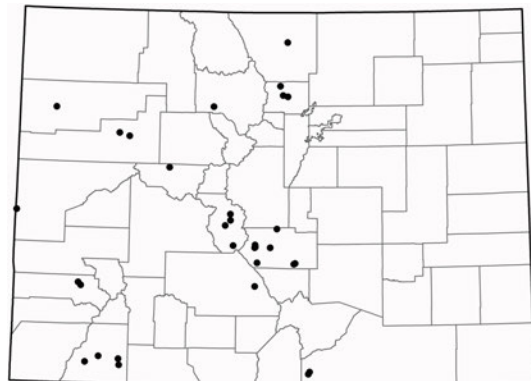
association occurs on stream banks and benches along narrow, somewhat steep streams with little to moderate floodplain development. It also occurs on immediate stream banks or steep-sided overflow channel areas along larger streams with well-developed floodplains. Stream channels are steep and narrow with rocky beds or broad and meandering.

Vegetation: This plant association is characterized by an overstory of 5-80% cover of *Populus angustifolia* (narrowleaf cottonwood) and a thick shrub understory of *Betula occidentalis* (river birch). Other tree species that can be present include *Pseudotsuga menziesii* (Douglas-fir) and *Juniperus scopulorum* (Rocky Mountain juniper). Other shrubs that can be abundant, but never more than birch include *Alnus incana* (thinleaf alder), *Acer glabrum* (mountain maple), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb willow), *Crataegus rivularis* (river hawthorn), *Ribes inerme* (whitestem gooseberry), *Salix ligulifolia* (strapleaf willow), *Rhus trilobata* (skunkbush sumac), *Salix irrorata* (bluestem willow), *Rubus parviflorus* (thimbleberry), and *Prunus virginiana* (chokecherry). Graminoid and forb cover is minor, except in degraded stands, where introduced, nonnative species can be abundant. These include *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), *Melilotus* spp. (sweetclover). Native herbaceous species include *Maianthemum stellatum* (starry false Solomon seal), *Rudbeckia laciniata* var. *ampla* (cutleaf coneflower), *Carex utriculata* (beaked sedge), and *Angelica ampla* (giant angelica).

Similar Communities: Two closely related communities have similar species composition but include significant amounts of other species not found in the Colorado association. They are the *Populus / Betula occidentalis* (cottonwood/water birch) community type (Manning and Padgett 1995), which has *Populus trichocarpa* (black cottonwood), and the *Populus angustifolia / Prunus virginiana* (narrowleaf cottonwood/common chokecherry) community type (Girard *et al.* 1997), which includes scattered *Betula occidentalis*.

Regional Distribution: This association occurs in the mountains and canyons of Utah, Nevada, Idaho, Wyoming, and Colorado. These riparian woodlands are a major type in the Wasatch Mountains but appear to be a minor association elsewhere.

Colorado Distribution: Along the Front Range and in western and southwestern Colorado.



Elevation Range in Colorado: 6,000.00 - 8,400.00 ft / 1,828.80 - 2,560.32 m

Site Geomorphology: This plant association occurs on streambanks and benches along narrow, somewhat steep streams with little to moderate floodplain development. It also occurs on immediate streambanks or steep-sided overflow channel areas along larger streams with well-developed floodplains. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are steep and narrow with rocky beds (Rosgen's Channel Type: A3, A4) or broad and meandering (Rosgen's Channel Type: B3, C3).

Soil: Soils have a surface layer of partially decomposed organic matter 2-4 inches (5-10 cm) thick. Subsurface layers are very coarse with 10-60% gravel or cobbles. Subsurface textures range from clay loams to loamy sands.

Successional and Ecological Processes: The *Populus angustifolia* / *Betula occidentalis* (narrowleaf cottonwood / river birch) plant association is considered to be early- to mid-seral. *Betula occidentalis* becomes abundant along stream banks with perennial stream flow and well-aerated soils. With continued aggradation of the alluvial surface and shading from a thick shrub canopy, successful *Populus angustifolia* reproduction may cease and the stand may become a *Betula occidentalis* dominated shrubland with a graminoid understory. *Populus angustifolia* appears to be reproducing in two of the stands sampled, however, the individuals may be sprouting from roots rather than developing from seeds.

Adjacent Vegetation: Adjacent riparian vegetation: this plant association is usually the only riparian community along a narrow stream channel and generally does not form a mosaic with other communities. Occasionally, there may be adjacent stands of *Pseudotsuga menziesii* (Douglas-fir), or shrublands of *Alnus incana* (thinleaf alder) or *Salix exigua* (coyote willow). Adjacent upland vegetation: south-facing canyon slopes have *Pinus edulis* (twoneedle pinyon) and *Juniperus monosperma* (oneseed juniper) woodlands. North-facing slopes have *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga menziesii* (Douglas-fir) forests.

Management: Because regeneration and establishment of new stands of cottonwood are dependent upon flooding events, any alteration to the natural flow regime of a river can affect the cottonwood ecosystem. Upstream dams stabilize stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that provide conditions for cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities. These late-seral communities are dominated by upland species, such as conifers in montane areas or other, more drought tolerant species in the foothill and plains environments. Forage productivity for this plant association is high and very palatable to livestock. Cottonwood seedlings and saplings as well as *Betula occidentalis* (water birch) shrubs are frequently browsed by cattle. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. Moist soils also make this community susceptible to soil compaction. Cottonwood-dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This maintains high forage quality and quantity (Hansen *et al.* 1995).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name	<i>Populus angustifolia</i> / <i>Salix</i> (<i>monticola</i> , <i>drummondiana</i> , <i>lucida</i>) Woodland
State Common Name	Narrowleaf Cottonwood/Mixed Willows Montane Riparian Forest
Global Scientific Name:	<i>Populus angustifolia</i> / <i>Salix</i> (<i>monticola</i> , <i>drummondiana</i> , <i>lucida</i>) Woodland
Global Common Name:	-

Community Classification

System: International Vegetation
Classification

Class: Woodland

Subclass: Deciduous woodland

Group: Cold-deciduous woodland

Subgroup: Natural/Semi-natural
cold-deciduous woodland

Formation: Temporarily flooded
cold-deciduous woodland

Alliance: Narrowleaf Cottonwood
Temporarily Flooded Woodland
Alliance



Global Rank: G3

Global Rank Reasons: This riparian woodland association is known from the Colorado Plateau, the San Juan Mountains, and the Great Basin areas of Colorado, Utah and Nevada. There are an estimated 20-50 occurrences in Colorado. Information on occurrences in Utah and Nevada is not available. The biophysical conditions necessary for establishment of this association are also widespread. The process of cottonwood regeneration requires periodic flooding. Stands naturally occur in relatively small bands and patches throughout its range. Improper livestock grazing and flood control have undoubtedly decreased the areal extent of this plant association over the past 200 years. This plant association continues to be threatened by improper livestock grazing, heavy recreational use, streamflow alterations, and invasion of exotic plants across its entire range.

Subnational Rank: S3

Subnational Rank Reasons: In Colorado eleven documented occurrences of the *Populus angustifolia* / *Salix* (*monticola*, *drummondiana*, *lucida*) woodland occur and many have been impacted by grazing. Most are also impacted by a variety of anthropogenic alterations including non-native species, stream impoundments, roads, recreation and mining.

General Description: Narrowleaf cottonwood is a dominant species of Central Colorado riparian areas of upper foothills and lower montane zones (Simonin 2001). This riparian woodland association occurs at moderate elevations (2400-2700 m) on all types of active floodplains, stream benches and low terraces, within 1-4.5 feet (0.3 -1.4 m) of the active channel elevation 2003). All sites show signs of active flooding (NatureServe 2009, Carsey et al.).

Vegetation: The upper canopy is dominated by young (sapling, pole and medium-sized 5-15 in, 12-35 cm in diameter) *Populus angustifolia* (narrowleaf cottonwood) trees with a cover of 25-90%. The shrub understory has a 15-70% cover and consistently includes two or more willow species although none individually exceeds 10% cover. Willow species can include *Salix exigua* (sandbar willow), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), *Salix lucida* ssp. *caudata* (shining willow), *Salix drummondiana* (Drummond's willow), and *Salix geyeriana* (Geyer willow). Other non-willow shrubs commonly present may include *Rosa woodsii* (Wood's rose), *Ribes* spp. (gooseberry), *Alnus incana* (thinleaf alder), *Crataegus rivularis* (river hawthorn), *Dasiphora floribunda* (shrubby cinquefoil), and *Symphoricarpos* spp. (snowberry) (NatureServe 2009, Carsey et al. 2003). Herbaceous cover is generally low with 10-40% forbs and 5-15% graminoids. Common herbaceous species include *Maianthemum stellatum* (starry false Solomon seal), *Erigeron* spp. (fleabane), and the introduced species *Trifolium* spp. (clover), *Poa pratensis* (Kentucky bluegrass), and *Bromus inermis* (smooth brome) (Carsey et al. 2003).

Similar Communities: -

Regional Distribution: Range of the *Populus angustifolia/Salix (monticola, drummondiana, lucida)* woodland association essentially includes the Great Basin, between the Sierra Nevada, the Rocky Mountains, and the deserts of the southwestern U.S. (NatureServe 2009) throughout the Colorado Plateau, Great Basin and San Juan Mountains of Colorado, Utah and Nevada. .



Colorado Distribution: Occurrences of the *Populus angustifolia / Salix (monticola, drummondiana, lucida)* woodland associations are located primarily in the southwestern counties of the State including Gunnison, Dolores, San Jan, Archuleta, Conejos and Saguache with one, northernmost, occurrence in Grand County.

Elevation Range in Colorado: 7,780.00 - 9,380.00 ft / 2,371.34 - 2,859.02 m

Site Geomorphology: Most *Populus angustifolia / Salix (monticola, drummondiana, lucida)* associations are located along stream channels with a morphology that ranges from steep and narrow to broad, moderate gradient and more sinuous. One stand occurs on

an overflow or back channel (Carsey et al. 2003).

Soil: Soils are somewhat deep (3 ft, 1 m) loamy to clay sands over very coarse alluvial layers with at least 25% gravel and other coarse fragments present in all layers (Carsey et al. 2003).

Successional and Ecological Processes: Narrowleaf cottonwood is a rapidly growing pioneer species, showing natural stand replacement adjacent to riparian systems with undisturbed hydrology (Simonin 2001). However, narrowleaf cottonwood shows slower growth rates than the majority of cottonwood species, requiring a longer time for adequate establishment (Simonin 2001). Although successional events in communities dominated by narrowleaf cottonwood are different between sites, common attributes are shared. Narrowleaf cottonwood colonizes moist, barren, newly deposited alluvium exposed to full sunlight (Simonin 2001). Cottonwoods reproduce through seeds and roots runners. Successful seedling requires the perfect flood - one that occurs at the right time of year (June, when the trees produce their seeds), with flooding that leaves bare, disturbed mudflats, and with slow regression. This combination provides ideal germination conditions for cottonwood seeds (Kingery 1998). As with all cottonwood woodlands, this association is found within a continually changing alluvial environment where riparian vegetation is constantly being "re-set" by flooding disturbance. Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities. The process of cottonwood regeneration is dependent on flooding disturbance. Periodic flooding allows cottonwood seedlings to germinate and become established on newly deposited, moist sandbars. Natural river processes of bank erosion, deposition and channel migration result in a dynamic patchwork of different age classes, plant associations and habitats (Carsey et al. 2003). Riparian habitats are sites for many migratory and non-migratory wildlife species. *Populus angustifolia* (narrowleaf cottonwood) is a dominant species of Central Colorado riparian areas of upper foothills and lower montane zones and provides important wildlife cover and resources (Simonin 2001). Immature cottonwood is highly palatable to ungulates (Beschta 2004) and although mature narrowleaf cottonwood is relatively unpalatable it provides excellent cover (Simonin 2001). Even where narrowleaf cottonwood communities do not directly benefit specific species, indirect benefits occur through maintenance of healthy streamside habitats. Narrowleaf cottonwood is an excellent bank stabilizing species, contributing to the development of stable riparian communities for use by wildlife. The clonal reproduction of established narrowleaf cottonwood stands leads to heterogeneous trunk size and spatial clumping, increasing habitat richness for wildlife. Narrowleaf cottonwood and other *Populus* species community types in Colorado provide habitat for over 200 species of vertebrates. Riparian habitats are sites for many migratory and non-migratory wildlife species. Narrowleaf cottonwood provides good avian nesting and breeding habitat for the greater pewee, sharp-shinned hawk, and bald eagle. Narrowleaf cottonwood is a major food plant of beaver and is most commonly harvested when greater than 1 inch (3 cm) d.b.h. (Simonin 2001). Each of the *Salix* spp. (willow) that may occur in this association (*S. drummondiana*, *S. monticola*, and *S. lucida*) with narrowleaf cottonwood are also excellent streambank stabilizers (USDA 2004, Esser 1992, Uchytel 1989) and provide forage and habitat resources for wildlife as well as food for livestock.

Adjacent Vegetation: The system often occurs as a mosaic of multiple plant

communities that are tree dominated with a diverse shrub component. The variety of plant associations connected to this system reflect elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include *Acer negundo* (box elder), *Populus balsamifera* (balsam poplar), *Pseudotsuga menziesii* (Douglas-fir), *Juniperus scopulorum* (Rocky Mountain juniper) or *Picea pungens* (blue spruce). Dominant shrubs may include *Acer glabrum* (Rocky Mountain maple), *Alnus incana* (thinleaf alder), *Betula occidentalis* (river birch), *Cornus sericea* (red-osier dogwood), *Crataegus rivularis* (river hawthorn), *Prunus virginiana* (chokecherry), *Salix exigua* (sandbar willow), *Shepherdia argentea* (silver buffaloberry), or *Symphoricarpos* (snowberry) spp. Upland vegetation surrounding this association generally ranges from grassland to forests (Rondeau 2001).

Management: Maintaining a natural hydrologic regime is essential to the long-term viability of the *Populus angustifolia* / *Salix* (*monticola*, *drummondiana*, *lucida*) association. Also important to the viability of this association is the maintenance of a natural channel shape with streambanks that are not oversteepened or downcut and a channel width that is not overwidened. Sustainable grazing management and eradication of non-native plant species will also greatly enhance the long-term viability of this plant community (Rondeau 2001). The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Annual and episodic flooding is extremely important for maintaining a diversity of age classes of *Populus angustifolia* (narrowleaf cottonwood) as well as a mosaic of plant associations within the floodplain. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001) with consequences that may include streambank destabilization, and channel downcutting, widening and braiding. Narrowleaf cottonwood provides essential habitat structure to riparian ecosystems and is high quality streambank stabilizer (USDA 2004). However, anthropogenic modification of riparian systems may adversely affect ecosystem health and channel stability. Drastic declines in the reproductive ability of cottonwoods and other native species is common. Disturbances such as irrigation diversions, reservoirs, farming, and grazing have profoundly altered natural stream ecology. Damming generally reduces the number and quality of narrowleaf cottonwood regeneration sites. Dams alter annual water table fluctuations by reducing downstream flow, altering sediment transport, decreasing organic matter transport, and decreasing sediment deposition. These modifications to river hydrology generally have negative impacts on downstream narrowleaf cottonwood communities. Additionally, overgrazing by wild ungulates (Beschta 2004) and damage from livestock grazing (defoliation, soil compaction, or floodplain water table subsidence due to channel widening or downcutting) has reduces recruitment and has decreased cottonwood (*Populus* spp.) populations (Simonin 2001). Over grazing disturbance may also initiate stable communities of invasive species such as *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), *Taraxacum officinale* (dandelion), and *Trifolium repens* (white clover) (Simonin 2001). Willow establishment along riparian zones is an effective management tool that yields positive benefits to a number of fish and wildlife species, as well as providing necessary protection to the stream environment. Heavy livestock utilization of riparian areas can lead to severe degradation unless managed properly (Esser 1992, USDA, 2009, Uchytel 1989). Each of the *Salix* (willow) species in this association provide important streambank protection by effectively stabilizing soils. Heavy grazing in moist willow communities can lead to soil compaction, streambank sloughing and damage to willow plants. Cattle or wild ungulate overgrazing of willow causes it to become decadent or stunted. Plants recover rapidly when browsing is

excluded. Grazing is also particularly detrimental to the establishment of willows (USDA 2009, Esser 1992, Uchytel 1989).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus tremuloides* / *Acer glabrum* Forest
State Common Name Montane Riparian Forests
Global Scientific Name: *Populus tremuloides* / *Acer glabrum* Forest
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Forest

Subclass: Deciduous forest

Group: Cold-deciduous forest

Subgroup: Natural/Semi-natural
cold-deciduous forest

Formation: Montane or boreal
cold-deciduous forest

Alliance: Quaking Aspen Forest
Alliance



Global Rank: G1G2

Global Rank Reasons: This association has only been documented from a small region of the southern Rockies in south-central Colorado. Dams, water diversion, or excessive livestock grazing could detrimentally impact known occurrences of this association. Recreational trails and packstock use are common in the canyons where stands occur and introduction of non-native seed in stock feed presents a threat to the stands. The role of fire and flooding disturbance in the regeneration of this type are unknown. It may prove to be more common than indicated as canyons in the region are more completely surveyed.

Subnational Rank: S2

Subnational Rank Reasons: The *Populus tremuloides* / *Acer glabrum* association has been documented from only eleven locations in Colorado. Most have been impacted by a variety of anthropogenic development activities including livestock grazing, homes, recreational trails, powerline right-of-way and non-native species. Additionally, overgrazing by elk impacts some sites.

General Description: This uncommon *Populus tremuloides* forest association is found in mountainous regions in central Colorado. Stands may also occur in north-central New Mexico where, if present, the association is seral to conifer forests with *Acer glabrum*-dominated understories (NatureServe 2009). The *Populus tremuloides*/*Acer*

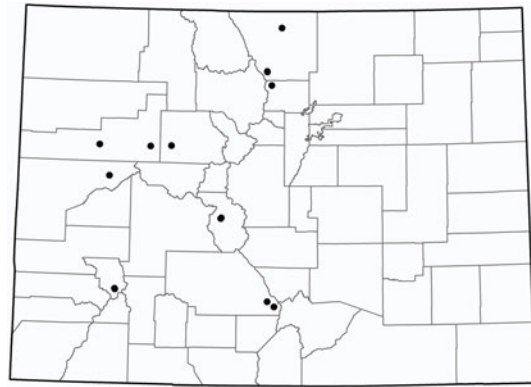
glabrum association occurs along narrow streams and gulches and in broader valleys where shading, aspect, or hillslope springs create moist soil conditions away from the stream channel. This forest is not restricted to riparian habitats, and will occur on steep, moist hillsides as well as following stream courses. Streams are often quite steep (5-7%) and very rocky (Carsey et al. 2003). This association is characterized by a nearly closed canopy of the broad-leaved deciduous tree *Populus tremuloides*. Species richness is moderately high for aspen associations and the understory is very lush. Shrubs are primarily broad-leaved deciduous species, with *Acer glabrum* being characteristic and dominant, occasionally reaching tree stature (NatureServe 2009). Other important tall shrubs include *Sambucus racemosa*, *Prunus virginiana*, and *Amelanchier alnifolia*. Short shrubs present include *Rosa woodsii*, *Ribes montigenum*, and *Mahonia repens*. Conifer species may be present in the understory but with low cover. The herbaceous layer is dominated by perennial forbs such as *Actaea rubra*, *Artemisia franserioides*, *Chamerion angustifolium* (= *Epilobium angustifolium*), *Erigeron eximius*, *Maianthemum stellatum*, *Osmorhiza depauperata*, *Oreochrysum parryi* (= *Solidago parryi*, and *Thalictrum fendleri*). Common grasses are *Calamagrostis canadensis* and *Elymus* spp. Diagnostic of this forest association is the tree canopy dominated by *Populus tremuloides* with an *Acer glabrum*-dominated tall-shrub layer.

Vegetation: Species richness is moderately high for aspen associations, with 49 species of vascular plants occurring in the sampled stands. The broad-leaved deciduous tree *Populus tremuloides* dominates the canopy of this forest association with over 90% cover. Other trees that may be present include *Populus balsamifera* (balsam poplar) or *Populus angustifolia* (narrowleaf cottonwood). The understory is dominated by *Acer Glabrum* (Rocky Mountain maple) and is very lush, with both shrub and herbaceous layers having over 100% cover. Occasionally *Acer glabrum* may reach tree stature, some individuals being over 8 m in height. Other shrubs that may be present include *Sambucus racemosa* (scarlet elderberry), *Prunus virginiana* (chokecherry), and *Amelanchier alnifolia* (Saskatoon serviceberry), *Rosa woodsii* (Wood's rose), *Ribes montigenum* (red-fruited gooseberry), and *Mahonia repens* (Oregon grape). Conifer species may be present in the understory but with low cover (NatureServe 2009, Carsey et al. 2003). The herbaceous layer is often rich in forbs, their combined total cover sometimes reaching as much as 60%. Forb species that may be present include *Thalictrum fendleri* (Fendler meadowrue), *Epilobium angustifolium* ssp. *circumvagum* (fireweed), *Mainthemem stellatum* (starry false Solomon seal), *Actaea rubra* (red baneberry), *Artemisia franserioides* (ragweed sagebrush), *Oreochrysum parryi* (Parry's goldenrod), *Osmorhiza depauperata* (blunt-fruited sweet cicely) (NatureServe 2009, Carsey et al. 2003). Graminoids are less abundant but include *Calamagrostis canadensis* (bluejoint reedgrass) and *Elymus* spp. (wildrye).

Similar Communities: -

Regional Distribution: This type is only recorded from the Rocky Mountains in Colorado.

Colorado Distribution: The association is known from locations primarily in the central and south-central mountain regions of Colorado. Occurrences are documented from as far north as Larimer County and south to Saguache County, east to Boulder County and west to Mesa County.



Elevation Range in Colorado: 7,350.00 - 9,744.00 ft / 2,240.28 - 2,969.97 m

Site Geomorphology: This association commonly occurs on north- to northeast-facing, moist-wet slopes and alluvial terraces in narrow and medium valleys, on stream banks, floodplains and moist steep hillslopes, but is also reported from easterly to southerly slopes (Carsey et al. 2003). Slopes are moderately steep (generally 5-13%) and undulating (NatureServe 2009).

Soil: Soils are saturated or poorly drained and range from silty clay loams to sandy loams, often with high organic matter content in the top 10 cm (4 inches) of the soil profile (NatureServe 2009).

Successional and Ecological Processes: On some sites the *Populus tremuloides* / *Acer glabrum* association is climax, whereas on others the association is seral to conifer-dominated forests (NatureServe 2009). Aspen is usually a seral tree in climax subalpine fir association at the high elevations. In such situations it may dominate the forest community for many decades following severe disturbance, such as fire or clearcutting, but will gradually decline as the conifers become reestablished. At lower elevations aspen can occur either as a temporarily dominant seral species in a variety of climax conifer associations, or it can achieve permanent dominance as the climax forest type (Rondeau 2001). For instance, in the San Juan National Forest, this association may be seral to the *Abies lasiocarpa* / *Cornus sericea* (subalpine fir / red-osier dogwood) or *Abies concolor* / *Cornus sericea* (white fir / red-osier dogwood) plant associations (Carsey et al. 2003). Colorado's extensive aspen forests provide the only large expanses of deciduous trees in the state (Preston and Kingery 1998). Well-stocked quaking aspen stands provide excellent watershed protection. Mountain slopes covered by quaking aspen provide high yields of good-quality water. Quaking aspen intercepts less snow than conifers, so snowpack is often greater under quaking aspen. The trees, the shrub and herbaceous understories, and the litter of quaking aspen stands provide nearly 100 percent soil cover and protects soil from erosion soil except during very intense rains (Howard 1996). The aspen ecosystem is rich in number and species of animals, especially in comparison to associated coniferous forest types. This natural species diversity and richness has been both increased and influenced by the introduction of domestic livestock. The high value of the aspen type as a forage resource for livestock and as forage and cover for wildlife makes the subject of animal impacts important to understanding and management of this ecosystem (Rondeau 2001). Quaking aspen forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Quaking aspen communities provide important feeding and nesting

sites for a diverse array of birds and generally, moist to mesic quaking aspen sites have greater avian species diversity than quaking aspen stands on dry sites (Howard 1996). Aspens guarantee nesting habitat for numerous songbirds including deciduous obligate species and cavity-nesting species (Preston and Kingery 1998). Most classes of domestic livestock use quaking aspen. Domestic sheep and cattle browse the leaves and twigs but domestic sheep browse quaking aspen more heavily than cattle. It is estimated that domestic sheep consume 4 times more quaking aspen sprouts than cattle. Heavy livestock browsing can adversely impact quaking aspen growth and regeneration (Howard 1996).

Adjacent Vegetation: Aspen forests usually occur as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands, wetlands, coniferous forests, etc. (Rondeau 2001).

Management: It is somewhat unclear why some quaking aspen stands break up and die while others remain stable. Some have speculated that both soil type and disturbance are important in quaking aspen stability (Howard 1996). Others implicate changes in the historic fire regime, excessive ungulate browse or a combination of the two while in some locations the phenomenal decline of Aspen has been related to drought. Aspen forests are usually maintained by fires (Rondeau 2001) and although aspen is able to naturally regenerate without fire or cutting on some sites, fire may be required for regeneration on others (Howard 1996). There is increasing concern that in the West, poor quaking aspen regeneration is due, at least in part, to wildlife overbrowsing young sprouts. Where browsing pressure is heavy, ungulates may remove quaking aspen regeneration before it grows above browseline. A few areas of the West have such large elk populations that even after large-scale wildfires, quaking aspen sprouts attained little height growth because of intense browsing. In such areas, quaking aspen sprouts probably require protection from browsing. In some areas fire suppression coupled with heavy ungulate browsing has reduced quaking aspen regeneration. Prescribed burning is one method of promoting quaking aspen. Before and during the mid-nineteenth century, fires were apparently more frequent, and larger acreages of quaking aspen and quaking aspen-conifer mixes burned, than any time since. Extensive sampling of quaking aspen in Colorado found few fire scars dating later than about 1880. These data indicate that there has been a great reduction of fire rejuvenation of quaking aspen in the West since about 1900. Extensive young stands of quaking aspen are uncommon in the West and conifers now dominate many seral quaking aspen stands (Howard 1996). In Colorado the phenomenon of Sudden Aspen Decline (SAD) may be drought-related. Aspen forests in some areas of Colorado have experienced widespread, severe, rapid dieback and mortality. This phenomenon, termed "sudden aspen decline," has increased dramatically in recent years. In 2008, 553,000 acres of damage were recorded, over 17% of the estimated aspen cover type in Colorado. The southwestern and northwestern Colorado mountains are experiencing the worst damage. Three interacting groups of factors appear to be involved. 1) Predisposing factors: Low elevations, south to west aspects, open stands are vulnerable to warm drought. 2) Inciting factors: Hot, dry conditions of 2000-2005, and possibly earlier, weakened vulnerable stands. 3) Contributing factors: Secondary insects and diseases are able to kill trees under stress. These include *Cytospora* canker, poplar borer, bronze poplar borer, and two aspen bark beetle species (USDA 2009).

Where aspen has been cut in the past and SAD is now present, healthy green regenerated patches can often be seen beside dying, unmanaged stands. It appears that

the diversification of age structure through management has increased the resilience of the landscape to SAD. Where clones still retain some vigor and energy, but are deteriorating, regeneration may be stimulated by burning, cutting or other stand manipulation before root systems are too weak to respond (USDA 2009).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus tremuloides* / *Alnus incana* Forest
State Common Name Montane Riparian Forests
Global Scientific Name: *Populus tremuloides* / *Alnus incana* Forest
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Forest

Subclass: Deciduous forest

Group: Cold-deciduous forest

Subgroup: Natural/Semi-natural
cold-deciduous forest

Formation: Temporarily flooded
cold-deciduous forest

Alliance: Quaking Aspen Temporarily
Flooded Forest Alliance



Global Rank: G3

Global Rank Reasons: This riparian plant association has been documented from no fewer than 20 stands in Colorado, but at least 50 occurrences are expected in Colorado with additional stands possible in adjacent Rocky Mountain states. Individual stands occur on sites with an unusual juxtaposition of riparian and upland conditions, where both *Populus tremuloides* and *Alnus incana* are present in abundance. Additional inventory work is needed to determine the full extent of this association.

Subnational Rank: S3

Subnational Rank Reasons: This plant association is known from throughout the Southern Rocky Mountains of Colorado from 27 documented occurrences. The majority of stands are threatened by a variety of anthropogenic impacts including grazing, invasion of non-native plant species, recreation, roads, and water diversions.

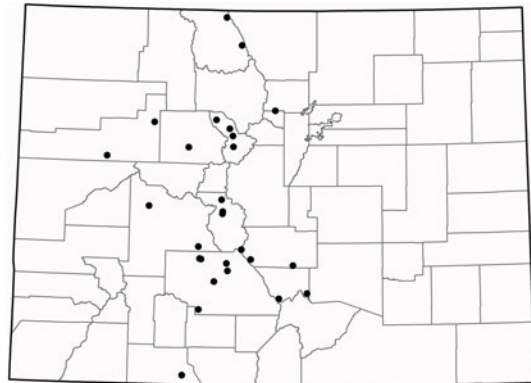
General Description: The *Populus tremuloides* / *Alnus incana* (quaking aspen / thinleaf alder) plant association is located in narrow ravines and along first- and second-order streams. At the upper end of its elevational range it typically occurs where upland *Populus tremuloides* forests intermix with riparian shrub vegetation, while at lower elevations it occurs where *Populus tremuloides* persists only in the riparian zone. The presence of obligate riparian species distinguish this association from upland *Populus tremuloides* communities. The open to closed tree canopy has 10-70% cover of *Populus*

tremuloides. Several conifer species can occur, but *Populus tremuloides* is clearly the dominant tree species. The shrub layer is dominated by 10-70% cover of *Alnus incana*, which is diagnostic of this riparian type (NatureServe 2009, Carsey et al. 2003).

Vegetation: This plant association has a tall, 20-40 ft (6-12 m) overstory of *Populus tremuloides* (quaking aspen). Several conifer species can occur but aspen is clearly the dominant canopy tree, at least along the streambanks. Other tree species that may be present include *Pinus contorta* (lodgepole pine), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce) and *Pseudotsuga menziesii* (Douglas-fir). The presence of obligate riparian species in the shrub and forb canopies along the immediate streambank distinguishes this riparian plant association from the adjacent upland *Populus tremuloides* associations (NatureServe 2009). The shrub layer is dominated by *Alnus incana* (thinleaf alder). Other shrubs that may be present in this association include *Salix drummondiana* (Drummond willow), *Lonicera involucrata* (twinberry honeysuckle), *Rosa woodsii* (Wood's rose), *Salix bebbiana* (Bebb willow), and *Cornus sericea* (red-osier dogwood) (Carsey et al. 2003). The forb layer can be dense and includes *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells), *Osmorhiza depauperata* (bluntseed sweetroot), and *Senecio triangularis* (arrowleaf ragwort). Graminoid cover may include *Calamagrostis canadensis* (bluejoint reedgrass), *Equisetum arvense* (field horsetail), and *Carex disperma* (softleaf sedge).

Similar Communities: -

Regional Distribution: This plant association has not been described in any previous literature or been documented outside of Colorado. However, it is expected to occur in other Rocky Mountain States.



Colorado Distribution: *Populus tremuloides* / *Alnus incana* forests are found throughout the Southern Rocky Mountains of Colorado, on both east and west slopes, from Jackson County on the northern border to Archuleta County on the southern border.

Elevation Range in Colorado: 7,960.00 - 10,400.00 ft / 2,426.21 - 3,169.92 m

Site Geomorphology: This riparian plant association is located in narrow ravines and along first- and second-order streams with stream gradients that range from 1 to 30% (NatureServe 2009). Stream channels are steep and narrow or occasionally, of moderate gradient and width (Carsey et al. 2003).

Soil: Soils are generally skeletal, shallow, sandy and sandy clay loams or deeper say clay loams (Carsey et al. 2003).

Successional and Ecological Processes: *Populus tremuloides* (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs

in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes (Carsey et al 2003). *Alnus incana* (thinleaf alder) is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining (NatureServe 2009, Carsey et al. 2003). After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop. The primary ecological process necessary to maintain this ecological system is hydrology and specifically surface and groundwater flow (Rondeau 2001). Annual and episodic flooding is important to maintaining this system and alteration of the flood regime due to water impoundment, diversions, etc. may produce changes to plant and community composition. Thinleaf alder is an early seral species and seasonal disturbances from flooding provide suitable seedbeds for establishment of new plants (Uchytal 1989). Although thinleaf alder is not a highly preferred food for either wildlife or domestic animals it does provide resources and cover for a variety of bird and animal species. Thinleaf alder communities provide hiding and thermal cover for big game animals such as white-tailed and mule deer and often serve as travel corridors for these and other big game animals. Many bird species use thinleaf alder communities for nesting and brood rearing and when thinleaf alder overhangs a streambank, plants provide cover and shade for salmonids (Uchytal 1989). Thinleaf alder is eaten to varying degrees by cattle, sheep, and goats all eat thinleaf with utilization by livestock dependant on stand accessibility, stand density, and the palatability of other browse species present (Uchytal 1989). For instance, in Montana, dense stands of alder hinder access and are of limited value for livestock and cattle tend to avoid thinleaf alder stands found on the mucky soils associated with mountain springs (Uchytal 1989). The twigs and leaves of younger thinleaf alder plants are eaten by deer, elk, and moose. Muskrats, beavers, cottontails, and snowshoe hares all eat alder twigs and leaves; beavers eat the bark and build dams and lodges with the stems; and alder seeds, buds, and catkins are eaten by redpolls, siskins, chickadees, and goldfinches and are considered to be an important winter food source (Uchytal 1989). Colorado's extensive aspen forests provide the only large expanses of deciduous trees in the state (Preston and Kingery 1998). Well-stocked quaking aspen stands provide excellent watershed protection. Mountain slopes covered by quaking aspen provide high yields of good-quality water. Quaking aspen intercepts less snow than conifers, so snowpack is often greater under quaking aspen. The trees, the shrub and herbaceous understories, and the litter of quaking aspen stands provide nearly 100 percent soil cover and protects soil from erosion soil except during very intense rains (Howard 1996). The aspen ecosystem is rich in number and species of animals, especially in comparison to associated coniferous forest types. This natural species diversity and richness has been both increased and influenced by the introduction of domestic livestock. The high value of the aspen type as a forage resource for livestock and as forage and cover for wildlife makes the subject of animal impacts important to understanding and management of this ecosystem (Rondeau 2001).

Adjacent Vegetation: Adjacent riparian vegetation: occurrences often contain a mosaic of one or two communities dominated by one of the following trees: *Abies concolor*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea pungens*, or *Populus tremuloides* (Rondeau 2001). Adjacent upland vegetation: generally the vegetation surrounding these riparian systems are dominated by the same trees that dominate in the riparian area, e.g. if the

riparian forest is *Populus tremuloides* the dominant upland vegetation is *Populus tremuloides* forest (Rondeau 2001).

Management: Potential for long-term viability of the *Populus tremuloides/Alnus incana* system will be improved by maintenance of a natural hydrologic regime complete with flooding flows, an unaltered floodplain and a natural channel morphology with banks that are not overly steepened or an overly widened channel. Also of importance to system viability is sustainable grazing management for both wild ungulates and livestock as well as management of non-native species. *Alnus incana* (thinleaf alder) is an excellent stream bank stabilizer (USDA 2004). Streambanks anchored by thinleaf alder are stable and can withstand relatively severe spring runoff, however, overgrazing and excessive trampling by livestock can seriously reduce thinleaf alder's ability to maintain streambank stability during spring runoff and flooding. However, because alder is easy to establish on disturbed sites and has a rapid growth rate it can quickly restabilize disturbed streambanks. Additionally, thinleaf alder improves soil fertility through the addition of nitrogen to the soil. (Uchytal 1989). Throughout Colorado large stands of aspen are dying but it is somewhat unclear as to why some quaking aspen stands break up and die while others remain stable. Some have speculated that both soil type and disturbance are important in quaking aspen stability (Howard 1996). Others implicate changes in the historic fire regime, excessive ungulate browse or a combination of the two while in some locations the phenomenal decline of Aspen has been related to drought. Aspen forests are usually maintained by fires (Rondeau 2001) and although aspen is able to naturally regenerate without fire or cutting on some sites, fire may be required for regeneration on others (Howard 1996). There is increasing concern that in the West, poor quaking aspen regeneration is due, at least in part, to wildlife overbrowsing young sprouts. Where browsing pressure is heavy, ungulates may remove quaking aspen regeneration before it grows above browseline. Prescribed burning is one method of promoting quaking aspen. In Colorado the phenomenon of Sudden Aspen Decline (SAD) may be drought-related. Aspen forests in some areas of Colorado have experienced widespread, severe, rapid dieback and mortality. This phenomenon, termed "sudden aspen decline," has increased dramatically in recent years. In 2008, 553,000 acres of damage were recorded, over 17% of the estimated aspen cover type in Colorado. The southwestern and northwestern Colorado mountains are experiencing the worst damage. Three interacting groups of factors appear to be involved. 1) Predisposing factors: Low elevations, south to west aspects, open stands are vulnerable to warm drought. 2) Inciting factors: Hot, dry conditions of 2000-2005, and possibly earlier, weakened vulnerable stands. 3) Contributing factors: Secondary insects and diseases are able to kill trees under stress. These include *Cytospora* canker, poplar borer, bronze poplar borer, and two aspen bark beetle species (USDA 2009). Where aspen has been cut in the past and SAD is now present, healthy green regenerated patches can often be seen beside dying, unmanaged stands. It appears that the diversification of age structure through management has increased the resilience of the landscape to SAD. Where clones still retain some vigor and energy, but are deteriorating, regeneration may be stimulated by burning, cutting or other stand manipulation before root systems are too weak to respond (USDA 2009).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Populus tremuloides* / *Salix drummondiana* Forest
State Common Name -
Global Scientific Name: *Populus tremuloides* / *Salix drummondiana* Forest
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Forest

Subclass: Deciduous forest

Group: Cold-deciduous forest

Subgroup: Natural/Semi-natural
cold-deciduous forest

Formation: Temporarily flooded
cold-deciduous forest

Alliance: Quaking Aspen Temporarily
Flooded Forest Alliance



Global Rank: G3G4

Global Rank Reasons: The *Populus tremuloides* / *Salix drummondiana* Forest association is known only from Colorado.

Subnational Rank: SU

Subnational Rank Reasons: The *Populus tremuloides* / *Salix drummondiana* (quaking aspen / Drummond willow) forest has been documented at one location in Colorado. This site is threatened by non-native species and by water diversions.

General Description: The *Populus tremuloides* / *Salix drummondiana* (quaking aspen / Drummond willow) association is an upper montane/subalpine riparian forest that is confined to specific environments occurring on floodplains or terraces of rivers and streams. This association is a linear system that most commonly occurs on relatively steep streams and rarely forms more than a narrow, 5-25 ft (1.5-7.5 m) wide, band of

vegetation along streambanks (Carsey et al. 2003, Rondeau 2001). The association is characterized by a closed to partially open canopy of *Populus tremuloides* with a tall shrub understory dominated by *Salix drummondiana* and a thick carpet of many forb species. The montane / subalpine riparian forest system forms small patches within this linear-matrix system. Occurrences often contain a mosaic of one or two communities dominated by a tree species (Rondeau 2001), which in this association is *Populus tremuloides* (quaking aspen).

Vegetation: *Populus tremuloides* / *Salix drummondiana* (quaking aspen / Drummond willow) forests form an open to closed, narrow canopy of trees and tall shrubs lining the stream bank. Other shrub species may be present with cover equal to but not exceeding that of *Salix drummondiana*. The herbaceous undergrowth may be sparse or richly diverse. In general, total forb cover exceeds that of graminoid cover, and no single species is dominant.

Similar Communities: -

Regional Distribution: This association is only known to occur in Colorado

Colorado Distribution: This association has been documented at one site in Saguache County in the southwest part of Colorado



Elevation Range in Colorado: 9,800.00 - 9,800.00 ft / 2,987.04 - 2,987.04 m

Site Geomorphology: The association may occur in a variety of geomorphic settings including as a narrow band of vegetation along high gradient streams in narrow, V-shaped valleys, as large woodland-willow carrs in the broad valleys of low gradient (1-3%), moderately sinuous streams, as well as along broad, highly sinuous streams and broad, actively downcutting channels. This association also occurs near seeps.

Soil: Soils range from deep sandy loams and sandy clay loams with no coarse fragments to shallow silty clay loams and sandy clay loams over coarse, angular cobbles.

Successional and Ecological Processes: The *Populus tremuloides* / *Salix drummondiana* (quaking aspen / Drummond willow) association is often an early colonizer of first-order, boulder-strewn, steep streams. This association could be an early-seral stage of the *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir - Engelmann spruce) plant association which also occurs along steep streams and alternates with the willow carrs. In wider valleys, this association occurs as a broad woodland-willow carr on well-developed soils near seeps or downstream from beaver dams. It appears to be a stable community in these environments. The primary ecological process necessary to maintain this ecological system is hydrology and specifically surface and groundwater flow (Rondeau 2001). Annual and episodic flooding is important to maintaining this

system and alteration of the flood regime due to water impoundment, diversions, etc. may produce changes to plant and community composition. *Salix drummondiana* (Drummond willow) is an excellent streambank stabilizer (USDA 2004) and provides forage and habitat resources for wildlife as well as food for livestock. Additionally, willow often forms thickets that provide good cover for a variety of wildlife species including moose, and good nesting and foraging habitat for ducks, shore birds, vireos, warblers, and sparrows and overhanging branches provide shade for salmonids (USDA 2009b). *Populus tremuloides* (quaking aspen) forests and woodlands can be self-perpetuating climax plant associations or early-seral stages of coniferous types. *Populus tremuloides* is a non-obligate riparian species and often occurs in upland communities. Where valley bottoms are moist and stable, *Populus tremuloides* can dominate the riparian area, while also occurring on adjacent mesic hillslopes (Carsey et al 2003). Colorado's extensive aspen forests provide the only large expanses of deciduous trees in the state (Preston and Kingery 1998). Well-stocked quaking aspen stands provide excellent watershed protection. Mountain slopes covered by quaking aspen provide high yields of good-quality water. Quaking aspen intercepts less snow than conifers, so snowpack is often greater under quaking aspen. The trees, the shrub and herbaceous understories, and the litter of quaking aspen stands provide nearly 100 percent soil cover and protects soil from erosion soil except during very intense rains (Howard 1996). The aspen ecosystem is rich in number and species of animals, especially in comparison to associated coniferous forest types. This natural species diversity and richness has been both increased and influenced by the introduction of domestic livestock. The high value of the aspen type as a forage resource for livestock and as forage and cover for wildlife makes the subject of animal impacts important to understanding and management of this ecosystem (Rondeau 2001). Quaking aspen forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife and livestock utilization of quaking aspen communities varies with species composition of the understory and relative age of the quaking aspen stand.

Adjacent Vegetation: Riparian vegetation is typically a linear mosaic of plant communities (Rondeau 2001) including willow carrs. Upslope vegetation surrounding these riparian systems are dominated by the same tree as that in the riparian area (Rondeau 2001).

Management: Maintaining a natural hydrologic regime is essential to the long-term viability of the *Populus tremuloides* / *Salix drummondiana* community association. Also important to the viability of this association is the maintenance of a natural channel shape with streambanks that are not oversteepened or downcut and a channel width that is not overwidened. Sustainable grazing management and eradication of non-native plant species will also greatly enhance the long-term viability of this plant community (Rondeau 2001). The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Annual and episodic flooding is important in maintaining this system. Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001) with consequences that may include streambank destabilization, and channel downcutting, widening and braiding. Willow establishment along riparian zones is an effective management tool that yields positive benefits to a number of fish and wildlife species, as well as providing necessary protection to the stream environment. Heavy livestock utilization of riparian areas can lead to severe degradation unless managed properly (USDA, 2009 b). *Salix*

drummondiana provides important streambank protection by effectively stabilizing soils. Heavy grazing in moist willow communities can lead to soil compaction, streambank sloughing and damage to willow plants. Cattle or wild ungulate overgrazing of willow causes it to become decadent or stunted. Throughout Colorado large stands of aspen are dying but it is somewhat unclear as to why some quaking aspen stands break up and die while others remain stable. Some have speculated that both soil type and disturbance are important in quaking aspen stability (Howard 1996). Others implicate changes in the historic fire regime, excessive ungulate browse or a combination of the two while in some locations the phenomenal decline of Aspen has been related to drought. Aspen forests are usually maintained by fires (Rondeau 2001) and although aspen is able to naturally regenerate without fire or cutting on some sites, fire may be required for regeneration on others (Howard 1996). There is increasing concern that in the West, poor quaking aspen regeneration is due, at least in part, to wildlife overbrowsing young sprouts. Where browsing pressure is heavy, ungulates may remove quaking aspen regeneration before it grows above browseline. In Colorado the phenomenon of Sudden Aspen Decline (SAD) may be drought-related. Aspen forests in some areas of Colorado have experienced widespread, severe, rapid dieback and mortality. This phenomenon, termed "sudden aspen decline," has increased dramatically in recent years. In 2008, 553,000 acres of damage were recorded, over 17% of the estimated aspen cover type in Colorado. The southwestern and northwestern Colorado mountains are experiencing the worst damage. Three interacting groups of factors appear to be involved. 1) Predisposing factors: Low elevations, south to west aspects, open stands are vulnerable to warm drought. 2) Inciting factors: Hot, dry conditions of 2000-2005, and possibly earlier, weakened vulnerable stands. 3) Contributing factors: Secondary insects and diseases are able to kill trees under stress. These include *Cytospora* canker, poplar borer, bronze poplar borer, and two aspen bark beetle species (USDA 2009a). Where aspen has been cut in the past and SAD is now present, healthy green regenerated patches can often be seen beside dying, unmanaged stands. It appears that the diversification of age structure through management has increased the resilience of the landscape to SAD. Where clones still retain some vigor and energy, but are deteriorating, regeneration may be stimulated by burning, cutting or other stand manipulation before root systems are too weak to respond (USDA 2009a).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Pseudotsuga menziesii* / *Betula occidentalis* Woodland
State Common Name Montane Riparian Forest
Global Scientific Name: *Pseudotsuga menziesii* / *Betula occidentalis* Woodland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Woodland

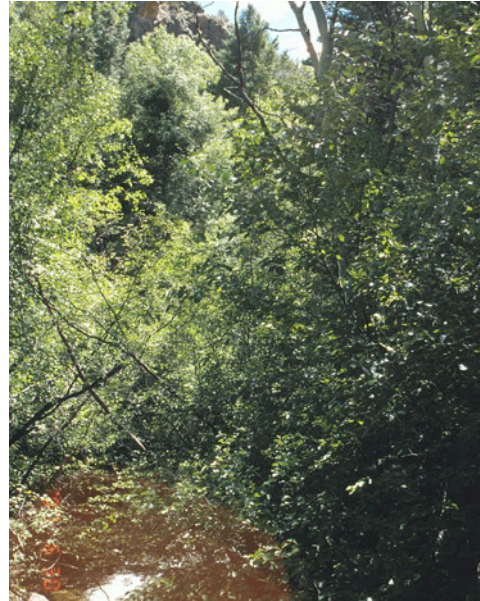
Subclass: Evergreen woodland

Group: Temperate or subpolar
needle-leaved evergreen woodland

Subgroup: Natural/Semi-natural
temperate or subpolar needle-leaved
evergreen woodland

Formation: Temporarily flooded
temperate or subpolar needle-leaved
evergreen woodland

Alliance: Douglas-fir Temporarily
Flooded Woodland Alliance



Global Rank: G3?

Global Rank Reasons: This woodland association is documented from 11 occurrences on the eastern slope of the Colorado Rockies (and one on the western slope). Less than 20 occurrences are expected to occur. One site has been documented in Utah and it may occur in Nevada. It appears to be limited to perennial streams where cold-air drainage and perennial water provide a cool, moist environment to support a diverse shrub canopy. Severe flooding must be infrequent enough to allow *Pseudotsuga menziesii* to achieve dominance. This plant association is highly threatened by development, road maintenance and improvements, and heavy recreational use. The question mark in the rank indicates that the community is suspected to be more abundant, but additional locations have not been documented.

Subnational Rank: S3

Subnational Rank Reasons: This plant association is limited mostly to foothill tributaries along the Colorado Front Range. It is highly threatened by development, road maintenance and improvements, and heavy recreational use.

General Description: The *Pseudotsuga menziesii* / *Betula occidentalis* (Douglas-fir / river birch) association occurs in narrow foothill canyons of the Colorado Front Range in the upper Arkansas and South Platte River Basins and in the Rio Grande National Forest. This plant association occurs in narrow canyons with small streams and is limited to a

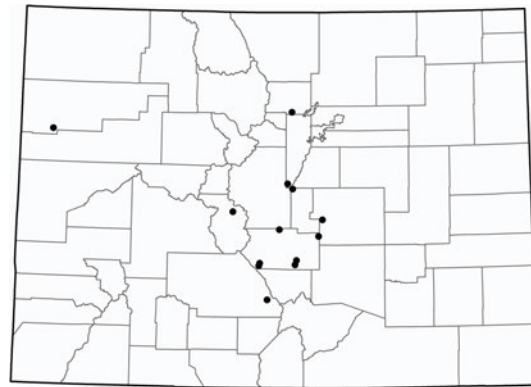
narrow band along stream banks. Stream channels are steep and narrow with mostly rocky beds.

Vegetation: This association is characterized by a dominance of *Pseudotsuga menziesii* (Douglas fir) and *Betula occidentalis* (river birch), which are key indicators for this type, even if other tree and shrub species present are abundant. The overstory canopy of this plant association is dominated by 25-50% cover of *Pseudotsuga menziesii* (Douglas-fir). Other tree species that may be present include *Populus angustifolia* (narrowleaf cottonwood), *Juniperus scopulorum* (Rocky Mountain juniper), *Pinus ponderosa* (ponderosa pine), *Abies concolor* (white fir), *Abies lasiocarpa* (subalpine fir), *Picea pungens* (blue spruce), and *Populus tremuloides* (quaking aspen). The shrub canopy is fairly thick and diverse with 20-80% cover of *Betula occidentalis* (river birch). Other shrubs that may be present include *Alnus incana* (thinleaf alder), *Acer glabrum* (Rocky Mountain maple), *Rosa woodsii* (Woods rose), *Jamesia americana* (wax flower), *Cornus sericea* (red-osier dogwood), *Quercus gambelii* (Gambel oak), *Salix bebbiana* (Bebb willow), *Salix ligulifolia* (strapleaf willow), *Salix monticola* (mountain willow), and *Salix irrorata* (bluestem willow). The herbaceous undergrowth is sparse and limited by heavy shade. Some of the more abundant species that may be present include *Maianthemum stellatum* (starry false Solomon seal), *Equisetum arvense* (field horsetail), *Carex disperma* (softleaf sedge), and *Melilotus officinalis* (yellow sweetclover).

Similar Communities: One closely related community, the Conifer / *Betula occidentalis* (conifer/water birch) community type (Manning and Padgett 1995), includes stands in the Snake Range, Nevada having *Pseudotsuga menziesii* (Douglas-fir) with *Betula occidentalis* (water birch) in the understory.

Regional Distribution: Documented locations occur across the eastern half of the Colorado Rocky Mountains ecoregion in Colorado and in sheltered canyons of the Colorado Plateau in southeastern Utah. It may also occur in Nevada.

Colorado Distribution: This plant association occurs in narrow foothill canyons of the Colorado Front Range, in the upper Arkansas and South Platte River Basins (Kittel *et al.* 1996, Kittel *et al.* 1997), in the Rio Grande National Forest (Kittel *et al.* 1999b) and 1 occurrence in the White River Basin. Documented in 7 counties.



Elevation Range in Colorado: 6,600.00 - 8,400.00 ft / 2,011.68 - 2,560.32 m

Site Geomorphology: The *Pseudotsuga menziesii* / *Betula occidentalis* (Douglas-fir/water birch) plant association occurs in narrow canyons with small streams and is limited to a narrow band along streambanks. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are steep and narrow with mostly rocky beds (Rosgen's Stream Classification: A2-A3, one B3).

Soil: The soils, derived from alluvial and colluvial deposits, are fairly shallow (60-135

in, 25-55 cm) and become skeletal with depth. Surface layers are sandy loams, clay loams, and loams. Subsurface layers are sandy loams with 10-30% cobbles and gravels. Organic matter from accumulated litter appears to be concentrated in the upper layers.

Successional and Ecological Processes: The *Pseudotsuga menziesii* / *Betula occidentalis* (Douglas-fir / river birch) plant association appears to be in a late-seral stage since *Pseudotsuga menziesii* is successfully reproducing. It also appears that this association is limited to perennial streams where the cold-air drainage and perennial stream flow provide a cool and moist environment to support a diverse shrub canopy.

Adjacent Vegetation: Adjacent riparian vegetation: in general, this is the only riparian community occurring along narrow stream channels. Occasionally, stands of *Betula occidentalis* (water birch) or *Alnus incana* (thinleaf alder) may occur on adjacent stream benches and overflow areas. Adjacent upland vegetation: steep colluvial slopes and canyon walls have *Pseudotsuga menziesii* (Douglas-fir) and *Pinus ponderosa* (ponderosa pine) forests or *Juniperus monosperma* (oneseed juniper) and *Pinus edulis* (two needle pinyon) woodlands mixed with patches of *Quercus gambelii* (Gambel's oak).

Management: *Pseudotsuga menziesii* (Douglas-fir) regeneration is favored by fire, which creates seedbeds and eliminates competition. Mature trees are relatively fire resistant, but seedlings and saplings are vulnerable to surface fires due to their thin bark and resin blisters (Hansen *et al.* 1995). The thick shrub cover and multiple vertical canopy layers of this plant association provide excellent wildlife habitat for hiding and thermal cover. Severe disturbance to this plant association may reduce the shrub cover (Hansen *et al.* 1988) and result in a more open, herbaceous understory community of introduced species (Hansen *et al.* 1995).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix drummondiana* / *Calamagrostis canadensis* Shrubland

State Common Name Lower Montane Willow Carrs

Global Scientific Name: *Salix drummondiana* / *Calamagrostis canadensis* Shrubland

Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Drummond's Willow
Temporarily Flooded Shrubland
Alliance



Global Rank: G3

Global Rank Reasons: This association requires low-gradient floodplain habitats in which natural processes are intact. This association is geographically widespread but occurs only in areas with suitable environmental conditions of medium- to fine-textured alluvial soils, perennial soil moisture, and abundant light. The low-gradient meadows where this association occurs are favored as summer pasture for domestic livestock. Livestock herbivory of seedlings can lead to losses of stands by attrition, and many stands are severely impacted (G. Kittel pers. comm.). This association is threatened by livestock grazing and invasive species throughout its range.

Subnational Rank: S3

Subnational Rank Reasons: This association is known from 31 locations in Colorado. Many of these sites are impacted by a variety of anthropogenic developments including grazing, stream diversions and impoundments, non-native species and roads.

General Description: The *Salix drummondiana* / *Calamagrostis canadensis* (Drummond willow / bluejoint reedgrass) plant association is characterized by a dense canopy of *Salix drummondiana* and a thick undergrowth of *Calamagrostis canadensis* (Carsey et al. 2003). This montane to subalpine riparian shrubland is a widespread mountainous plant community association known from lakeshores, floodplains, riparian zones, and wet meadows at elevations ranging from 707 to 3110 m (2320-10,200 feet) (NatureServe 2009). This association typically occurs as small, isolated patches in forest and shrubland openings along channels in narrow valley bottoms but can also occur along moderate-sized streams in relatively broad glaciated valleys. Although *Salix*

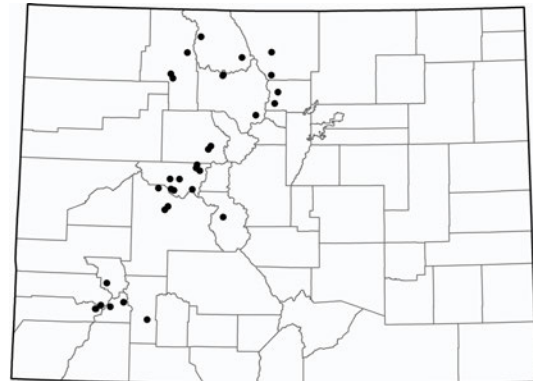
drummondiana (Drummond willow) usually occurs along steep, narrow stream margins it is also often associated with beaver activity and can occasionally occur along low-gradient streams as well as within the riparian mosaic with *Abies lasiocarpa*-*Picea engelmannii* (subalpine fir-Engelmann spruce) forests (Carsey et al. 2003, NatureServe 2009).

Vegetation: This is a broad-leaved deciduous shrubland association, consisting of a mixed layer of multi-stemmed *Salix* clumps scattered in a matrix of graminoids. *Salix drummondiana* (Drummond willow) dominates the shrub overstory with typically >20% cover. Total shrub cover is high, between 30% and 75%. Other shrubs can be present and abundant but with lesser amounts. These may include *Salix planifolia* (planeleaf willow) and *Alnus incana* (thinleaf alder), *Cornus sericea* (red-osier dogwood), *Lonicera involucrata* (twinberry honeysuckle) and *Ribes inerme* (mountain gooseberry) (Carsey et al. 2003, NatureServe 2009). The lush herbaceous cover is typically over 70% and dominated by graminoids, both perennial grasses and sedges. *Calamagrostis canadensis* (bluejoint reedgrass) is the dominant graminoid but other abundant graminoids are also present including *Carex aquatilis* (water sedge), *Carex utriculata* (beaked sedge), *Carex microptera* (small-winged sedge), *Deschampsia caespitosa* (tufted hairgrass) and *Glyceria striata* (fowl mannagrass). Forb cover is typically low. Common forbs include *Heracleum maximum* (cow parsnip), *Equisetum arvense* (field horsetail), *Senecio triangularis* (arrowleaf ragwort), *Thalictrum occidentale* (western meadowrue), *Cardamine cordifolia* (heartleaf bittercress), *Galium boreale* (northern bedstraw), *Geranium richardsonii* (Richardson geranium) and *Mertensia ciliata* (tall fringed bluebells) (Carsey et al. 2003, NatureServe 2009).

Similar Communities: -

Regional Distribution: This association has been described from southwestern Colorado to Montana, Idaho, and Washington, and is to be expected throughout the northern intermountain region at suitable sites.

Colorado Distribution: This plant association occurs in scattered locations on the West Slope in the Yampa, Colorado and Gunnison River Basins and in the Routt National Forest (NatureServe 2009).



Elevation Range in Colorado: 7,320.00 - 10,700.00 ft / 2,231.14 - 3,261.36 m

Site Geomorphology: The association most often occurs in valley bottom positions, ranging from relatively narrow montane valleys to wide glacial troughs. Stands can be long narrow strings of vegetation along steep-gradient streams or wide willow shrublands (NatureServe 2009).

Soil: Soils are usually well-developed but poorly drained, dark-colored silty clay loams. These soils often have much organic material intermixed and overlie deposits of gravel and rocks. Soils can occasionally be well-drained, gravelly loamy sands (NatureServe 2009).

Successional and Ecological Processes: The *Salix drummondiana* / *Calamagrostis canadensis* (Drummond willow / bluejoint reedgrass) plant association is often an early colonizer of first-order, boulder-strewn, steep streams. Only a few stands representing the *Salix drummondiana* / *Calamagrostis canadensis* (Drummond willow / bluejoint reedgrass) plant association have been found in Colorado, and livestock grazing has probably altered the species composition of these stands. This association appears to be limited to saturated wetland environments and therefore may be dependent on beaver populations that maintain a high water table. In addition, near beaver activity, this association may be a mid-successional community that will eventually become a *Salix planifolia* (planeleaf willow) or *Salix monticola* (mountain willow) type as the area dries slightly and accumulates sediment (Carsey et al 2003). This association provides wildlife and domestic livestock with important resources. *Calamagrostis canadensis* (bluejoint reedgrass) furnishes a large amount of forage for many big game species and livestock and although it is grazed lightly by deer but makes up a major part of the diet of elk in the winter (Tesky 1992). In the West all classes of livestock eat willows in the West, but cattle consume more than others because they frequent riparian areas. Moose consume large amounts of Drummond willow during the winter, while use by other ungulates is generally light. Willows are a preferred food and building material of beaver. Ducks and grouse, other birds, and small mammals eat willow shoots, catkins, buds and leaves. Red-naped sapsuckers, warblers, hummingbirds, chipmunks, and red squirrels also use Drummond willow. In Colorado, red-naped sapsuckers drill wells in the stems and feed on the sap of Drummond willow. Heavy drilling can occur, with up to 90 percent of a single plant's branches containing wells. These wells serve as feeding sites for other animals such as warblers, hummingbirds, chipmunks, and red squirrels (Uchytel 1991, USDA, 2009). Drummond willow often forms 6.5-to 13-foot-tall (2-4 m) thickets that provide good cover for a variety of wildlife species, especially moose, and excellent nesting and foraging habitat for ducks, shore birds, vireos, warblers, and sparrows and dense overhanging branches provide shade for salmonids (Uchytel 1991).

Adjacent Vegetation: This system often occurs as a mosaic of multiple riparian communities that range from herbaceous dominated communities to tree dominated communities (Rondeau 2001). Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001).

Management: Potential for long-term community sustainability will be enhanced by maintaining a natural hydrologic regime complete with flooding, maintaining a natural channel morphology and hydrologic processes, sustainable grazing management and eradication of non-native species. Beaver are primary users as well as maintainers to this system. In addition to beavers, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow together with annual and episodic flooding (Rondeau 2001). Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001). *Salix drummondiana*/*Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) associations provide important streambank protection by effectively stabilizing soils (USDA 2004). However, heavy grazing in moist communities can lead to soil compaction, streambank sloughing and damage to willow plants. Bluejoint reedgrass is sensitive to overgrazing (Tesky 1992) and cattle or wild ungulate overgrazing of Drummond willow causes it to become decadent or stunted (Uchytel 1991). However, plants recover rapidly when browsing is excluded. Grazing is

particularly detrimental to the establishment of willows and should be restricted when soils are moist, especially along streams where bank sloughing can occur (Uchytel 1991, Tesky 1992).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix geyeriana* - *Salix monticola* / Mesic Forbs Shrubland
State Common Name Geyer's Willow-Rocky Mountain Willow/Mesic Forb
Global Scientific Name: *Salix geyeriana* - *Salix monticola* / Mesic Forbs Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Geyer's Willow Temporarily
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: There are only 21 documented occurrences of this association, and less than 50 expected to exist in Colorado. No known occurrences of this association have been reported from outside of Colorado. The often saturated soils of this plant association are vulnerable to compaction by livestock, vehicles, and heavy equipment. Overgrazing by livestock can desiccate the site, increase non-native grass cover, and damage the roots of the shrubs.

Subnational Rank: S3

Subnational Rank Reasons: In Colorado, this association is documented from over twenty locations, and at least that many more are expected to occur. Stands with their native herbaceous undergrowth intact are extremely rare.

General Description: The *Salix geyeriana* - *Salix monticola* / mesic forb plant association is a tall, mixed willow shrubland with an undergrowth species composition that is grazing-induced. The undergrowth is a carpet of grasses and forbs on a hummocky ground surface. Season-long grazing has increased the non-native grass cover and reduced the native forbs in most occurrences. This plant association occurs on broad alluvial floodplains with steep side slopes. Stream channels are broad and moderately sinuous to highly sinuous or narrow, entrenched, ephemeral gullies.

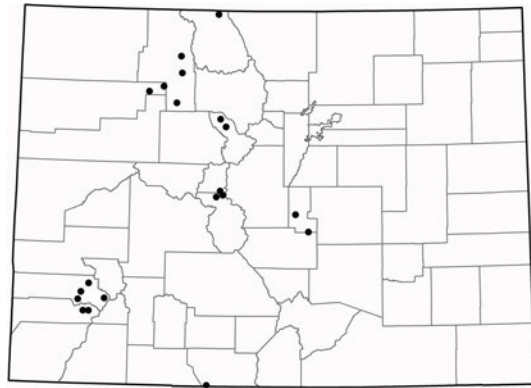
Vegetation: This plant association is characterized by a tall, nearly closed canopy of *Salix monticola* (mountain willow) and *Salix geyeriana* (Geyer willow), with a combined cover between 10-90% and usually so near in abundance, one cannot determine which is the dominant willow in the stand. Other shrubs that may be present include *Ribes*

inermis (whitestem gooseberry), *Alnus incana* (thinleaf alder), *Salix drummondiana* (Drummond willow), and *Dasiphora floribunda* (shrubby cinquefoil). The undergrowth in undisturbed stands is a thick carpet of forbs including *Mertensia ciliata* (tall fringed bluebells), *Achillea millefolium* var. *occidentalis* (western yarrow), *Heracleum maximum* (common cowparsnip), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Senecio triangularis* (arrowleaf ragwort), and *Cardamine cordifolia* (heartleaf bittercress). The graminoid layer is usually sparse, but includes *Carex utriculata* (beaked sedge) and *Carex aquatilis* (water sedge). Disturbed stands have a high cover of non-native grasses including *Agrostis stolonifera* (creeping bentgrass) and *Poa pratensis* (Kentucky bluegrass).

Similar Communities: There are three closely related communities. Both the *Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis* - *Carex aquatilis* - *Carex rostrata* (Geyer's willow-mountain willow/bluejoint reedgrass-water sedge-beaked sedge) plant association (Baker 1989) and the *Salix geyeriana* - *Salix* spp. / *Calamagrostis canadensis* (Geyer's willow-willow/bluejoint reedgrass) plant association (Johnston 1987) have only native graminoids in the undergrowth. The *Salix boothii* (Booth's willow) community type (Padgett *et al.* 1989) includes stands co-dominated with *Salix geyeriana* (Geyer's willow) or *S. monticola* (mountain willow).

Regional Distribution: This association is known from the Routt National Forest, the San Miguel River Basin, the Arkansas River Basin, and the Rio Grande/Closed Basin areas of Colorado.

Colorado Distribution: This association occurs in the Routt National Forest (Kettler and McMullen 1996), the San Miguel River Basin (Kittel and Lederer 1993), the Arkansas River Basin (Kittel *et al.* 1996), the Rio Grande/Closed Basin (Kittel *et al.* 1999b), the White River Basin, the Upper Yampa, the Upper Colorado-Dolores River Basin, the N. Platte Basin, and the Blue and Conejos River Basins.



Elevation Range in Colorado: 7,700.00 - 9,800.00 ft / 2,346.96 - 2,987.04 m

Site Geomorphology: This plant association occurs on broad alluvial floodplains with steep side slopes. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are broad and moderately sinuous to highly sinuous (Rosgen's Channel Type: B3, C4) or narrow, entrenched, ephemeral gullies (Rosgen's Channel Type: G4).

Soil: Soils are silt, silty loams, silty clay loams, sandy clay loams and deep sands. Several stands in the San Miguel River Basin occur on deep clay loams of old beaver ponds. Some soil profiles have considerable coarse materials while others are relatively fine textured. Mottling is evident near the surface indicating elevated water tables during part of the year.

Successional and Ecological Processes: The *Salix geyeriana* - *Salix monticola* / mesic forb plant association differs from the *Salix geyeriana* / mesic forb plant association because *Salix monticola* is always present with a significant cover and sometimes in a greater abundance than *Salix geyeriana*. The presence of *Salix monticola* may be due to differences in environmental factors or may represent a different successional stage of the *Salix geyeriana* / mesic forb association. This plant association may be a grazing-induced type due to the abundance of non-native grasses in some stands. With removal of season-long grazing, this association may return to a native forb dominated undergrowth or a dominance of *Calamagrostis canadensis* (bluejoint reedgrass), becoming a *Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis* plant association.

Adjacent Vegetation: Adjacent riparian vegetation: a narrow band of *Alnus incana* (thinleaf alder) or *Betula occidentalis* (water birch) shrublands may occur at the stream edge. Other plant associations include mixed *Populus angustifolia* - *Picea pungens* (narrowleaf cottonwood - blue spruce) forests; *Alnus incana* (thinleaf alder) and *Salix planifolia* (planeleaf willow) shrublands; and *Carex aquatilis* (water sedge), *C. utriculata* (Northwest Territory sedge), and *Eleocharis quinqueflora* (fewflower spikerush) meadows. Adjacent upland vegetation: *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir - Engelmann spruce), *Pseudotsuga menziesii* (Douglas-fir), *Picea pungens* (blue spruce), and *Populus tremuloides* (quaking aspen) forests and *Quercus gambelii* (Gambel's oak) woodlands occur on adjacent hillslopes.

Management: The management responses of this plant association are likely to be similar to other tall-willow shrublands dominated by *Salix geyeriana* (Geyer's willow) or *S. monticola* (mountain willow). The wet and often saturated soils of this plant association are vulnerable to compaction by livestock and heavy equipment. Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of willow root structure. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen *et al.* 1995) and continue for only short duration. Deferred and rest rotation grazing systems are recommended for maintaining the vigor and productivity of this plant association. Rest periods are recommended in order to provide time for plant regrowth. Late summer and fall grazing are not recommended because willow species are vulnerable to pruning damage due to limited regrowth at the end of the growing season (Hansen *et al.* 1995). Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Beaver dams abate channel downcutting, bank erosion, and downstream movement of sediment. Beaver dams raise the water across the floodplain and provide year-round saturated soils. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. Land managers should consider maintaining beaver rather than removing them (Hansen *et al.* 1995). Prescribed burning is an effective method of rejuvenating decadent stands of willows. The willow species in this plant association vigorously sprout following quick, hot fires. Slow-burning fires can actually damage the plants (Hansen *et al.* 1995). *Salix geyeriana* (Geyer's willow) is an effective streambank stabilizer that can be grown from nursery cuttings and then transplanted. Cuttings should be taken in the spring from dormant 2-4 year old wood, and they should be 12-20 in (30-50 cm) long with a diameter of at least 0.5 in (1 cm). Roots and shoots should appear 10-15 days after planting if conditions are right (Hansen *et al.* 1995).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix geyeriana* / *Carex aquatilis* Shrubland
State Common Name Montane Willow Carr
Global Scientific Name: *Salix geyeriana* / *Carex aquatilis* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Seasonally flooded
cold-deciduous shrubland

Alliance: Geyer's Willow Seasonally
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: This association is reported from several western states with less than 100 estimated occurrences. Few pristine stands remain because of human-cause disturbances. Most stands are threatened by improper livestock grazing. More survey is needed to document stands in Montana and Wyoming.

Subnational Rank: S3

Subnational Rank Reasons: The *Salix geyeriana* / *Carex aquatilis* Shrubland association is known from only ten sites in Colorado. Most have been impacted by anthropogenic development including improper grazing, mining, invasion of non-native plant species, roads, channel alteration and recreation.

General Description: *Salix geyeriana* / *Carex aquatilis* Shrubland (Geyer willow/water sedge) plant associations occur in a variety of environmental settings. The community is frequently found on broad valley bottom floodplains in Idaho, Utah, and Colorado and may also occur in Wyoming and Montana with elevations that range from 2100-3200 m (6800-10,500 feet). Floodplains tend to be broad and undulating and are usually flooded in early spring and summer, with saturated soils throughout the growing season. This plant association also occurs on narrow, flat benches along steep stream channels (Rosgen's Channel Type:G3), along broad and sinuous stream channels (Rosgen's Channel Type C3) and on floodplains of narrow, subalpine, low-gradient (1-5%), braided or highly sinuous streams (Rosgen's Channel Type: D3,E3) (NatureServe 2009). Additionally the association can occur on hillside seeps. Vegetation is characterized by a

tall-shrub canopy dominated by *Salix geyeriana* (10-80% cover) with smaller shrubs often occurring under the canopy. The canopy is nearly closed and a thick carpet of mesic grasses and forbs blanket the ground. The ground surface is often hummocky with willows establishing on the raised mounds and grasses dominating in the swales (Carsey et al. 2003, NatureServe 2009). This association is relatively uncommon in Colorado. Few stands are in pristine condition. It may be less common than it was historically due to heavy grazing at the turn of the century.

Vegetation: This plant association is characterized by a tall willow canopy dominated by *Salix geyeriana* (Geyer willow). When *Salix geyeriana* is the single overstory dominant the canopy may contain corridor-like openings between the individual willows, or may be nearly closed when the shrub canopy is a mix of several species. Other shrubs may include *Betula nana* (bog birch), *Salix brachycarpa* (barrenground willow), *S. boothii* (Booth willow), *S. monticola* (mountain willow), *S. planifolia* (planeleaf willow) and *S. wolfii* (wolf willow) (Carsey et al. 2003, NatureServe 2009). The understory is a moderate to dense herbaceous layer with higher cover of graminoid than forb cover and is dominated by *Carex aquatilis* (water sedge), especially in low, wetter areas. Other graminoids are present in lower cover and may include *Carex utriculata* (beaked sedge), *Deschampsia caespitosa* (tufted hairgrass), and *Calamagrostis canadensis* (bluejoint reedgrass). Forb cover is concentrated on elevated micro-ridges and higher areas where shrubs are rooted. Forb species that may be present include *Senecio triangularis* (arrowleaf ragwort), *Achillea millefolium* var. *occidentalis* (western yarrow), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Geum macrophyllum* (largeleaf avens), *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Chamerion angustifolium* (fireweed), *Equisetum arvense* (field horsetail), *Fragaria virginiana* (wild strawberry), *Heracleum maximum* (cowparsnip), *Mertensia ciliata* (tall fringed bluebells), *Pedicularis groenlandica* (elephantella), *Senecio triangularis* (arrowleaf ragwort), *Stellaria longifolia* (longleaf starwort), and *Thalictrum fendleri* (Fendler's meadowrue). Introduced species are common in disturbed stands and include *Agrostis stolonifera* (creeping bentgrass), *Phleum pratense* (common timothy), *Poa pratensis* (Kentucky bluegrass), *Taraxacum officinale* (dandelion), and *Trifolium repens* (white dutch clover) (Carsey et al. 2003, NatureServe 2009).

Similar Communities: *Salix geyeriana* / *Carex utriculata* Shrubland, and *Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis* Shrubland (NatureServe 2009).

Regional Distribution: This association is known to occur in Colorado, Utah, and Idaho. Stands may also occur in southern Montana and northern Wyoming.

Colorado Distribution: This association is widely distributed in the central, mountainous regions of the State from Jackson County in the north to Saguache County in the south (NatureServe 2009).



Elevation Range in Colorado: 8,440.00 - 9,480.00 ft / 2,572.51 - 2,889.50 m

Site Geomorphology: *Salix geyeriana* / *Carex aquatilis* (Geyer willow / Water sedge) shrublands occur in a number of geomorphic settings including; on floodplains that have an undulating topography with hummocks, ridges and swales that create a micro-environment for its heterogeneous understory; on narrow benches of steep stream channels; on broad floodplains of low-gradient sinuous stream channels; and along narrow, low-gradient, sinuous stream channels (NatureServe 2009, Carsey et al. 2003).

Soil: Soils are shallow to deep with mottling often occurring near the surface. Soil textures are fine sandy clay loams, clay loams and silty loams often alternating with layers of coarse sand (Carsey et al. 2003).

Successional and Ecological Processes: *Salix geyeriana* dominated associations appear to be long-lived and late-seral, remaining in areas where a shallow water table saturates soils, not dropping below 3 ft (1 m) for much of the growing season. Stands are limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow.

Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds (Carsey et al. 2003). *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils.

Calamagrostis canadensis (bluejoint reedgrass) dominates the drier sites with lower water tables (Carsey et al 2003). Geyer willow communities provide excellent forage and cover resources for wildlife and domestic livestock. Geyer willow is relished by livestock.

Livestock and wild ungulates apparently prefer Geyer willow over Drummond willow (*Salix drummondiana*) Wolf willow (*Salix wolfii*), and Booth willow (*Salix boothii*). Geyer willow is highly palatable to moose, and is highly palatable to elk in northwestern Montana. In Oregon, palatability of Geyer willow to livestock, big game, and beaver is moderately high. Willows in general are preferred food and building material of beaver. Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals. Good cover resources are provided by the characteristic growth form of widely spaced clumps of Geyer willow, which allows for easy access and movement of livestock and large wildlife species. In Oregon, Geyer willow communities provide excellent habitat for deer. Geyer willow communities also provide excellent nesting and foraging habitat for a variety of birds, such as ducks and shorebirds, blackbirds, warblers, vireos, and sparrows (Uchytel 1991). Geyer willow communities provide high quality streambank stabilization characteristics (USDA 2004). Thus Geyer willow has high value for rehabilitation of disturbed sites and is especially useful for streambank stabilization (Uchytel 1991).

Adjacent Vegetation: This system often occurs as a mosaic of multiple riparian communities that range from herbaceous dominated communities to tree dominated

communities (Rondeau 2001). On very wet sites, Geyer willow usually has understories dominated by beaked sedge (*Carex rostrata*), water sedge (*C. aquatilis*), and/or fowl bluegrass (*Poa palustris*). On some of the drier sites Geyer willow occupies, mesic forbs and Kentucky bluegrass (*Poa pratensis*) are common. Other common understory associates include wooly sedge (*Carex lanuginosa*), Sitka sedge (*C. sitchensis*), widefruit sedge (*C. eurycarpa*), smallwing sedge (*C. microptera*), Baltic rush (*Juncus balticus*), bluejoint reedgrass (*Calamagrostis canadensis*), and tufted hairgrass (*Deschampsia caespitosa*) (Uchytel 1991). Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001). Adjacent uplands are dominated by Engelmann spruce (*Picea engelmannii*), blue spruce (*P. pungens*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), or big sagebrush (*Artemisia tridentata*) (Uchytel 1991).

Management: Beaver are primary users as well as maintainers to this system. In addition to beavers, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow together with annual and episodic flooding (Rondeau 2001). Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001).

Potential for long-term viability of the *Salix geyeriana*/Mesic forb (Geyer willow/Mesic forb) association will benefit by the maintenance of natural hydrologic conditions with seasonal flooding that maintains high water tables, by the management or eradication of non-native plant species and by sustainable management of livestock grazing. The association has many corridors between willow clumps that allow livestock access and increase the risk of overgrazing. Overgrazing of *Salix geyeriana* causes lost vigor, decreased stand density, and eventual elimination. The mesic forb understory will become dominated by *Poa pratensis* or other weedy species that increase with grazing. Livestock grazing, as well as human developments (e.g., roads, recreation sites, etc.), compact the Mollisol soils of stands and are not usually compatible (especially under wet conditions). Moreover, when the association converts to *Poa pratensis* dominance, streambank stability decreases and cattle trampling causes bank sloughing, creek overwidening, and water table alterations. *Salix geyeriana* may be less tolerant of browsing pressure than *Salix boothii*, thus, moderate grazing may move the association toward *Salix boothii*-dominated associations. Similarly, understory shrub and forb composition may be the result of disturbances (e.g., some species, such as *Rosa woodsii* and some mesic forbs, increase under livestock grazing). The removal of season-long grazing may help this association return to a native forb-dominated undergrowth or dominance by *Calamagrostis canadensis* (NatureServe 2009).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix geyeriana* / Mesic Forbs Shrubland
State Common Name Montane Willow Carr
Global Scientific Name: *Salix geyeriana* / Mesic Forbs Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Geyer's Willow Temporarily
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: This association is a widely distributed and well-documented association known mainly from mid to high elevations of the northern Rockies (especially central and eastern Idaho) and central Rockies (especially Colorado). This association usually occurs on streambanks and terraces in wide, low-gradient valley bottoms of variable size streams, but it may also occur on the drier margins of floodplains. Habitats and soils supporting this association are variable but are relatively common across the landscape. Despite the association's broad geographic range, wide distribution of potential habitat, and relatively low environmental specificity, stands of this type are infrequently observed. Large stands in good to excellent ecological condition, with no exotic grasses or forbs in the understory, are rare. This association is known from only about 60-100 occurrences. Because this is a broadly defined association by some researchers, degraded stands with exotic species in the understory have been included in classification results. This makes estimation of the exact number of occurrences difficult. Livestock overgrazing, hydrologic alterations, road building, and recreational use are documented threats to the association. Stands are apparently under-represented in protected areas.

Subnational Rank: S3

Subnational Rank Reasons: The *Salix geyeriana* / Mesic Forbs Shrubland association is known from only eight occurrences in Colorado. Most have been impacted by anthropogenic development ,especially grazing and invasion of non-native plant species.

General Description: The *Salix geyeriana* / mesic forb (Geyer willow / mesic forb) plant association is a tall (5-15 ft, 1.5-2.5 m), deciduous shrubland confined to a narrow band along stream banks. The association is clearly dominated by clumps of 1.5- to 2.5-m tall *Salix geyeriana* (usually 60-90% cover) with *Salix boothii* sometimes also present with low to moderate cover. The herbaceous undergrowth is dominated by mosses and a diverse mixture of mesic forbs (with cover greater than that of mesic graminoids) in the understory, forming multiple height layers. No single species has consistently high cover or constancy. The association is widely distributed in the northern central and southern Rocky Mountains at mid to high elevations of about 1122 to over 3019 m (3680-9900 feet). Although this association is well documented in several western states it is infrequently sampled. However, large, pristine stands without introduced species in the undergrowth are extremely rare (NatureServe 2009, Carsey et al 2003). This plant association generally occurs along moderately wide, low-gradient valley bottoms with sinuous stream channels. It can also occur in narrow, slightly steeper, valley bottoms (65- 165 ft, 20-50 m), and on flood benches of moderately sinuous stream channels (Carsey et al 2003). Sites supporting this association include terraces and streambanks (at or much higher than mean high water), as well as the drier margins of wetland floodplains (NatureServe 2009).

Vegetation: *Salix geyeriana* (Geyer willow) dominates the tall shrub canopy with usually 60-90% cover. *Salix boothii* (Booth willow) is sometimes also present with low to moderate cover. Other willow species that may be present include *Salix monticola* (mountain willow), *Salix drummondiana* (Drummond willow), *Salix planifolia* (planeleaf willow), *Salix wolfii* (Wolf willow), and *Salix brachycarpa* (barrenground willow). *Alnus incana* (thinleaf alder) can also be present as well as low shrubs including *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Ericameria parryi* (Parry's rabbitbrush), *Ribes inerme* (mountain gooseberry), *Ribes lacustre* (prickly currant), and/or *Rosa woodsii* (Wood's rose), and trees with low to moderate cover. (Carsey et al. 2003, NatureServe 2009). Forbs dominate the understory, forming multiple height layers, with a diverse mix of mesic species with cover that varies from dense to low, but that is always greater than that of mesic graminoids. No single species has consistently high cover or constancy. The most common and widespread includes *Mertensia ciliata* (tall fringed bluebells), *Heracleum maximum* (common cowparsnip), *Senecio triangularis* (arrowleaf ragwort), *Oxypolis fendleri* (Fendler cowbane), *Fragaria virginiana* (strawberry), *Aconitum columbianum* (monkshood), *Equisetum arvense* (field horsetail), *Geum macrophyllum* (largeleaf avens), *Mainthemum stellatum* (starry false Solomon seal), *Pedicularis groenlandica* (elephantella), *Swertia perennis* (star gentian). Graminoid cover is sparse tending to be dominated by exotic species with low cover such as *Agrostis gigantea* (redtop), *Agrostis stolonifera* (creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Phleum pratense* (common timothy), but also includes native graminoids most commonly *Bromus ciliatus* (fringed brome), *Calamagrostis canadensis* (bluejoint reedgrass), *Carex microptera* (small-winged sedge), *Carex utriculata* (beaked sedge), or *Juncus balticus* (mountain rush). Introduced forbs include *Cardaria chalapensis* (lenspod whitetop), *Cirsium arvense* (Canada thistle), *Descurainia sophia* (flixweed), *Lepidium campestre* (field pepperweed), and *Taraxacum officinale* (Dandelion) (NatureServe 2009,

Carsey et al. 2003).

Similar Communities: *Salix geyeriana* - *Salix monticola* / Mesic Forbs Shrubland (NatureServe 2009)

Regional Distribution: This association is known mainly from mid to high elevations of the northern, central and southern Rocky Mountains from Montana and Idaho to Colorado extending west into the high plateaus of Utah. Very similar associations, if determined synonymous, may extend the range to Nevada and Oregon (NatureServe 2009).



Colorado Distribution: This association is known from only a few, widely scattered sites in Colorado from Routt County to Saguache County in the south, and Chaffee County to the east and Dolores County to the west.

Elevation Range in Colorado: 6,800.00 - 9,850.00 ft / 2,072.64 - 3,002.28 m

Site Geomorphology: *Salix geyeriana* / Mesic forb (Geyer willow/Mesic forb) shrublands occur in wide, low-gradient valley bottoms as well as in narrow, slightly steeper valley bottoms and on flood benches of moderately sinuous stream channels (Carsey et al. 2003).

Soil: Soils are coarse skeletal sandy loams and sandy clay loams overlying gravel and cobble horizons. Soils of this plant association tend to have more coarse fragments than other more moist *Salix geyeriana* associations (Carsey et al. 2003)

Successional and Ecological Processes: The *Salix geyeriana* / mesic forb (Geyer willow / mesic forb) plant association appears to be a long-lived, late-seral community that will remain dominant where a high water table saturates soils for much of the growing season. However, if the stand has predominantly non-native species in the undergrowth, such as *Trifolium repens* (white clover) and *Taraxacum officinale* (dandelion), it is likely a grazing-induced community. With appropriate grazing management, the stand can revert back to the *Salix geyeriana* / mesic forb (Geyer willow / mesic forb) or the *Salix geyeriana* / mesic graminoid (Geyer willow / mesic graminoid) plant association (Carsey et al. 2003). Geyer willow communities provide excellent forage and cover resources for wildlife and domestic livestock. Geyer willow is relished by livestock. Livestock and wild ungulates apparently prefer Geyer willow over Drummond willow (*Salix drummondiana*) Wolf willow (*Salix wolfii*), and Booth willow (*Salix boothii*). Geyer willow is highly palatable to moose, and is highly palatable to elk in northwestern Montana. In Oregon, palatability of Geyer willow to livestock, big game, and beaver is moderately high. Willows in general are preferred food and building material of beaver. Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals. Good cover resources are provided by the characteristic growth form of widely spaced clumps of Geyer willow, which allows for

easy access and movement of livestock and large wildlife species. In Oregon, Geyer willow communities provide excellent habitat for deer. Geyer willow communities also provide excellent nesting and foraging habitat for a variety of birds, such as ducks and shorebirds, blackbirds, warblers, vireos, and sparrows (Uchytel 1991). Geyer willow communities provide high quality streambank stabilization characteristics (USDA 2004). Thus Geyer willow has high value for rehabilitation of disturbed sites and is especially useful for streambank stabilization (Uchytel 1991).

Adjacent Vegetation: On very wet sites, Geyer willow usually has understories dominated by beaked sedge (*Carex rostrata*), water sedge (*C. aquatilis*), and/or fowl bluegrass (*Poa palustris*). On some of the drier sites Geyer willow occupies, mesic forbs and Kentucky bluegrass (*Poa pratensis*) are common. Other common understory associates include woolly sedge (*Carex lanuginosa*), Sitka sedge (*C. sitchensis*), widefruit sedge (*C. eurycarpa*), smallwing sedge (*C. microptera*), Baltic rush (*Juncus balticus*), bluejoint reedgrass (*Calamagrostis canadensis*), and tufted hairgrass (*Deschampsia caespitosa*) (Uchytel 1991). Adjacent uplands are dominated by Engelmann spruce (*Picea engelmannii*), blue spruce (*P. pungens*), subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), ponderosa pine (*P. ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), or big sagebrush (*Artemisia tridentata*) (Uchytel 1991).

Management: Geyer willow communities usually occur in broad, open valleys and meadows with fairly constant water supplies. Communities on these sites are relatively stable and maintained by seasonal flooding and high water tables (Uchytel 1991). Potential for long-term viability of the *Salix geyeriana* / Mesic forb (Geyer willow / Mesic forb) association will benefit by the maintenance of natural hydrologic conditions with seasonal flooding that maintains high water tables, by the management or eradication of non-native plant species and by sustainable management of livestock grazing. The association has many corridors between willow clumps that allow livestock access and increase the risk of overgrazing. Overgrazing of *Salix geyeriana* causes lost vigor, decreased stand density, and eventual elimination. The mesic forb understory will become dominated by *Poa pratensis* or other weedy species that increase with grazing. Livestock grazing, as well as human developments (e.g., roads, recreation sites, etc.), compact the Mollisol soils of stands and are not usually compatible (especially under wet conditions). Moreover, when the association converts to *Poa pratensis* dominance, streambank stability decreases and cattle trampling causes bank sloughing, creek overwidening, and water table alterations. *Salix geyeriana* may be less tolerant of browsing pressure than *Salix boothii*, thus, moderate grazing may move the association toward *Salix boothii*-dominated associations. Similarly, understory shrub and forb composition may be the result of disturbances (e.g., some species, such as *Rosa woodsii* and some mesic forbs, increase under livestock grazing). The removal of season-long grazing may help this association return to a native forb-dominated undergrowth or dominance by *Calamagrostis canadensis* (NatureServe 2009).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix geyeriana* / Mesic Graminoids Shrubland
State Common Name Geyer's Willow/Mesic Graminoid
Global Scientific Name: *Salix geyeriana* / Mesic Graminoids Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Geyer's Willow Temporarily
Flooded Shrubland Alliance



Global Rank: G3?

Global Rank Reasons: This association is widely distributed at mid to high elevations, ranging from the Great Basin to the Central Rockies, north to central and eastern Idaho and adjacent Wyoming. Extensive stands of the association are relatively frequently observed in a wide variety of fluvial settings, but they are especially common on seasonally wet sites in wide montane valley bottoms (e.g., glacial troughs and basins). This association is distinguished by having moderate cover and constancy of mixed mesic graminoid species, none of which are distinctly dominant. The high cover of mesic graminoids under an open *Salix geeyeriana* canopy makes this association susceptible to overgrazing by livestock and conversion of the understory to dominance by exotic grasses (e.g., *Poa pratensis*). While stands of this type do exist in less disturbed, late-seral states with native understory species, the association is more often expressed as disturbance-induced stands. If stands in poor to fair ecological condition with understories dominated by exotic grass species are not considered, the total known occurrences of this association is probably less than 100. Unfortunately, this is a broadly defined type that sometimes encompasses *Salix geeyeriana* / *Poa pratensis* and other disturbance-induced *Salix geeyeriana* stands with no clearly dominant understory graminoid species. In addition, some stands dominated by *Salix boothii* are also included within this association based on similarities in environmental setting and composition. This broad lumping is problematic for determining a clear definition of this association and assessing its true extent across its range. More in-depth analysis of existing stand data needs to occur in order to determine the actual number of occurrences. Until this occurs, G3? is an appropriate rank.

Subnational Rank: S3

Subnational Rank Reasons: *Salix geeyeriana* / Mesic Graminoids shrublands are documented from only seven sites in Colorado. The majority of these sites have been impacted by anthropogenic development including livestock grazing, roads, channel alteration and invasion of non-native plant species.

General Description: This is an important association in Idaho, Oregon, Montana, Utah, Colorado, and northwestern Wyoming. Stands of this association are often found in wide mountain valleys, cirques, and troughs, at elevations from about 1525 to 2745 m (5000-9000 feet) with narrow, meandering streams or braided rivers. This plant association is a tall (2-5m), deciduous shrubland with an open to nearly closed canopy of clumped willows and a thick layer of sedges and grasses in the undergrowth. Other shrubs, including *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Ribes* spp. (gooseberry), *Rosa woodsii* (Wood's rose), and low *Salix* spp. (willow), are scattered around the bases of taller *Salix* clumps. The herbaceous understory is dominated by a diverse mix of mesic graminoid species that always has greater total cover than the total cover of mesic forbs. In good-condition, mid- to late-seral stands, the most common graminoids are *Carex microptera*, *Carex pellita*, *Deschampsia caespitosa*, and occasionally *Carex nebrascensis*, but no single species consistently has high cover. Other graminoids with moderate cover and constancy include *Calamagrostis canadensis*, *Carex aquatilis*, *Carex praeegracilis*, *Carex rostrata*, *Carex utriculata*, *Glyceria* spp., and *Juncus balticus*. *Poa pratensis* is present in nearly all stands, but its cover varies depending on the amount of grazing disturbance and site desiccation. Stands in poor condition need to be co-dominated by a mixture of native graminoids (not a single species such as *Deschampsia caespitosa*) with the introduced graminoids and forbs. The most common forb species are sometimes indicative of grazing disturbance (e.g., *Achillea millefolium*, *Geum macrophyllum*, *Iris missouriensis*, *Maianthemum stellatum*, *Potentilla gracilis*,

Thalictrum spp., *Taraxacum officinale*, and *Trifolium* spp.).

Vegetation: When ecological conditions are good, this type is clearly distinguished from other *Salix geyeriana*-dominated stands by having moderate cover and constancy of mixed native mesic graminoid species including (but not limited to) *Calamagrostis canadensis* (bluejoint reedgrass), *Carex aquatilis* (water sedge), *Carex pellita* (wooly sedge), *Carex utriculata* (beaked sedge), and/or *Deschampsia caespitosa* (tufted hairgrass), none of which are distinctly dominant (NatureServe 2009). This association is characterized by an open canopy of tall, clumped *Salix geyeriana*, with occasionally intermixed *Salix boothii* (with <20% cover). Dominance of *Salix geyeriana* (20-70% cover), occasionally intermixed with *Salix boothii* (with <20% cover), characterizes this association. Other shrubs, including *Alnus incana* ssp. *tenuifolia*, *Dasiphora fruticosa* ssp. *floribunda*, *Ribes inerme*, *Ribes lacustre*, *Rosa woodsii*, and other *Salix* spp. such as *Salix drummondiana*, *Salix lemmonii*, *Salix lucida* ssp. *lasiandra* (= *Salix lasiandra*), *Salix monticola*, *Salix planifolia*, or *Salix wolfii*, are scattered around the bases of taller *Salix* clumps. The herbaceous understory is dominated by a diverse mix of mesic graminoid species that always has greater total cover than the total cover of mesic forbs. In good-condition, mid- to late-seral stands, the most common graminoids are *Carex microptera* (small-winged sedge), *Carex pellita* (wooly sedge), *Deschampsia caespitosa* (tufted hairgrass), and occasionally *Carex nebrascensis* (Nebraska sedge), but no single species consistently has high cover. Introduced grasses are frequently present, but their cover varies depending on the amount of grazing disturbance and site desiccation. Introduced grasses include *Phalaris arundinacea* (reed canarygrass), *Phleum pratense* (common timothy), and *Poa pratensis* (Kentucky bluegrass). Stands in poor condition need to be co-dominated by a mixture of native graminoids (not a single species such as *Deschampsia caespitosa*) with the introduced graminoids and forbs. The most common forb species are sometimes indicative of grazing disturbance. Associated species include *Achillea millefolium* (western yarrow), *Antennaria* spp. (pussytoes), *Caltha leptosepala* (marsh marigold), *Cirsium* spp. (thistle), *Geum macrophyllum* (largeleaf avens), *Iris missouriensis* (wild iris), *Maianthemum stellatum* (starry false Solomon seal), *Pedicularis groenlandica* (elephantella), *Penstemon* spp. (penstemon), *Polygonum bistortoides* (American bistort), *Potentilla gracilis* (showy cinquefoil), *Thalictrum* spp. (meadowrue), *Taraxacum officinale* (dandelion), *Trifolium* spp. (clover), *Urtica dioica* (stinging nettle), *Veronica* spp. (speedwell), and *Vicia americana* (American vetch) (NatureServe 2009).

Similar Communities: *Salix geyeriana* / *Carex aquatilis* Shrubland (NatureServe 2009)

Regional Distribution: This association is widely distributed in the West at mid to high elevations, ranging from Idaho, Wyoming, Utah, Nevada, Colorado, and possibly California, Montana and Oregon.

Colorado Distribution: Documented occurrences are found in seven locations in two counties in the north, central region of the state, Routt and Grand County.



Elevation Range in Colorado: 7,488.00 - 8,777.00 ft / 2,282.34 - 2,675.23 m

Site Geomorphology: These riparian sites usually occur in broad montane and subalpine valleys (Uchytíl 1991). The association mainly occurs on seasonally saturated or flooded sites such as streambanks, terraces, floodplains, abandoned meanders, spring-fed meadows, lake or reservoir shores, and occasionally alluvial gravel bars (NatureServe 2009). Geyer willow communities are often somewhat removed from a stream's edge, occurring in broad, low gradient valley bottoms and is also frequently associated with abandoned and sediment-filled beaver ponds (Uchytíl 1991).

Soil: Soils vary but are mostly silt to clay loams with organic/sedge peat horizons (NatureServe 2009).

Successional and Ecological Processes: Geyer willow communities usually occur in broad, open valleys and meadows with fairly constant water supplies. Communities on these sites are relatively stable and maintained by seasonal flooding and high water tables (Uchytíl 1991). Geyer willow communities provide excellent forage and cover resources for wildlife and domestic livestock. Geyer willow is relished by livestock. Livestock and wild ungulates apparently prefer Geyer willow over *Salix drummondiana* (Drummond willow), *Salix wolfii* (Wolf willow), and *Salix boothii* (Booth willow). Geyer willow is highly palatable to moose, and is highly palatable to elk in northwestern Montana. In Oregon, palatability of Geyer willow to livestock, big game, and beaver is moderately high. Willows in general are preferred food and building material of beaver. Willow shoots, catkins, buds, and leaves are eaten by ducks and grouse, other birds, and small mammals. Good cover resources are provided by the characteristic growth form of widely spaced clumps of Geyer willow, which allows for easy access and movement of livestock and large wildlife species. In Oregon, Geyer willow communities provide excellent habitat for deer. Geyer willow communities also provide excellent nesting and foraging habitat for a variety of birds, such as ducks and shorebirds, blackbirds, warblers, vireos, and sparrows (Uchytíl 1991). The easy access afforded by the clumped form of the willows and high cover of grasses and sedges makes this association highly productive for livestock forage but also makes this community type susceptible to overgrazing and conversion of the understory from native species to exotic grasses. While stands do exist in less disturbed, late-seral states with native understory species, it is more often expressed as disturbance-induced (e.g., by livestock grazing) states. Similarly, understory shrub and forb composition may be the result of grazing disturbance. Thus, it is hypothesized that under persistent, heavy livestock grazing the association will move toward *Salix geyeriana* / *Poa pratensis* (Geyer willow/Kentucky bluegrass), *Salix geyeriana* / *Poa palustris* (Geyer willow/fowl bluegrass), *Salix geyeriana* / mesic graminoid-forb, or *Salix geyeriana* / mesic forbs. Overgrazing may directly or indirectly eliminate *Salix geyeriana* by decreasing its vigor or altering hydrologic. The resulting associations may be drier types such as *Poa pratensis* meadows or other associations. Alternatively, *Salix geyeriana* / mesic graminoids possibly originated from *Salix geyeriana* / *Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass), *Salix geyeriana* / *Carex aquatilis* (Geyer willow/water sedge), *Salix geyeriana* / *Carex rostrata* (Geyer willow/beaked sedge), or *Salix geyeriana* / *Deschampsia caespitosa* associations (Geyer willow/tufted hairgrass) which have been disturbed by grazing, or alterations in hydrology, and subsequently invaded by various mesic graminoid species (NatureServe 2009).

Adjacent Vegetation: This system often occurs as a mosaic of multiple riparian

communities that range from herbaceous dominated communities to tree dominated communities (Rondeau 2001). On very wet sites, Geyer willow usually has understories dominated by *Carex rostrata* (beaked sedge), *C. aquatilis* (water sedge) and/or *Poa palustris* (fowl bluegrass). On some of the drier sites Geyer willow occupies, mesic forbs and *Poa pratensis* (Kentucky bluegrass) are common. Other common understory associates include *Carex pellita* (wooly sedge), *Carex sitchensis* (Sitka sedge), *C. eurycarpa* (widefruit sedge), *C. microptera* (smallwing sedge), *Juncus balticus* (mountain rush), *Calamagrostis canadensis* (bluejoint reedgrass), and *Deschampsia caespitosa* (tufted hairgrass) (Uchytel 1991). Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001). Adjacent uplands are dominated by *Picea engelmannii* (Engelmann spruce), *P. pungens* (blue spruce) *Abies lasiocarpa* (subalpine fir), *Pinus contorta* (lodgepole pine), *P. ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Populus tremuloides* (quaking aspen), or *Artemisia tridentata* (big sagebrush) (Uchytel 1991).

Management: Beaver are primary users as well as maintainers to this system. In addition to beavers, the primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow together with annual and episodic flooding (Rondeau 2001). Alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant and community composition (Rondeau 2001). Geyer willow communities also provide high quality streambank stabilization characteristics (USDA 2004). Thus Geyer willow has high value for rehabilitation of disturbed sites and is especially important for streambank stabilization (Uchytel 1991). Potential for long-term viability of the *Salix geyeriana* / Mesic forb (Geyer willow/Mesic forb) association will benefit by the maintenance of natural hydrologic conditions with seasonal flooding that maintains high water tables, by promoting beaver populations, by the management or eradication of non-native plant species and by sustainable management of livestock grazing. Many Geyer willow communities have a long history of overgrazing, which has resulted in the replacement of native grasses and sedges with bluegrasses (Uchytel 1991). Overgrazing of *Salix geyeriana* causes lost vigor, decreased stand density, and eventual elimination. The mesic forb understory will become dominated by *Poa pratensis* (Kentucky bluegrass) or other weedy species that increase with grazing. Livestock grazing, as well as human developments (e.g., roads, recreation sites, etc.), compact the Mollisol soils of stands and are not usually compatible (especially under wet conditions). Moreover, when the association converts to *Poa pratensis* dominance, streambank stability decreases and cattle trampling causes bank sloughing, creek overwidening, and water table alterations. *Salix geyeriana* may be less tolerant of browsing pressure than *Salix boothii*, thus, moderate grazing may move the association toward *Salix boothii*-dominated associations. Similarly, understory shrub and forb composition may be the result of disturbances (e.g., some species, such as *Rosa woodsii* and some mesic forbs, increase under livestock grazing). The removal of season-long grazing may help this association return to a native forb-dominated undergrowth or dominance by *Calamagrostis canadensis* (NatureServe 2009) and decadent plants may recover from overbrowsing with 5 to 6 years of rest (Uchytel 1991).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix monticola* / *Carex aquatilis* Shrubland
State Common Name Montane Riparian Willow Carr
Global Scientific Name: *Salix monticola* / *Carex aquatilis* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Mountain Willow
Temporarily Flooded Shrubland
Alliance



Global Rank: G3

Global Rank Reasons: In Colorado, this association is documented at 14 locations, although additional occurrences are expected to occur. This minor association appears to require coarse-textured soils along braided or meandering streams in narrow mountain valleys in the Colorado Rocky Mountains. It is threatened by improper grazing, inappropriate stream flow alterations, and heavy recreational use. There are no known protected sites.

Subnational Rank: S3

Subnational Rank Reasons: In Colorado, this association is documented at 14 locations; however, an additional 20-30 stands are expected to occur. This association is threatened by improper livestock grazing, inappropriate stream flow alterations, and heavy recreation use.

General Description: The *Salix monticola* / *Carex aquatilis* (mountain willow/water sedge) plant association is a tall (5-8 ft, 1.5-2.5 m), deciduous shrubland with a fairly open willow canopy and a thick carpet of grasses and sedges in the undergrowth. It occurs on open floodplains, often occupying the entire valley floor. The undergrowth is dominated by patches of *Carex aquatilis* (water sedge). This association often includes *Carex utriculata* (beaked sedge) and *Calamagrostis canadensis* (bluejoint reedgrass), but is distinguished from the *Salix monticola* / *Carex utriculata* (mountain willow/beaked sedge) and *Salix monticola* / *Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) associations because *Carex aquatilis* (water sedge) is either the clear dominant or most consistently present of the three throughout the stand. This plant association occurs in narrow valleys on coarse-textured stream banks. Stream channels are narrow

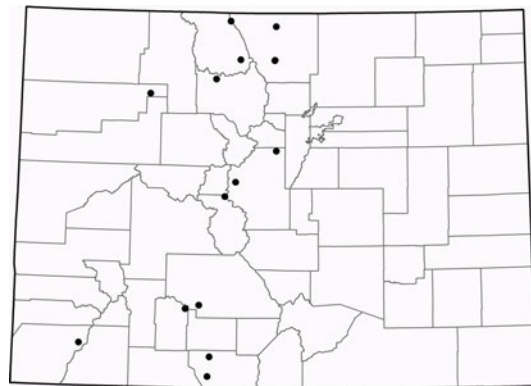
and highly sinuous or braided by beaver activity.

Vegetation: This plant association forms a tall willow carr dominated by *Salix monticola* (mountain willow) as the matrix species. The matrix species is the willow with the highest abundance, even though other willow species combined may have greater canopy cover. Other shrubs that may be present include *Salix bebbiana* (Bebb willow), *Salix drummondiana* (Drummond willow), *Cornus sericea* (red-osier dogwood), and *Lonicera involucrata* (twinberry honeysuckle). The herbaceous undergrowth is dominated by *Carex aquatilis* (water sedge). Cover of other graminoid and forb species is low due to shading and flood disturbance. Stands with abundant *Carex utriculata* (beaked sedge) or *Calamagrostis canadensis* (bluejoint reedgrass) may indicate a transitional stage to another *Salix monticola* (mountain willow) association.

Similar Communities: *Salix monticola* (mountain willow) occurs as nearly pure stands in Colorado, but is replaced by other *Salix* (willow) species, e.g., *S. boothii* (Booth's willow) and *S. drummondiana* (Drummond's willow), farther north and west of the state line. Closely related communities include the *Salix boothii* / *Carex aquatilis* (Booth's willow/water sedge) community type (Padgett *et al.* 1989), which occasionally has *Salix monticola* (mountain willow) in the canopy.

Regional Distribution: This southern Rocky Mountain riparian plant association has been documented in the Yampa, South Platte, Rio Grande/Closed Basin, and Arkansas river basins in Colorado.

Colorado Distribution: This plant association is a minor type known to occur in the Yampa (Kittel and Lederer 1993), South Platte (Kittel *et al.* 1997), Arkansas (Kittel *et al.* 1999a), Rio Grande Rivers and Closed Basins (Kittel *et al.* 1999b), and in the San Juan National Forest (Richard *et al.* 1996).



Elevation Range in Colorado: 7,700.00 - 10,800.00 ft / 2,346.96 - 3,291.84 m

Site Geomorphology: This plant association occurs in narrow valleys on coarse-textured streambanks. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are narrow and highly sinuous (Rosgen's Channel Type: D6E4) or braided by beaver activity (Rosgen's Channel Type: D6).

Soil: Soils are sandy clay loams to sandy loams with layers of gravel and organic matter. Mottles appear at 8 inches (20 cm) depth.

Successional and Ecological Processes: *Salix monticola* (mountain willow) dominated plant associations appear to be longlived and stable. They occur on mesic sites that support a diversity of graminoids and forbs. *Salix monticola* appears to grow only where the water table does not drop below 3 ft (1 m) of the surface. It appears to be limited to cold, wet environments in broad valley bottoms at high elevations. The presence of

dying conifer trees in these associations may indicate a rise in the water table. *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables.

Adjacent Vegetation: Adjacent riparian vegetation: *Picea pungens* (blue spruce), *Populus angustifolia* (narrowleaf cottonwood) forests, and *Alnus incana* (thinleaf alder) shrublands occur in adjacent riparian areas. Adjacent upland vegetation: at higher elevations, *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir-Engelmann spruce) forests and *Populus tremuloides* (quaking aspen) woodlands occur on adjacent hill slopes. At lower elevations, *Pinus ponderosa* (ponderosa pine) forests and *Quercus gambelii* (Gambel's oak) scrub occur on adjacent hillslopes.

Management: *Salix monticola* (mountain willow) appears to be less tolerant of browsing pressure than other tall montane willow species. It forms, in the same way that *Salix geyeriana* (Geyer's willow) does, the classic "mushroom" shape under heavy browsing pressure by deer and cattle (Hansen *et al.* 1995). *Carex* spp. (sedges) in riparian areas of mid-elevation rangelands are often heavily grazed by livestock. Improper grazing by livestock in this plant association can dry sites, increase non-native cover, and reduce the vigor of willow root structure. The wet and often saturated soils of this plant association are also vulnerable to compaction by livestock and heavy equipment. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen *et al.* 1995). Deferred and rest rotation grazing systems are recommended for maintaining the vigor and productivity of this plant association. Rest periods are recommended in order to provide time for plant establishment. Late summer and fall grazing are not recommended because willow species are vulnerable to pruning damage due to limited regrowth at the end of the growing season (Hansen *et al.* 1995, Kovalchik and Elmore 1992). Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Beaver dams abate channel downcutting, bank erosion, and downstream movement of sediment. Beaver dams raise the water table across the floodplain and provide year-round saturated soils. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. Land managers should consider maintaining beaver rather than removing them (Hansen *et al.* 1995). According to Hansen *et al.* (1995), burning of this plant association temporarily increases the productivity of *Carex aquatilis* (water sedge). However, livestock grazing needs to be eliminated for the year prior to burning and for at least 2-3 years after in order to prevent livestock from consuming young, palatable regrowth. Prescribed burning is also an effective method of rejuvenating decadent stands of willows. The willow species in this plant association vigorously sprout following quick, hot fires. Slow-burning fires can actually damage the plants (Hansen *et al.* 1995). Both *Salix monticola* (mountain willow) and *Carex aquatilis* (water sedge) are effective streambank stabilizers. *Carex aquatilis* holds streambanks with its dense network of rhizomatous roots. *Salix monticola*, much like *Salix geyeriana*

(Geyer's willow), can probably be grown and transplanted from nursery cuttings. Cuttings should be taken in the spring from dormant 2-4 year old wood, and they should be 12-20 in (30-50 cm) long with a diameter of at least 0.5 in (1 cm). Roots and shoots should appear 10-15 days after planting if conditions are right (Hansen *et al.* 1995). Local genetic material is preferred in any restoration project.

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix monticola* / *Carex utriculata* Shrubland
State Common Name Montane Riparian Willow Carr
Global Scientific Name: *Salix monticola* / *Carex utriculata* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Mountain Willow
Temporarily Flooded Shrubland
Alliance



Global Rank: G3

Global Rank Reasons: This shrubland association is known only from Colorado, where it is documented from 21 locations and an additional 10 or so are expected to occur. These shrublands require low-gradient subalpine streams with significant floodplains rich in fine and organic soils. Grazing and invasion of exotics have impacted almost every occurrence. While most documented sites occur on Federal lands (USFS and BLM), and at least one is in excellent condition, there are no known protection plans.

Subnational Rank: S3

Subnational Rank Reasons: This shrubland has been documented from 21 locations in Colorado. Anthropogenic development impacts the majority of sites. These activities include domestic livestock grazing, roads, invasion of non-native plant species, mining, recreation and channel alteration and diversions. Additionally, in some sites ungulate browse (elk) is excessively heavy and impacts the shrubland.

General Description: The *Salix monticola* / *Carex utriculata* (mountain willow / beaked sedge) plant association is a tall (5-8 ft, or 1.5-2.5 m), deciduous shrubland with an open canopy of willows and a thick understory of grasses and sedges (Carsey et al. 2003). Willows establish on higher hummocks, while *Carex utriculata* establishes at the water

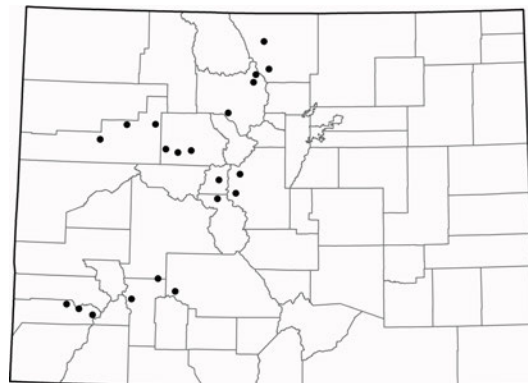
margins and in wet swales between willow hummocks. The willow canopy is dominated by *Salix monticola* (mountain willow) with 10-80% cover, although other willow species may be present (NatureServe 2009). The undergrowth is dominated by patches of *Carex utriculata* (beaked sedge). This association often includes *Carex aquatilis* (water sedge) and *Calamagrostis canadensis* (bluejoint reedgrass), but is distinguished from the *Salix monticola* / *Carex aquatilis* (mountain willow/water sedge) and *Salix monticola* / *Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) associations because *Carex utriculata* is either the clear dominant or most consistently present of the three throughout the stand (Carsey et al. 2003). *Salix monticola* / *Carex utriculata* shrublands are found throughout the southern Rocky Mountains of Colorado (NatureServe 2009). These shrublands occur along wet banks and terraces of low-gradient, subalpine streams at 2500-3100 m (8300-10,240 feet) elevation in open flood plains and broad valley bottoms and often occupies the entire valley floor. Beaver ponds commonly occur in association with this shrubland (NatureServe 2009, Carsey et al 2003).

Vegetation: This association is characterized by a thick shrub canopy dominated by *Salix monticola* (mountain willow) as the matrix species. The matrix species is the willow with the highest abundance, even though other willow species may have greater combined canopy cover. Other shrub species that may be present include *Salix geyeriana* (Geyer willow), *Salix brachycarpa* (barrenground willow), *Salix drummondiana* (Drummond willow), *Salix ligulifolia* (strapleaf willow), and *Salix boothii* (Booth willow). *Betula occidentalis* (river birch) and *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil) are also often present and *Ribes* spp. (gooseberry) are often present in low abundance (Carsey et al., NatureServe 2009). The undergrowth is dominated by graminoids with *Carex utriculata* (beaked sedge) as the most abundant graminoid (1-44% cover). Other graminoids are often present as well but cover is minor and include *Carex aquatilis* (water sedge) with 1-11% cover, *Poa pratensis* (Kentucky bluegrass), and *Deschampsia caespitosa* (tufted hairgrass). Total forb cover is generally less than 10%. Forb species include *Cardamine cordifolia* (heartleaf bittercress), *Mertensia ciliata* (tall fringed bluebells), *Heracleum maximum* (common cowparsnip), *Caltha leptosepala* (marsh marigold), *Geum macrophyllum* (largeleaf avens) and *Agrostis scabra* (rough bentgrass) (Carsey et al. 2003) .

Similar Communities: *Salix monticola* / *Calamagrostis canadensis* Shrubland, *Salix monticola* / *Carex aquatilis* Shrubland.

Regional Distribution: This plant association is found throughout the southern Rocky Mountains of Colorado.

Colorado Distribution: *Salix monticola* / *Carex utriculata* shrublands are documented from widely scattered sites throughout the Rocky Mountains of Colorado. Occurrences in Larimer County define the northeast extent of distribution and occurrences in Dolores County the southwest extent.



Elevation Range in Colorado: 7,680.00 - 10,850.00 ft / 2,340.86 - 3,307.08 m

Site Geomorphology: *Salix monticola* / *Carex utriculata* shrublands occurs in broad valley bottoms and open floodplains with low-gradient, moderately wide to wide, meandering streams (Carsey et al. 2003).

Soil: Soils are clay loam, sandy clay loam and heavy silty clay textures with occasional mottling often with significant organic matter; some profiles have a buried organic layer; and others have up to 40% organic matter in the top 20 inches (50 cm) (Carsey et al 2003, NatureServe 2009).

Successional and Ecological Processes: This plant association requires a high water table and saturated soils for much of the growing season and may be an early successional stage of the *Salix monticola* / *Carex aquatilis* and the *Salix monticola* / *Calamagrostis canadensis* associations. *Carex utriculata* (beaked sedge), *Carex aquatilis* (water sedge), and *Calamagrostis canadensis* (bluejoint reedgrass) are common dominant undergrowth of several *Salix* plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain. *Carex utriculata* (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (water sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables (Carsey et al. 2003). Both *Salix monticola* (mountain willow) and *Carex utriculata* (beaked sedge) provide important resources for wildlife and domestic livestock. Mountain willow is an important food source for moose, deer small mammals, beaver, snowshoe hares, songbirds, and game birds, including ruffed grouse and ptarmigan and from Wyoming to Alaska provides browse for moose. Honey bees use the pollen and nectar of mountain willow as a food source for brood rearing. In south-central Colorado, browse suitability ratings for mountain willow are listed as high for elk and cattle and moderate for deer and sheep (Esser 1992). Beaked sedge is grazed by cattle, horses, moose, elk, mule deer, bison, grizzly bears, and sandhill cranes. Due to low stature and structural diversity, beaked sedge stands may serve as foraging areas rather than nesting habitat for avian species (Anderson 2008). Mountain willow also provides high cover value. Mountain willow characteristically produces dense thickets along streams and rivers, which provide thermal and hiding cover for elk, deer, and moose. Branches are used by beavers in the construction of dams and lodges and willow branches that overhang stream banks also provide shade and cover for fish (Esser 1992). Beaked sedge forms dense sod from its extensive rhizome and root systems which overhangs streambanks and provides excellent cover for fish. Beaked sedge may also provide cover for trumpeter swan nests and fair cover for upland game birds, waterfowl, and small nongame birds, and as good cover for small mammals (Anderson 2008).

Adjacent Vegetation: This system often occurs as a mosaic of multiple communities including tree, shrub and herbaceous plant associations (Rondeau 2001). Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001).

Management: Maintaining a natural hydrologic regime that sustains a high water table with saturated soils is important to the long-term viability of this community. Beaver

are likely maintainers of this system and beaver activity is evident in the majority of the *Salix monticola* / *Carex utriculata* (mountain willow/beaked sedge) occurrences in Colorado. By virtue of beaver damming activities water storage is enhanced, soils are saturated and a high water table is maintained. Beaver mitigate impacts of drought. In times of extreme drought beaver are able to mitigate wetland loss and play a dominant role in determining the amount of wetland habitat, regardless of the amount of rainfall (Hood and Bayley 2008). Even during drought, where beaver were present, Hood and Bayley (2008) found that there was 60 per cent more open water than those same areas during previous drought periods when beaver were absent. Additionally beaver ponds provide critical habitat for a variety of migratory songbirds, particularly in the semi-arid interior of the Western U.S. (Cooke and Zacke 2008). Willow establishment along riparian zones is an effective management tool that yields positive benefits to a number of fish and wildlife species, as well as providing necessary protection to the stream environment. Heavy livestock utilization of riparian areas can lead to severe degradation unless managed properly. On severely disturbed sites mountain willow is useful in stabilizing streambanks and providing erosion control. Because of its ability to produce roots and root crown shoots, which provide for quick recovery mountain willow is an important invader of sites disturbed by man or natural phenomena (Esser 1992). *Carex utriculata* (beaked sedge) is also a high quality streambank-stabilizing species (USDA 2004). Beaked sedge has a dense network of rhizomatous roots and forms a thick sod that is highly resistant to erosion and is effective in stabilizing streambanks. The closely crowded erect stalks of beaked sedge are also useful in trapping sediment in runoff and keeping it from depositing in streams (Anderson 2008).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix planifolia* / *Carex aquatilis* Shrubland
State Common Name Subalpine Riparian Willow Carr
Global Scientific Name: *Salix planifolia* / *Carex aquatilis* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

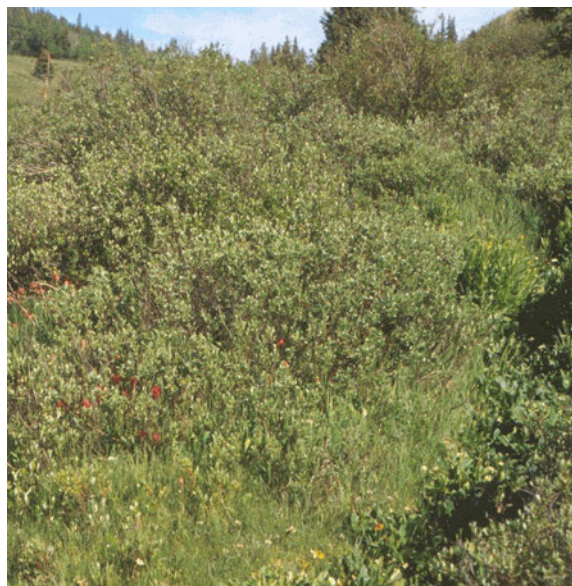
Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Seasonally flooded
cold-deciduous shrubland

Alliance: Planeleaf Willow Seasonally
Flooded Shrubland Alliance



Global Rank: G5

Global Rank Reasons: -

Subnational Rank: S4

Subnational Rank Reasons: *Salix planifolia* / *Carex aquatilis* shrublands are known from 33 sites that are widely distributed from the north to the south throughout mountainous regions of Colorado. Many sites are impacted by anthropogenic development including livestock grazing, roads, recreation and non-native plant species. However, many sites are also in excellent condition with regard to vegetation quality and hydrologic function and is likely due to Wilderness designation which protects many of the sites. Beaver activity is common at many of these sites and likely contributes to system viability by helping to maintain hydrology.

General Description: The *Salix planifolia* / *Carex aquatilis* (planeleaf willow/water sedge) plant association is a low-stature willow shrubland that grows in wet to saturated soils, usually above 9,000 ft (2,800 m) (Carsey et al. 2003). Vegetation is characterized by a low (<1.5 m), typically closed shrub layer (ranging from 30-100% cover) that is dominated by *Salix planifolia*, with an herbaceous layer dominated by the wet sedge *Carex aquatilis* (NatureServe 2009). *Salix planifolia* occasionally mixes with *Salix brachycarpa* (barrenground willow) or *Salix wolfii* (Wolf willow) at higher elevations and grades into taller willow carrs with *Salix monticola* (mountain willow) at lower elevations. The moderately dense to dense herbaceous layer is dominated by wet

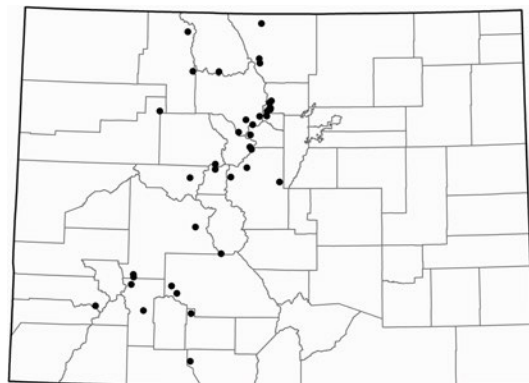
graminoids but often has a diverse forb layer. This wetland/riparian low shrubland association typically occurs in the upper montane and subalpine zones in the Rocky Mountains from New Mexico to Montana, and west into Utah and Idaho. Elevation ranges from 2700-3700 m (8300-11,700 feet) in Colorado to 1750-2690 m (5740-8830 feet) in Montana. *Salix planifolia* / *Carex aquatilis* (planeleaf willow/water sedge) shrublands are a common plant association of subalpine glacial valleys. The association occurs on snow-melt fed swales and in wide, wet glaciated valleys bottoms adjacent to streams, around lakes, fens and seeps, and in depressions where snowmelt runoff saturates soils during the growing season. It also occurs in narrow valleys with sinuous streams and wet floodplains associated with beaver ponds. Stream channel characteristics vary from wide and moderately sinuous, to narrow and sinuous, or highly braided by beaver activity. The water table at these sites is usually near the surface throughout the growing season.

Vegetation: This plant association which is characterized by low-stature (1.5-5 ft; 0.5-1.5 m), typically closed shrub canopy (ranging from 30-100% cover) dominated by *Salix planifolia* (planeleaf willow). Other common willow species that may be present at lower elevations are *Salix geyeriana* or *Salix monticola* and at higher elevations *Salix brachycarpa*, *Salix glauca*, and *Salix wolfii*. Wet graminoids dominate the moderately dense to dense herbaceous layer but which often has a diverse forb layer. *Carex aquatilis* (water sedge) is the dominant graminoid in the herbaceous undergrowth but other graminoid species may be present including *Carex utriculata* (beaked sedge), *Calamagrostis canadensis* (bluejoint reedgrass), and *Deschampsia caespitosa* (tufted hairgrass). Additional less frequent graminoids include *Carex canescens*, *Carex microptera*, *Carex rostrata* (northern stands only), *Eleocharis quinqueflora*, *Glyceria borealis*, *Phleum alpinum*, and *Trisetum wolfii*. Total forb cover is often less than 30%. Species that may be present include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Pedicularis groenlandica* (elephanthead lousewort), *Conioselinum scopulorum* (Rocky Mountain hemlockparsley), *Aconitum columbianum* (monkshood), *Erigeron peregrinus*, *Ligusticum tenuifolium*, *Mertensia ciliata* (tall fringed bluebells), *Polygonum bistortoides*, *Rhodiola rhodantha*, *Saxifraga odontoloma* (brook saxifrage), *Senecio triangularis* (arrowleaf ragwort), *Swertia perennis*, and *Veronica wormsjoldii*.

Similar Communities: *Salix planifolia* / *Calamagrostis canadensis* Shrubland, *Salix (farriae, planifolia)* / *Carex utriculata* Shrubland, *Salix planifolia* / *Carex scopulorum* Shrubland, *Salix planifolia* / *Deschampsia caespitosa* Shrubland, *Salix planifolia* / *Caltha leptosepala* Shrubland, *Salix planifolia* / *Carex utriculata* Shrubland

Regional Distribution: This riparian association is found in the montane and subalpine zones in the Rocky Mountains from northern New Mexico to Montana and Idaho.

Colorado Distribution: *Salix planifolia* / *Carex aquatilis* shrublands are a common type and occurs throughout the Rocky Mountains of Colorado (Carsey et al. 2003). This association occurs in 19 counties in Colorado extending from the northern to



the southern border.

Elevation Range in Colorado: 9,400.00 - 11,380.00 ft / 2,865.12 - 3,468.62 m

Site Geomorphology: Stands typically occur in wide, glaciated valleys bottoms. Sites may be flat or uneven with raised hummocks to moderately sloping. Stream channels are variable and may be wide and moderately sinuous (Rosgen's Channel Type: B3), narrow and sinuous (Rosgen's Channel Type: E4), or highly braided by beaver activity (Rosgen's Channel Type: D4) (NatureServe 2009).

Soil: Soils are typically poorly drained and have an organic peat top layer over mineral silty clays, heavy silty clay loams, silty loams, sandy loams, or loamy sands. Mottling is often evident (Carsey et al. 2003, NatureServe 2009).

Successional and Ecological Processes: *Salix planifolia* (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. *Salix planifolia* and *Salix brachycarpa* can form extensive stands, often creating intricate mosaics in broad, subalpine valleys. In general, *Salix planifolia* occupies the wettest micro-habitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is often found on slightly drier and more well-drained micro-habitats than *Salix planifolia*. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. At montane elevations, *Salix planifolia* is often a co-dominant in *Salix monticola* plant associations. The *Salix planifolia* / *Carex aquatilis* (planeleaf willow/water sedge) plant association occurs in wet swales that are saturated throughout the growing season. The dense canopy layers and thick undergrowth indicate stable conditions. Both *Carex aquatilis* (water sedge) and *Caltha leptosepala* (marsh marigold) can tolerate saturated soils, and occasionally they co-dominate the undergrowth. These shrublands provide wildlife and domestic livestock with valuable resources. All classes of livestock eat willows (*Salix* spp.), but cattle consume more than others because they frequent riparian areas. In southwestern Montana and in Yellowstone National Park, moose eat large amounts of this willow in the winter and small amounts in the summer but consumption by elk and mule deer is generally low. Willows in general are a preferred food and building material of beaver and ducks, grouse, other birds, and small mammals eat willow shoots, catkins, buds, and leaves. Planeleaf willow, occurring in montane and subalpine riparian communities, provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows. Nesting sandhill cranes frequently used low-statured planeleaf willow cover in Idaho and planeleaf willow branches overhanging streambanks provide cover and shade for salmonids (Uchytel 1991). *Carex aquatilis* (water sedge) provides fair to good forage for wildlife and domestic livestock but excellent cover for wildlife. In Montana and Washington riparian and wetland sites, water sedge provides fair food for elk, mule deer, and whitetail deer and small mammals but poor food for pronghorn. Water sedge palatability in Montana and Washington riparian and wetland sites is listed as good for cattle, domestic sheep, and horses and has fair energy and nutritional value (Hauser 2006). Water sedge is however an excellent source of cover in riparian and wetland communities for birds and small mammals. In Montana and Washington wetland and riparian zones, water sedge provides good cover for waterfowl, small nongame birds,

and small mammals. In Montana, water sedge communities are often found adjacent to waterways supporting trout. The dense sod created by water sedge hangs over streambanks, creating valuable cover and shade for fish (Hauser 2006).

Adjacent Vegetation: Adjacent riparian systems range from herbaceous dominated communities to tree dominated communities (Rondeau 2001). Generally, the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001).

Management: *Salix planifolia* / *Carex aquatilis* shrublands often forms relatively stable communities maintained by high water tables and high elevation climates. In Colorado, high-elevation planeleaf willow communities are considered climax wetland communities. These communities can experience successional shifts if water tables change (Uchytel 1991). Maintaining natural hydrology with a water table that is near the surface throughout the growing season is essential to the long-term viability of this system. The primary abiotic ecological process necessary to maintain this ecological system is hydrology and specifically surface flow. Beaver are primary users as well as maintainers to this system. Beaver damming activity increases water storage, soil saturation and helps maintain a high water table. Annual and episodic flooding is important in maintaining this system and alteration of the flooding regime due to water impoundments, diversions etc. may produce changes to plant and community composition (Rondeau 2001). Grazing can impact native vegetation, and contribute to the invasion of non-native plant species. In northwest Moffat County, Colorado, grazing led to a decline of water sedge and an increase in Kentucky bluegrass (*Poa pratensis*) and Rocky Mountain iris (*Iris missouriensis*). Season-long grazing of water sedge communities causes soil compaction and breaks the sod, leading to a decrease of water sedge and an increase of Baltic rush (*Juncus balticus*), small sedges, Kentucky bluegrass, and forbs (Hauser 2006). Planeleaf willow becomes decadent or stunted when overbrowsed by cattle or wild ungulates and beavers. However, decadent plants recover relatively rapidly when browsers are excluded. Because planeleaf willow usually grows on wet sites that are easily trampled by livestock, packstock, hikers, campers, big game, and off-road vehicles, trails and roads should be located on nearby uplands (Uchytel 1991). Both planeleaf willow and water sedge is recommended for use in revegetating disturbed riparian areas, and is especially useful for streambank stabilization (Uchytel 1991, Hauser 2006). Water sedge is an excellent species for stabilizing streambanks due to its strong rhizomatous growth. In Montana and Washington riparian and wetland sites, water sedge has medium erosion control and short-term and long-term revegetation potential. For example, in the southern Rocky Mountains of Colorado, water sedge was used to revegetate mined peatlands (Hauser 2006).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix planifolia* / *Deschampsia caespitosa* Shrubland
State Common Name Subalpine Riparian Willow Carr
Global Scientific Name: *Salix planifolia* / *Deschampsia caespitosa* Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Planeleaf Willow
Temporarily Flooded Shrubland
Alliance



Global Rank: G2G3

Global Rank Reasons: -

Subnational Rank: S3

Subnational Rank Reasons: This association has been documented to occur in only eight sites in Colorado. Although some of the sites are impacted by grazing and off-road vehicle use many of the occurrences are located in areas that are protected with Wilderness designation and are in sustainable condition.

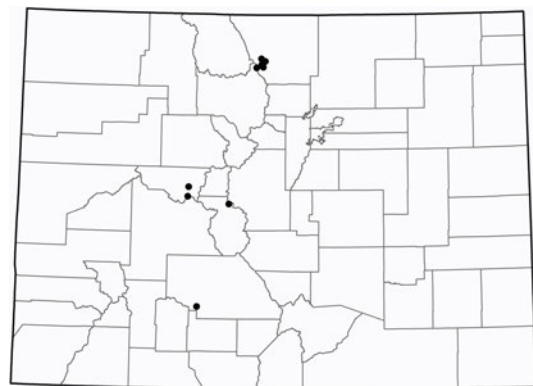
General Description: This riparian shrubland association occurs in the subalpine zone in the southern Rocky Mountains, Uinta Mountains, Beartooth Mountains and Plateau, and Big Horn Mountains. This higher elevation wetland plant association usually occurs along streams and in adjacent meadows in broad valleys and swales and below seeps on gentle slopes. Elevation ranges from 2745-3570 m (9000-11,700 feet) in Colorado and Utah and down to 2490-3040 m (8160-9960 feet) in northern Wyoming. This association is characterized by a moderately dense to dense shrub layer (40-90% cover) that is dominated by *Salix planifolia* with a lush herbaceous layer dominated by the perennial grass *Deschampsia caespitosa*. Other willow species that may be present with low cover. The dense herbaceous layer is dominated by *Deschampsia caespitosa* (tufted hairgrass) but is sometimes species-rich and has several *Carex* species and grasses present. The forb layer can be diverse but generally has low (<10%) total cover (NatureServe 2009). Water table depth varies but is generally close enough to the surface during the growing season for upper soil layer to be moist, but not wet, as stands dominated by *Carex aquatilis* in the understory. Litter and duff provide much of the ground cover, with significant lichen and moss cover. Bare ground is typically low (NatureServe 2009).

Vegetation: This riparian association is characterized by a moderately dense to dense shrub layer (40-90% cover) that is dominated by *Salix planifolia* (planeleaf willow) with a lush herbaceous layer dominated by the perennial grass *Deschampsia caespitosa* (tufted hairgrass). Other willow species that may be present with low cover include *Salix brachycarpa* (barrenground willow), *Salix glauca* (grayleaf willow), *Salix geyeriana* (Geyer willow), and *Salix wolfii* (wolf willow). Other shrubs that may be present in lower concentrations include *Betula nana* (bog birch), *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), and *Vaccinium caespitosum* (dwarf bilberry). The dense *Deschampsia caespitosa*-dominated herbaceous layer is sometimes species-rich and has several *Carex* species and grasses present such as *Carex aquatilis* (water sedge), *Carex microptera* (smallwing sedge), *Carex utriculata* (beaked sedge), *Carex scopulorum* (mountain sedge), *Calamagrostis canadensis* (bluejoint reedgrass), *Danthonia intermedia* (timber oatgrass), *Eleocharis quinqueflora* (fewflower spikerush), *Festuca brachyphylla* (alpine fescue), and *Phleum alpinum* (alpine timothy). The forb layer can be diverse but generally has low (<10%) total cover. Associated forb species can include *Caltha leptosepala* (marsh marigold), *Erigeron peregrinus* (subalpine fleabane), *Fragaria* spp. (strawberry), *Ligusticum tenuifolium* (Idaho licorice-root), *Mertensia ciliata* (tall fringed bluebells), *Pedicularis groenlandica* (elephantella), *Polygonum bistortoides* (American bistort), *Potentilla diversifolia* (varileaf cinquefoil), *Rhodiola rhodantha* (redpod stonecrop), *Senecio triangularis* (arrowleaf ragwort), *Swertia perennis* (felwort), *Symphiotrichum foliaceum*, *Thalictrum* spp. (meadowrue), and *Veronica* spp. (speedwell). Stands disturbed by heavy grazing tend to dry out and often have significant cover of *Poa pratensis* (Kentucky bluegrass) (NatureServe 2009).

Similar Communities: *Salix planifolia* / *Carex aquatilis* Shrubland (planeleaf willow / water sedge), *Salix planifolia* / *Carex scopulorum* (planeleaf willow / mountain sedge) Shrubland and *Salix planifolia* / *Caltha leptosepala* (planeleaf willow / marsh marigold) Shrubland.

Regional Distribution: This subalpine riparian shrubland association occurs in the southern Rocky Mountains, Uinta Mountains, Beartooth Mountains and Plateau, and Big Horn Mountains from Colorado to northwestern Wyoming and Utah.

Colorado Distribution: This association has been documented to occur in three counties in the Southern Rocky Mountains in Colorado, Larimer, Pitkin and Saguache.



Elevation Range in Colorado: 9,992.00 - 11,760.00 ft / 3,045.56 - 3,584.45 m

Site Geomorphology: *Salix planifolia* / *Deschampsia caespitosa* shrublands occur higher elevation broad valleys and swales below seeps on gentle slopes.

Soil: Soils are variable and range from shallow to medium depth (<44 cm), moderately well-drained to poorly drained, fine-textured mineral soils typically with high organic matter content and occasionally moderate amounts of rock fragments. Parent material is

often granitic (NatureServe).

Successional and Ecological Processes: Planeleaf willow often forms relatively stable communities maintained by high water tables and high elevation climates. In Colorado, high-elevation planeleaf willow communities are considered climax wetland communities. These communities can experience successional shifts if water tables change. If sites become permanently drier, *Salix wolfii* (wolf willow) and grasses will increase. Planeleaf willow often persists in communities dominated by other willows. These communities are relatively stable and maintained by high water tables or seasonal flooding (Uchytel 1991). *Salix planifolia* / *Deschampsia caespitosa* shrublands provide valuable ecosystem functions as well as resources for native wildlife and domestic livestock. Planeleaf willow is an excellent streambank stabilizer and recommended for use in revegetating disturbed riparian areas, and, because it roots quickly is especially useful for streambank stabilization (Uchytel 1991, USDA 2004). All classes of livestock eat willows (*Salix* spp.), but cattle consume more than others because they frequent riparian areas. In southwestern Montana and in Yellowstone National Park, moose eat large amounts of this willow in the winter and small amounts in the summer but consumption by elk and mule deer is generally low. Willows in general are a preferred food and building material of beaver and ducks, grouse, other birds, and small mammals eat willow shoots, catkins, buds, and leaves. Planeleaf willow, occurring in montane and subalpine riparian communities, provides excellent nesting and foraging habitat for a variety of birds, such as ducks, shorebirds, warblers, vireos, and sparrows. Nesting sandhill cranes frequently used low-statured planeleaf willow cover in Idaho and planeleaf willow branches overhanging streambanks provide cover and shade for salmonids (Uchytel 1991). Tufted hairgrass, kobresia and many other grasses and sedges are highly nutritional and in Colorado alpine ecosystems form the best forage and are utilized by wild populations of elk, deer and mountain sheep (Zwinger and Willard 1996). However, while native animals tend to space themselves and range widely, causing no perceptible damage to the tundra the addition of domestic animals or an overpopulation of native animals, causes considerable disturbance (Zwinger and Willard 1996). Tufted hairgrass provides good to excellent forage for all classes of livestock and is sometimes cut for hay on native meadows. In Arizona tufted hairgrass provides excellent forage in mountain meadows and in Colorado it produces an abundance of forage. In western Montana tufted hairgrass/sedge meadows are among the best summer range for cattle. However, tufted hairgrass is a decreaser with excessive grazing by cattle although it is tolerant of moderate amounts of fairly close grazing because of dense growth and tillering. Thus grazing practices should allow for ample seedset to maintain stands (Walsh 1995).

Adjacent Vegetation: Riparian systems range from herbaceous dominated communities to tree dominated communities (Rondeau 2001). Generally the upland vegetation surrounding these riparian systems are of either conifer or aspen forests (Rondeau 2001).

Management: Annual and episodic flooding is important in maintaining this system. Alteration to the flooding regime due to water impoundment, diversions, etc. may produce changes to the species and community composition (Rondeau 2001). Additionally both planeleaf willow and tufted hairgrass are sensitive to grazing pressure and long-term, excessive grazing can be detrimental to community viability. Planeleaf willow often forms relatively stable communities maintained by high water

tables and high elevation climates. In Colorado, high-elevation planeleaf willow communities are considered climax wetland communities. These communities can experience successional shifts if water tables change (Uchytíl 1991). Species composition and dominance in tufted hairgrass meadows are also very sensitive to fluctuations in the water table. Lowering the water table through channel cutting, poor road locations, or drought has changed site potential and favored the expansion of (*Poa pratensis*) Kentucky bluegrass and perennial forbs in the central Oregon pumice zone. Raised water tables favor *Carex* spp. (sedge) and *Juncus* spp. (rush) dominance (Walsh 1995). Livestock grazing of tufted hairgrass in late spring and early summer may result in severe soil displacement and pedestalling of hairgrass clumps on wet soils. Long-term, intensive herbage removal is detrimental to tufted hairgrass and reduces seed production. Carbohydrate reserves become depleted after sustained close grazing, resulting in declines in root length, basal area, and leaf length. Eventually stand composition shifts to other species. Thus tufted hairgrass is a key indicator of condition and grazing utilization of mountain meadows in California. In Wyoming tufted hairgrass is a key representative of the desirable grass group in alpine and subalpine areas and can be used as an indicator of the response of this group to grazing. The best-condition alpine and subalpine sedge / tufted hairgrass communities have the highest proportion of tufted hairgrass (Walsh 1995).

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Colorado Natural Heritage Program Community Characterization Abstract

State Scientific Name *Salix wolfii* / Mesic Forbs Shrubland
State Common Name Subalpine Riparian Willow Carr
Global Scientific Name: *Salix wolfii* / Mesic Forbs Shrubland
Global Common Name: -

Community Classification

System: International Vegetation
Classification

Class: Shrubland

Subclass: Deciduous shrubland

Group: Cold-deciduous shrubland

Subgroup: Natural/Semi-natural
cold-deciduous shrubland

Formation: Temporarily flooded
cold-deciduous shrubland

Alliance: Wolf Willow Temporarily
Flooded Shrubland Alliance



Global Rank: G3

Global Rank Reasons: This is a widespread association, known from Colorado, Utah, Wyoming and Idaho, although never very abundant where it occurs. Stands are found in wide mountain valleys along first- or second-order streams on well-drained slopes and hummocks on the valley floor. The water table is usually within the top meter of soil, and groundwater slowly seeps to the surface. Threats include overuse by livestock and changes in the hydrologic regime that can result in a lower water table.

Subnational Rank: S3

Subnational Rank Reasons: This association is known from 25 sites in Colorado. The majority of these sites are impacted by grazing. Other anthropogenic impacts include invasion of non-native plant species, off-road vehicle use and recreational trampling.

General Description: The *Salix wolfii* / mesic forb (Wolf willow / mesic forb) plant association occurs from mid-montane to upper subalpine elevations of 1890-3355 m (6200-11,000 feet) in Colorado, Idaho, western Wyoming, and Utah. It frequently covers wide, open, gently sloping areas near first- and second-order streams in wide mountain valleys (NatureServe 2009, Carsey et al. 2003). The water table is usually within the top 3 ft (1 m) of soil and groundwater slowly seeps to the surface. Stream channels are narrow, relatively deep and sinuous (Carsey et al. 2003). It can be recognized by the

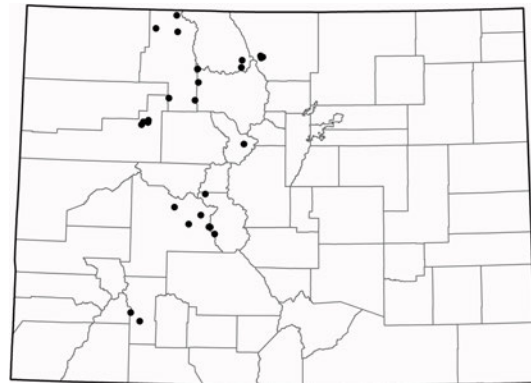
generally dense layer of low-growing, silvery *Salix wolfii* (Wolf willow) dominating the short shrub layer, with a variety of mesic forbs and some graminoids in the undergrowth. In Colorado, *Salix wolfii* (Wolf willow) grows in small patches and does not form as large, expansive willow carrs (i.e., shrubland thickets) like *Salix planifolia* (planeleaf willow). *Salix wolfii* often forms a mosaic with stands of *S. planifolia*, *S. brachycarpa* (barrenground willow) and open *Carex* spp. (sedge) meadows (NatureServe 2009, Carsey et al. 2003).

Vegetation: *Salix wolfii* (Wolf willow) dominates the shrub layer with 10-90% cover. Other willow species that may be present include *Salix planifolia* (planeleaf willow), *Salix boothii* (Booth willow), and *Salix geyeriana* (Geyer willow) (Carsey et al. 2003). Additional short shrubs that are often present include *Dasiphora fruticosa* ssp. *floribunda* (shrubby cinquefoil), *Betula nana* (bog birch), *Ribes inerme* (mountain gooseberry), and *Lonicera involucrata* (twinberry honeysuckle) (NatureServe 2009). Total forb cover exceeds that of total graminoid cover. No single forb species is particularly more abundant than any other, and no one species is present in every stand. Forb species that may be present include *Caltha leptosepala* (marsh marigold), *Mertensia ciliata* (tall fringed bluebells), *Senecio triangularis* (arrowleaf ragwort), *Ligusticum porteri* (Porter licorice root), *Fragaria virginiana* (strawberry), *Cardamine cordifolia* (heartleaf bittercress), *Geum macrophyllum* (large-leaved avens), *Heracleum maximum* (common cowparsnip), *Veratrum californicum* (California false hellebore) and *Saxifraga odontoloma* (brook saxifrage). Graminoid species present are diverse, yet generally have a low cover relative to the amount of total forb cover. Graminoid species may include *Deschampsia caespitosa* (tufted hairgrass), *Calamagrostis canadensis* (bluejoint reedgrass), and various *Carex* (sedge) species including *Carex microptera* (smallwing sedge) (NatureServe 2009, Carsey et al. 2003).

Similar Communities: *Salix wolfii* / *Carex microptera* (wolf willow/ smallwing sedge) Shrubland and *Salix wolfii* / *Fragaria virginiana* (wolf willow/ strawberry) Shrubland (NatureServe 2009).

Regional Distribution: This association is known from Colorado, Utah, Wyoming and Idaho.

Colorado Distribution: *Salix wolfii* / Mesic Forbs shrublands are known from counties in the central mountainous regions of Colorado extending from Routt County in the north to Hinsdale County in the south.



Elevation Range in Colorado: 8,200.00 - 10,720.00 ft / 2,499.36 - 3,267.46 m

Site Geomorphology: This association occurs in wide mountain valleys, along first- or second-order streams on well-drained slopes and hummocks on the valley floor (Carsey et al. 2003).

Soil: Soils may be saturated in the spring and early summer, but dry somewhat during the summer as the water table drops. Soil textures often have a high organic content

and are silty clays, silty clay loams, silty loams, or deep sandy clays, clay loams, and sandy clay loams over gravels and rocks. Some stands have a loamy horizon underlain by a clay horizon (Carsey et al 2003).

Successional and Ecological Processes: *Salix planifolia* (planeleaf willow), *Salix brachycarpa* (barrenground willow) and *Salix wolfii* (Wolf willow) are abundant low-stature willows of first- and second-order streams of subalpine elevations of Colorado. Stands of *Salix wolfii* are less frequently encountered, and are usually limited in size. *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils. When non-native and increaser species are abundant, the *Salix wolfii* / mesic forb association may be a grazing-induced phase of the *Salix wolfii* / *Carex aquatilis* (Wolf willow/ water sedge) association. Many stands in the Routt National Forest are heavily grazed and contain a high number of exotic and increaser species such as *Taraxacum officinale* (dandelion) and *Fragaria virginiana* (strawberry). However, other stands in Colorado without abundant increaser or non-native species do not appear to be grazing induced (Carsey et al. 2003).

Adjacent Vegetation: Adjacent riparian areas include *Abies lasiocarpa* - *Picea engelmannii* forests along narrow reaches and wet meadows of *Carex aquatilis*, *Carex utriculata*, *Deschampsia caespitosa*, or *Eleocharis palustris* along wider sections of streams. *Salix boothii*, *Salix planifolia*, *Alnus incana*, or *Betula glandulosa* shrublands are also present. *Abies lasiocarpa* - *Picea engelmannii*, *Pinus contorta*, and *Populus tremuloides* forests occur on steep-sided slopes. *Artemisia tridentata* scrub and subalpine meadows with *Festuca thurberi* occur outside the riparian areas in broad valleys.

Management: Potential for long-term viability of this system will be enhanced by maintaining a natural hydrologic regime, promoting beaver activity, eradicating non-native plant species and sustainably managing grazing as well as recreational trampling. Livestock grazing eliminates plant species with rhizomes and favors tap-rooted and short-lived species (Cooper D.J. pers. comm. 2009) thus altering plant community composition. The primary abiotic ecological process necessary to maintain this ecological systems is hydrology and specifically surface flow. Annual and episodic flooding is important in maintaining this system and alteration of the flooding regime due to water impoundment, diversions, etc. may produce changes to plant composition as well as community composition (Rondeau 2001). Beaver are users as well as maintainers to this system. By virtue of beaver damming activities water storage is enhanced, soils are saturated and a high water table is maintained. Beaver mitigate impacts of drought. In times of extreme drought beaver are able to mitigate wetland loss and play a dominant role in determining the amount of wetland habitat, regardless of the amount of rainfall (Hood and Bayley 2008). Even during drought, where beaver were present, Hood and Bayley (2008) found that there was 60 per cent more open water than those same areas during previous drought periods when beaver were absent. Additionally beaver ponds provide critical habitat for a variety of migratory songbirds, particularly in the semi-arid interior of the Western U.S. (Cooke and Zacke 2008). Maintaining natural soil characteristics is important to the maintenance of the association. Peat soils, which are common in this wolf willow/mesic forb shrublands, are usually distinguished by hydrological characteristics (Sullivan 1994). Essential to the development of peat soils is a natural hydroperiod with a positive water balance (Mitsch and Gosselink 2000). Hydroperiod influences plant composition for it affects seedling germination, survival and mortality at various stages of the plant's life cycle

(Smith 1996).

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State Name: *Aletes lithophilus* (rock-loving neoparrya)

Global Name: *Neoparrya lithophila* (Rock-loving Aletes)

Taxonomy

Class: Dicotyledoneae

Order: Apiales

Family: Apiaceae

Ranks and Status

Global Rank: G3

State Rank: S3

Federal Protection Status: BLM and

USFS Sensitive Species

State Protection Status: None



Description and Phenology

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

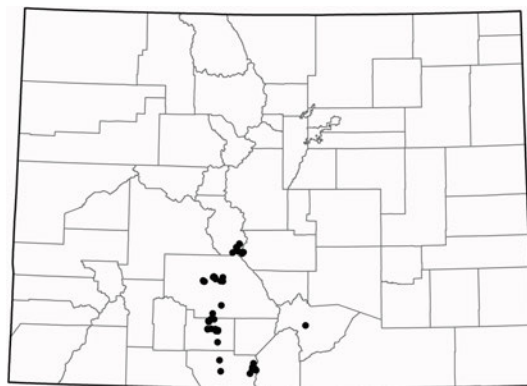
Neoparrya lithophila grows on volcanic substrates, in cracks or shelves usually with minimal talus. It is seen in moderate to steep rock outcrops, or outcrops of volcanic soils. It also occurs on sedimentary rock derived from extrusive volcanics (Dry Union Formation at Salida). The surrounding habitat 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 - 3,108

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

Motorized recreation is considered to be the primary threat to the species at this time (CNHP Scorecard 2008). 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 1993). Most of the *N. lithophila* individuals at Farisita Dike are inaccessible to cattle. O'Kane (1986) noted that its "palatability is probably low because of aromatic oils present in the herbage."

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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

Argyrochosma fendleri is 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

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 (2008) 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.

Elevation Range Feet: 5,000 - 9,400

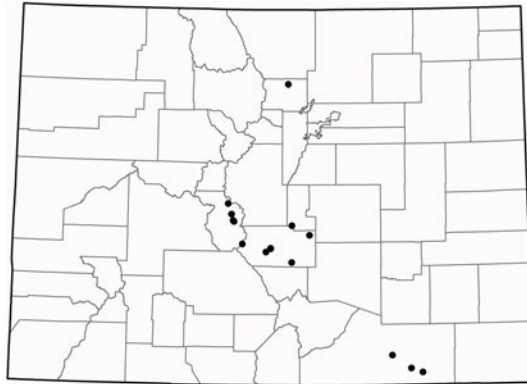
Elevation Range Meters: 1,524 - 2,865

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

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.

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Version Date: 02/23/2007

State Name: *Askellia nana* (dwarf hawksbeard)

Global Name: *Crepis nana* (Dwarf Alpine Hawk's-beard)

Taxonomy

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae

Ranks and Status

Global Rank: G5

State Rank: S2

Federal Protection Status: None

State Protection Status: None



Description and Phenology

Crepis nana is a perennial, 1 to 8 cm high, mainly prostrate, with a basal rosette in which the flowers appear before the purplish leaves. Leaves have narrow petioles and attenuate bases. Flowers are in small yellow heads that do not spread open, and fruiting heads that are crowded among the leaves. A taproot and slight caudex are present (Aiken et al. 2003).

Look Alikes: There are no similar looking species in the same habitat.

Phenology: The plants flower mid-July through August (Cronquist et al. 1994).

Habitat

Crepis (Askellia) nana is found on talus slopes and other rocky or gravelly places at higher elevations (Cronquist et al. 1994). Soils are dry, calcareous sand or gravel with low organic content. (Aiken et al. 2003).

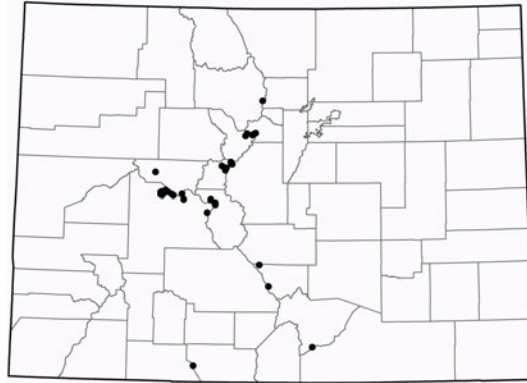
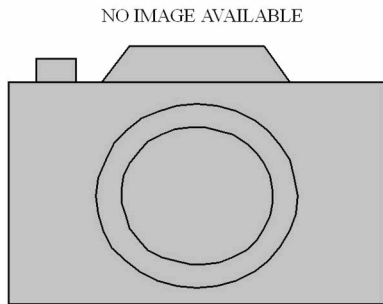
Elevation Range Feet: 10,000 - 14,000

Elevation Range Meters: 3,048 - 4,267

Distribution

Global Range: *Crepis nana* grows in the northern hemisphere in Canada, United States, and Eurasia. In the U.S., it occurs in California, Nevada, Washington, Oregon, Idaho, Montana, Wyoming, Utah and Colorado.

Colorado State Range: This species is found in 11 counties in the central mountains of Colorado. CNHP records are from Pitkin, Gunnison, Lake, Summit, Clear Creek and Custer counties. There are also specimens at the CU Herbarium from Boulder and Park counties.



Threats and Management Issues

As a high alpine species, *C. nana* is probably well protected from human impacts; however, global warming may threaten its continued survival.

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Version Date: 04/13/2009

State Name: *Boecheera crandallii* (Crandall's rock-cress)

Global Name: *Arabis crandallii* (Crandall's Rockcress)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Ranks and Status

Global Rank: G2

State Rank: S2

Federal Protection Status: BLM

Sensitive Species

State Protection Status: None



Description and Phenology

Perennial with a branched caudex, stems slender and numerous, erect, rarely branched, densely pubescent to sparsely so, 1.5-4 dm high. Basal leaves are numerous, entire, occasionally somewhat toothed, oblanceolate in shape and pubescent, 1.5-3 cm long. Upper leaves are oblong to lanceolate, hairy and 8-15 mm long. Flower petals are white-pinkish 5-7 mm long and 2-3 mm wide. Fruits (siliques) are smooth, slender pods 3-6 cm long, with constrictions between the seeds. Seeds are round to slightly oblong, wingless to very narrowly winged (Rollins 1993).

Phenology: *Arabis (Boecheera) crandallii* flowers from May through June (Rollins 1993).

Habitat

This plant grows in limestone chip-rock and stony areas, often among sagebrush, ridges, and steep hill slopes (Rollins 1993); it occurs in rocky sagebrush areas in the hills of the western end of the Gunnison Basin. It is commonly growing with *Boecheera pallidiflora* (Weber 1996).

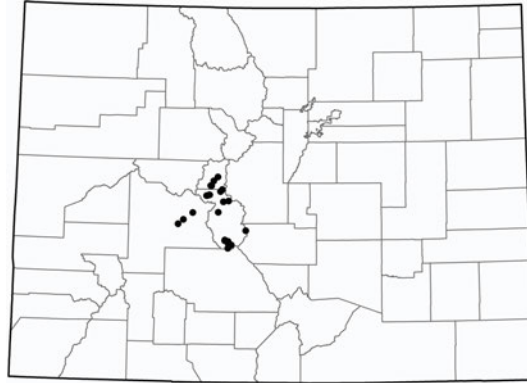
Elevation Range Feet: 8,200 - 10,300

Elevation Range Meters: 2,499 - 3,139

Distribution

Global Range: *A. crandallii* is a regional endemic of southwest Colorado and southwest Wyoming (Carbon and Sweetwater counties).

Colorado State Range: This species is known from eight counties in west-central Colorado (Ladyman 2005). Estimated range in Colorado is 2509 square kilometers (969 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

The primary threat at this time is considered to be roads (CNHP Scorecard 2008). It is not known if all of the occurrences are or are not threatened by these activities. Habitat loss is another substantial threat to this species. Extrinsic factors such as resource extraction, activities associated with recreation, road development, and grazing are the primary range-wide threats to *Arabis (Boechea) crandallii*. Invasion of habitat by non-native species is also a source of concern. The species is likely only moderately competitive and may be out-competed by non-native plant species. Occurrences on land managed by the USDA Forest Service Region 2 are likely to be most vulnerable to invasive weeds encroaching in their habitat, activities associated with recreation, campground and road improvement, and livestock grazing. Details of imminent threats to specific occurrences are unavailable. Long-term population sustainability may be vulnerable to declines in pollinator populations. Actions that substantially reduce the numbers of individuals within a population may exacerbate the potential for inbreeding depression that would reduce population viability (Ladyman 2005).

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Version Date: 04/14/2009

State Name: *Bolophyta tetraeuris* (Barneby's fever-few)

Global Name: *Parthenium tetraeuris* (Barneby's Feverfew)

Taxonomy

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae

Taxonomic Comments: Synonym is *Bolophyta tetraeuris* (Barneby) W.A. Weber. *Parthenium tetraeuris* is included in *P. alpinum* by Flora of North America Editorial Committee (2006).



Ranks and Status

Global Rank: G3

State Rank: S3

Federal Protection Status: None

State Protection Status: None

Description and Phenology

Parthenium tetraeuris is an inconspicuous perennial that forms low mounds of leaves, 2-5 cm tall. White disk flowers bloom in May.

Look Alikes: This species is not likely to be confused with any other species in its habitat when they are in flower. However, in its vegetative state it is difficult to distinguish from *Eriogonum lachnogynum* and *Tetraeuris acaulis*.

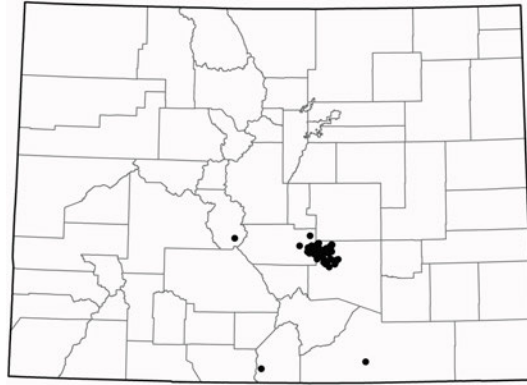
Phenology: Flowers in May, fruit in late May and June.

Habitat

Barren, light colored shale and limestone benches and knolls, derived from the Smoky Hill shale and the Fort Hays limestone members of the Niobrara Formation and the Greenhorn limestone formation (gypseous shale). Primarily in the Arkansas River Valley near Pueblo, Colorado, where these bedrock exposures are especially prevalent. Usually associated with pinyon-juniper woodlands. Elevations are 5400 to 5750 ft (1460-1700 m).

Distribution

Global Range: Abruptly confined to exposures of gypseous shale (5,400 to 5,750 feet); currently known from 6 counties in Colorado (Chaffee, Conejos, Costilla, Fremont, Las Animas, and Pueblo). Most occurrences are from Pueblo and Fremont county sites (ca. 179,000 individuals).



Threats and Management Issues

Threatened by housing and recreational development, mining for cement products, and off road vehicle use; the effects of grazing are not known (O'Kane 1988). Road development and the expansion of the city of Pueblo are also significant threats (Peterson 1983).

References

Barneby, R.C. 1947. A new monocephalous *Parthenium*. Leaflets Western Botany 5:19-20.

Coles, J. 1994. Personal communication about Rare Plant Guide Species.

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

Jennings, W. F. 1995. Personal communication about Rare Plant Guide Species.

Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. 2nd edition. 2 vols. Timber Press, Portland, OR.

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

Peterson, J.S. 1983 c. Status report on *Parthenium tetraeuris*. Unpublished report prepared for the Colorado Natural Areas Program, CO.

Peterson, J.S. 1983. Status report on *Parthenium tetraeuris* Barneby. Colorado Natural Heritage Inventory, Denver, Colorado.

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: 12/20/2007

State Name: *Braya glabella* var. *glabella* (arctic braya)

Global Name: *Braya glabella* ssp. *glabella* (Smooth Rockcress)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Ranks and Status

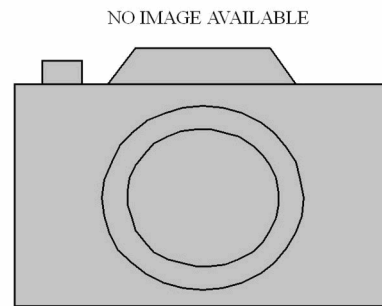
Global Rank: G5TNR

State Rank: S1

Federal Protection Status: USFS

Sensitive Species

State Protection Status: None



Description and Phenology

Low growing perennial, 3.5-17 cm tall; flowers white to purple-tinged, flowering stem leafless; leaves and flowering stems are pubescent with simple or branched hairs; fruit is short and thick (Spackman et al. 1997).

Look Alikes: It is distinguished from *B. humilis*, with which it is sympatric, by its smaller stature, leafless stems, white to purple tinged petals, and short, thick fruit; *B. humilis* has long, narrow fruits and grayish white petals, and leafy stems (Siems and Neely 1990).

Phenology: *B. glabella* ssp. *glabella* flowers in late June to July and produces fruits in late July and August (Ryke et al. 1994).

Habitat

B. glabella ssp. *glabella* is always found on calcareous substrates especially limestone derived from Mississippian Leadville Limestone, with or without materials derived from other Paleozoic calcareous formations. It occurs on sparsely vegetated slopes above timberline with fine gravels or on disturbed sites associated with inactive mines (Siems and Neely 1990).

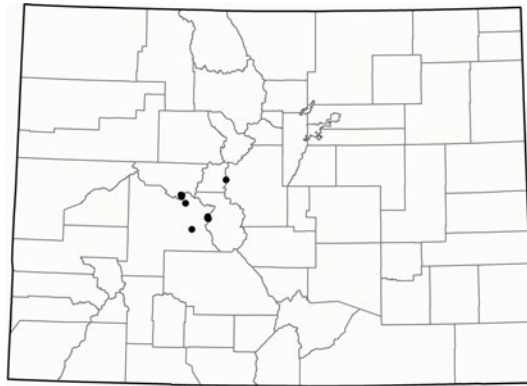
Elevation Range Feet: 12,000 - 12,300

Elevation Range Meters: 3,657 - 3,749

Distribution

Global Range: Arctic braya occurs from Siberia to northern Canada south to Michigan and Alberta. Disjunct populations are found in northwest Wyoming (Gros Ventre Range in Sublette County) and central Colorado.

Colorado State Range: Chaffee, Gunnison, and Pitkin Counties.



Threats and Management Issues

Concern for the viability of the taxon in Region 2 is based on its limited distribution at the southern periphery of its range, small population sizes, and management of the fragile alpine habitats in which it occurs. Of the activities that typically occur or are planned for the Pike, San Isabel, White River, or Gunnison national forests, mining and recreation are likely to have the greatest effects on *B. glabella* ssp. *glabella*. Erosion from nearby jeep trails may affect a few occurrences. Other potential threats to the taxon include competition from invasive plant species, global warming, and air pollution (Moore et al. 2006).

References

- Fertig, W. 1998. Additions to the Flora of Wyoming. Castilleja, Vol. 17, No. 4.
- Harris, J. G. 1985. A Revision of the Genus *Braya* (Cruciferae) in North America. Unpublished dissertation, University of Alberta, Edmonton, Alberta, Canada.
- Kartesz, J.T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: Kartesz, J.T., and C.A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, N.C.
- Moore, L., S. Friedley, D.L. Hazlett. (2006, October 30). *Braya glabella* ssp. *glabella* Richardson (smooth northern-rockcress): A Technical Conservation Assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/aleteshumilis.pdf> [March 20, 2009].
- Ryke, N., D. Winters, L. McMartin and S. Vest. 1994. Threatened, Endangered and Sensitive Species of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands. May 25, 1994.
- Siems, B. A. and E. E. Neely. 1990. *Braya glabella* var. *glabella* (Brassicaceae) in Colorado. *Madrono* 37(2):145-146.
- Siems, B. A. and E. E. Neely. 1990. *Braya glabella* var. *glabella* (Brassicaceae) in Colorado. *Madrono* 37(2):146-148.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by Colorado Natural Heritage Program.
- Weber, W. A. 1990. Colorado Flora: Eastern Slope. University Press of Colorado,

Niwot, CO.

Welsh, S. L. 1974. Anderson's Flora of Alaska and Adjacent Canada. Brigham Young University Press, Provo, UT.

Version Date: 04/13/2009

State Name: *Braya humilis* (alpine braya)

Global Name: *Braya humilis* (Low Braya)

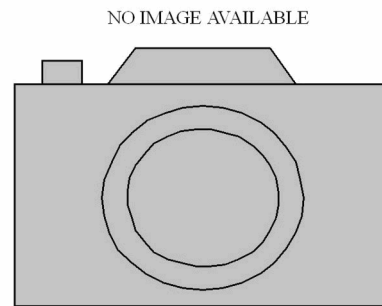
Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Taxonomic Comments: While numerous subspecies or varieties are recognized in *Braya humilis* by some researchers, Kartesz (1994 checklist and Jan98 review draft dataset) instead treats the species broadly without recognition of any infraspecific taxa.



Ranks and Status

Global Rank: G5

State Rank: S2

Federal Protection Status: None

State Protection Status: None

Description and Phenology

Braya humilis is a short-lived perennial with 1 to several erect to prostrate stems, 3-20 cm long, which arise from a simple or branched rootcrown and taproot. The numerous basal leaves are lance-shaped and 1-3 cm long with entire or toothed margins. The widely spaced stem leaves are alternate and smaller. Foliage is sparsely to densely covered with simple and branched hairs. Flowers are borne on short stalks in terminal clusters that expand as the fruit matures. Each flower has 4 white petals, which are 3-4 mm long, 4 sepals, 4 long stamens, and 2 short stamens. The erect or spreading linear fruits are 1-3 cm long.

Diagnostic Characteristics: *Braya humilis* is most likely confused with species of *Arabis*; however, the fruits of *B. humilis* are round in cross-section and constricted between the seeds, while those of *Arabis* usually are not.

Look Alikes: Similar to *B. glabella* ssp. *glabella*, with which it often occurs, but differs in having several leaves on the stem, grayish white flowers rather than white to purple tinged flowers and long, slender curved capsules with slight constrictions between the seeds, vs. short thick capsules.

Phenology: Flowers in mid-July and produces fruits in late July through August.

Habitat

Calcareous soils (Leadville Limestone or Manitou Dolomite), exposed slopes, soliflucation lobes, scree slopes; seems to occur on slightly disturbed microsites.

Elevation Range Feet: 12,000 - 12,300

Elevation Range Meters: 3,657 - 3,749

Distribution

Global Range: Alaska to Greenland south to British Columbia, Alberta, and Vermont, with disjunct populations in northwest Wyoming and central Colorado.

Colorado State Range: Central Mountains in Chaffee, Summit, Park, Lake and Gunnison counties.



Threats and Management Issues

Some sites are threatened by off road vehicle use and recreation. Resumption of mining may pose a future threat in some areas.

References

Carron, J. No date. Population and extinction probability modeling of *Braya humilis*. The Nature Conservancy, Colorado Field Office. 9 pp.

Lesica, P. and P. F. Stickney. 1994. Noteworthy collections: Montana. Madrono 41:228-231.

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

Version Date: 04/15/2009

State Name: *Carex concinna* (low northern sedge)

Global Name: *Carex concinna* (Beautiful Sedge)

Taxonomy

Class: Monocotyledoneae

Order: Cyperales

Family: Cyperaceae

Ranks and Status

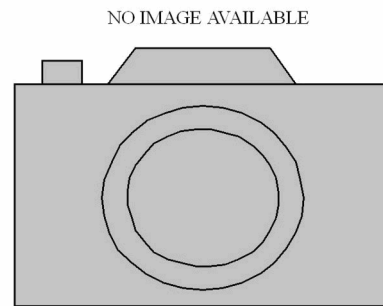
Global Rank: G4G5

State Rank: S1

Federal Protection Status: BLM

Sensitive Species

State Protection Status: None



Description and Phenology

Stems single or loosely tufted, 10-40 cm tall; rhizomatous, bracts reduced to bladeless sheath; perigynium pubescent (Spackman et al. 1997).

Look Alikes: *Carex peckii* which also has pubescent perigynia, has bracts with well developed blades, while *C. concinna* has bracts reduced to bladeless sheaths.

Phenology: Based on only a few herbarium specimens available, this species fruits mature in mid to late July.

Habitat

Cool, moist forests with mosses, on rich peaty soil, often calcereous (Spackman et al. 1997).

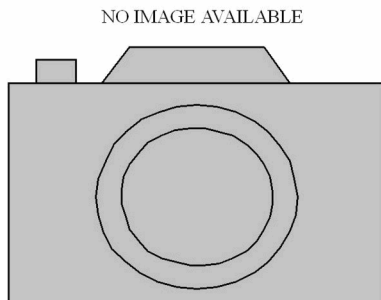
Elevation Range Feet: 8,800 - 10,500

Elevation Range Meters: 2,682 - 3,200

Distribution

Global Range: Alaska and the Yukon Territory to Newfoundland, south to Oregon, Colorado, South Dakota and Michigan.

Colorado State Range: Chaffee, Summit, and Clear Creek Counties.



Threats and Management Issues

Roads and mining have likely destroyed some populations however, currently known populations do not appear immediately threatened. Hydrologic alterations would threaten its habitat.

References

Hermann, F. J. 1970. Manual of the Carices of the Rocky Mountains and Colorado Basin. U.S.D.A. Forest Service Agriculture Handbook No. 374.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by Colorado Natural Heritage Program.

Version Date: 04/16/2009

State Name: *Delphinium ramosum* var. *alpestre* (Colorado larkspur)

Global Name: *Delphinium alpestre* (Colorado Larkspur)

Taxonomy

Class: Dicotyledoneae

Order: Ranunculales

Family: Ranunculaceae

Ranks and Status

Global Rank: G2

State Rank: S2

Federal Protection Status: None

State Protection Status: None



Description and Phenology

A slender perennial herb, up to 2 dm tall, with deeply lobed leaves. Flowers are borne July to September and are dark blue in the front and brownish on the back.

Phenology: Flowers mid July to mid August.

Habitat

Open alpine meadows and talus slopes.

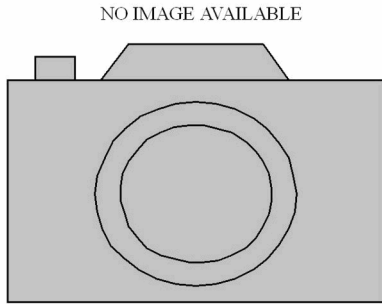
Elevation Range Feet: 10,500 - 13,600

Elevation Range Meters: 3,200 - 4,145

Distribution

Global Range: South central mountains of Colorado, and northern New Mexico.

Colorado State Range: Known from Chaffee, Costilla, Fremont, Huerfano, Las Animas, Mineral, Park, Saguache, and Summit counties in Colorado. Estimated range in Colorado is 17,864 square kilometers (6897 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

The primary threat at this time is considered to be recreation/hiking (CNHP Scorecard 2008). It is not known if all of the occurrences are or are not threatened by these activities. This species occurs in alpine habitat where threats may include accidental trampling by hikers and habitat alteration due to global warming.

References

Colorado Natural Heritage Program. 2008. Biotics database.

Harrington, H.D. 1954. Manual of the plants of Colorado. Swallow Press, Chicago. 666 pp.

New Mexico Native Plant Protection Advisory Committee. 1984. A handbook of rare and endemic plants of New Mexico. Univ. New Mexico Press, Albuquerque. 291 pp.

Weber, W.A., and R.C. Wittmann. 1996. Colorado flora: Western slope. Univ. Press of Colorado, Niwot, Colorado. 496 pp.

Version Date: 04/16/2009

State Name: *Draba crassa* (thick-leaf whitlow-grass)

Global Name: *Draba crassa* (Thick-leaf Whitlow-grass)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Ranks and Status

Global Rank: G3

State Rank: S3

Federal Protection Status: None

State Protection Status: None



Description and Phenology

D. crassa is a yellow-flowered mustard, with the typical four petals and sepals. It forms a thick-rooted rosette. Its oblanceolate to obovate leaves are shiny and nearly succulent, with glabrous surfaces and ciliate margins. There is an average of four leaves on each stem.

Phenology: Flowers in late June through early July, fruits in mid to late July.

Habitat

Found in alpine tundra, typically in talus or rock stripes (Welsh et al. 1987). Associated species may include *Poa arctica*, *Kobresia* spp. and *Draba* spp.

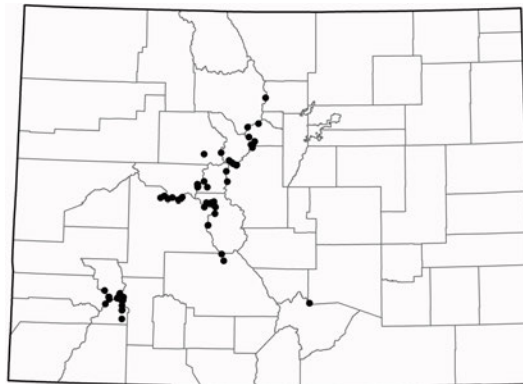
Elevation Range Feet: 11,800 - 14,000

Elevation Range Meters: 3,596 - 4,267

Distribution

Global Range: Regional endemic of south central Montana, western Wyoming, northeastern Utah, and central Colorado.

Colorado State Range: Alpine areas in Chaffee, Clear Creek, Eagle, Grand, Gunnison, Hinsdale, Huerfano, Lake, Ouray, Park, Piktin, Pueblo, Saguache, San Juan, San Miguel, and Summit counties.



Threats and Management Issues

Recreational use of the habitat, such as foot traffic from hikers poses a threat to some occurrences, particularly those within popular hiking areas.

References

Kartesz, J.T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: Kartesz, J.T., and C.A. Meacham. *Synthesis of the North American Flora, Version 1.0*. North Carolina Botanical Garden, Chapel Hill, N.C.

Rollins, R.C. 1993. *The Cruciferae of continental North America: Systematics of the mustard family from the Arctic to Panama*. Stanford Univ. Press, Stanford, California. 976 pp.

Weber, W.A. 1987. *Colorado Flora: Western Slope*. Colorado Associated University Press, Boulder, Colorado. 530pp

Welsh, S.L., N.D. Atwood, L.C. Higgins and S. Goodrich. 1987. *Utah Flora, Great Basin Naturalist Memoirs, No. 9*. Brigham Young University, Provo, Utah.

Version Date: 04/13/2009

State Name: *Draba fladnizensis* (arctic draba)

Global Name: *Draba fladnizensis* (White Arctic Whitlow-grass)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

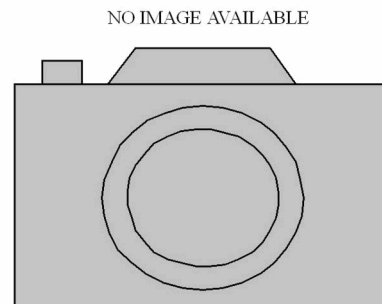
Ranks and Status

Global Rank: G4

State Rank: S2S3

Federal Protection Status: None

State Protection Status: None



Description and Phenology

Draba fladnizensis is a low perennial herb with 1 to a few leafless stems that are 2-6 cm high and which arise from basal leaf rosettes that, in turn, arise from the ends of a simple or branched rootcrown. The narrowly lance-shaped leaves are 15-25 mm long and have long, straight hairs on the entire margins; otherwise, they are glabrous or sparsely hairy. 3-12 stalked flowers are borne at the tops of the stems. Each flower has 4 separate sepals, 4 separate, white petals that are ca. 2-3 mm long, and 4 long and 2 short stamens. The style is less than 0.5 mm long or absent. The glabrous, narrowly egg-shaped capsules are 3-9 mm long and are borne on erect or ascending stalks.

Diagnostic Characteristics: There are many similar-appearing species of *Draba* in our area. A technical manual and hand lens or microscope are required for positive identification. *D. crassifolia* is similar but has yellow flowers. *D. lonchocarpa* and *D. porsildii* have white flowers but the leaves have branched hairs and lack the long, straight hairs on the margins.

Look Alikes: Similar to *Draba lactea* (Hulten 1968).

Phenology: Flowers late June through August, produces fruits beginning in July and continuing through September (herbarium specimen information).

Habitat

Draba fladnizensis is known to occur in wet meadows, on bare soil in dry tundra, and in rocky areas both wet and dry. Some associated species include: *Carex scopulorum*, *Draba crassifolia*, *Saxifraga sepyllifolia* and *Saxifraga flagellaris*.

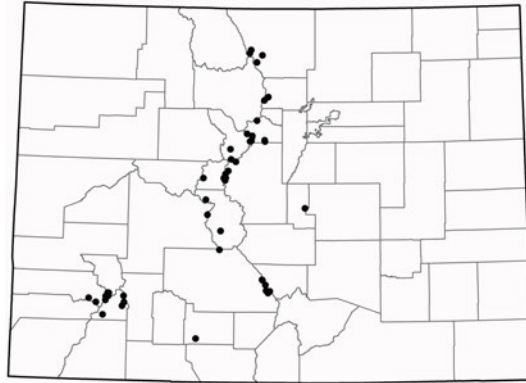
Elevation Range Feet: 11,800 - 14,000

Elevation Range Meters: 3,596 - 4,267

Distribution

Global Range: Circumpolar, south in North America to British Columbia, Utah, and Colorado. Sparse.

Colorado State Range: *Draba fladnizensis* is sparsley distributed in the following counties: Boulder, San Juan, Summit, Saguache, Park, Clear Creek, Larimer, Rio Grande, San Miguel, and Chaffee.



Threats and Management Issues

Several occurrences are reported to be impacted by heavy trail use, and one occurrence reports mining as a potential threat. The habitat is naturally protected (rock scree slopes).

References

- Dixon, H. 1983. Specimen collections at Adams State College Herbarium, Alamosa, CO.
- Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.
- Komarkova, V. 1972. Specimen collections at University of Colorado Herbarium, Boulder, CO.
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- Rollins, R. C. 1951. Plants collected during 1951 by R.C. Rollins deposited at the University of Colorado Herbarium, Boulder, CO.
- Weber, W. A. 1969. Specimen collections at the University of Colorado Herbarium, Boulder, CO.
- Willard, B. 1960. Plants collected during 1960 by B. Willard deposited at the University of Colorado Herbarium, Boulder, Colorado.
- Yeatts, L. 1991. Plants collected during 1991 by L. Yeatts deposited at the University of Colorado Herbarium, Boulder, Colorado.

Version Date: 04/13/2009

State Name: *Draba grayana* (Gray's Peak whitflow-grass)

Global Name: *Draba grayana* (Gray's Peak Whitflow-grass)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Ranks and Status

Global Rank: G2

State Rank: S2

Federal Protection Status: USFS

Sensitive Species

State Protection Status: None



Description and Phenology

D. grayana is a yellow-flowered mustard, with the typical four petals and sepals. The stems are densely hairy with tangled simple and forked hairs. The basal leaves have a conspicuous marginal fringe of hairs; the upper and lower surfaces may be glabrous or have a few simple hairs.

Look Alikes: *Draba grayana* is distinguished from other yellow flowered alpine *Drabas* having fewer than 4 stem leaves and growing in dry rocky sites as follows: *D. grayana* has clawed petals exceeding the sepals, and dense, tangled, simple pubescence on stems; *D. streptobrachia* has stellate or cruciform pubescence; and *D. exunguiculata* has glabrous stems and clawless petals equalling the sepals; *D. crassifolia* has a much shorter style (less than .15 mm); *D. crassa* has semi-succulent basal leaves that are glabrous on the surface (although ciliate-margined) (Kettler et al. 1993).

Phenology: Flowers mid-late July through August. Produces fruits from August through September.

Habitat

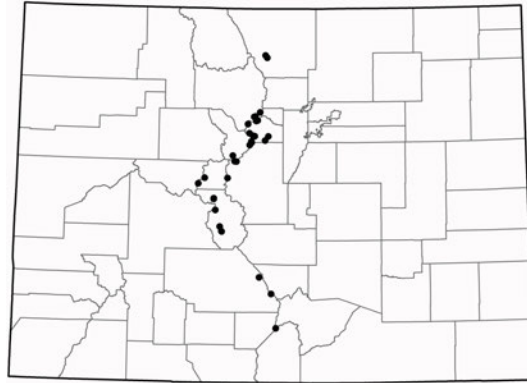
This species can be found on open knolls, steep hillsides, alpine fell-fields and gravelly slopes.

Elevation Range Feet: 11,500 - 14,000

Elevation Range Meters: 3,505 - 4,267

Distribution

Global Range: Colorado endemic known from Chaffee, Clear Creek, Grand, Huerfano, Larimer, Park, Pitkin, Saguache, and Summit counties. Estimated range is 14,416 square kilometers (5,566 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

Non-motorized recreation is considered to be the primary threat to the species at this time (CNHP Scorecard 2008). Recreational use of habitat, such as foot traffic, poses a threat to some occurrences, particularly those within popular hiking areas where they may be subjected to trampling. Over-collection as a desirable rock garden species is also a concern. As the human population grows in areas within easy access to *Draba grayana* habitat the impact from these threats may become substantially more significant. Mining activities are not a perceived threat to any of the currently known occurrences although individual occurrences may have been impacted in the past. Mountain goats have a negative impact on the habitat for this species in some parts of its range. The magnitude of the impact is related to the size of the mountain goat population. Additionally, wet nitrogen deposition (acid rain) poses a substantial risk to forb communities in alpine tundra in some regions of the Rocky Mountains, especially along the Front Range of Colorado. Global warming is a potential threat to all species currently restricted to sub-alpine and alpine-tundra zones (Ladyman 2004).

References

- Colorado Natural Heritage Program. 2008. Biotics database.
- Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.
- Kettler, S. M., N. D. Lederer, D. Bacher, and S. Spackman. 1993. Final Report: Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands, Plants of Special Concern. Colorado Natural Heritage Program, Fort Collins, CO.
- Ladyman, J.A.R. (2004, July 28). *Draba grayana* (Rydb.) C.L. Hitchcock (*Grays draba*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available:
<http://www.fs.fed.us/r2/projects/scp/assessments/drabagrayana.pdf> [March 2006].
- Price, Robert. 1980. Personal communication with Robert Price 15 Oct. 1980.
- Weber, W. A. and R. C. Wittmann. 1992. Catalog of The Colorado Flora: A Biodiversity Baseline. University Press of Colorado, Niwot, CO.
- Yeatts, L. 1985. Specimen collections at Kathryn Kalmbach Herbarium, Denver Botanic Gardens, Denver, CO.

Version Date: 04/16/2009

State Name: *Draba oligosperma* (woods draba)

Global Name: *Draba oligosperma* (Few-seed Whitlow-grass)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Taxonomic Comments: Kartesz lumps *D. juniperina* into this taxon. In his 1994 checklist Kartesz considered *D. pectinipila* as distinct; he now lumps this into *D. oligosperma* as well (John Kartesz, e-mail to K. Maybury, 2/97; also 8/98 review draft dataset).

Ranks and Status

Global Rank: G5

State Rank: S2

Federal Protection Status: None

State Protection Status: None



Description and Phenology

D. oligosperma is a yellow-flowered mustard, with the typical four petals and sepals. Its flowering stems are leafless. Its narrow leaves have sessile stellate hairs that are highly symmetrical and appear as a tight-flowered rosette.

Look Alikes: Similar to *D. pectinipila* but this species has white petals and the fruits are more elongate and bear doubly pectinate hairs (Dorn 1978).

Phenology: Flowers from mid to late May into early June. Fruits from late June through early July and possibly beyond.

Habitat

Alpine scree slopes of central ranges, but found in pinyon-juniper in Moffat County (Weber 1987).

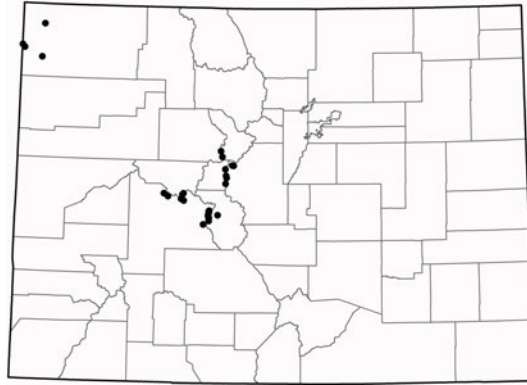
Elevation Range Feet: 11,500 - 14,000

Elevation Range Meters: 3,505 - 4,267

Distribution

Global Range: *Draba oligosperma* is known from western Canada (Alberta, British Columbia, Northwest Territories and Yukon Territory) and western U. S. (Alaska, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming).

Colorado State Range: Chaffee, Gunnison, Lake, Moffat, Pitkin, and Park Counties.



Threats and Management Issues

One occurrence reports impacts from heavy hiking use. The remaining sites do not contain information on threats. The alpine populations are likely protected by their relatively inaccessible habitat. These populations should be monitored for recreational impacts if recreational activities are taking place in the vicinity of populations.

References

- Dorn, R. D. 1978. A New Species of *Draba* (Cruciferae) From Wyoming and Utah. *Madrono* 25:101-103.
- Weber, W.A. 1987. *Colorado Flora: Western Slope*. Colorado Associated University Press, Boulder, Colorado. 530pp
- Welsh, S.L., N.D. Atwood, L.C. Higgins and S. Goodrich. 1987. *Utah Flora, Great Basin Naturalist Memoirs, No. 9*. Brigham Young University, Provo, Utah.

Version Date: 04/13/2009

State Name: *Draba streptobrachia* (Colorado Divide whitlow-grass)

Global Name: *Draba streptobrachia* (Colorado Divide Whitlow-grass)

Taxonomy

Class: Dicotyledoneae

Order: Capparales

Family: Brassicaceae

Taxonomic Comments: Kartesz 1999 has placed *Draba spectabilis* var. *dasycarpa* in *D. streptobrachia*.

Ranks and Status

Global Rank: G3

State Rank: S3

Federal Protection Status: None

State Protection Status: None



Description and Phenology

D. streptobrachia is a yellow-flowered mustard, with the typical four petals and sepals. Short-stalked cruciform or stellate hairs are found on both sides of the leaves and within the inflorescence. The stems are covered with unevenly-branched stellate hairs, and the fruit may have forked hairs or be glabrous.

Look Alikes: *Draba streptobrachia* is distinguished from other yellow-flowered alpine *Drabas* having fewer than 4 stem leaves and growing in dry rocky sites as follows: *D. crassa* has semi-succulent basal leaves with glabrous surfaces (although ciliate margins); *D. grayana* and *D. exunguiculata* have simple straight hairs if any, rather than twisted stellate or cruciform hairs; *D. crassifolia* has shorter styles (less than 0.15 mm long) (Kettler 1993). *D. weberi*, an extremely restricted endemic of Summit County, appears to be closely related to *D. streptobrachia*, although it differs in its wetter habitat of stream edges, its moderately pubescent stems with simple and forked trichomes or glabrous, sparsely pubescent leaves with simple and short-stalked forked trichomes, and its shorter styles (0.3-0.5 mm vs. 0.5-1.2 mm) (Price 1991).

Phenology: *Draba streptobrachia* flowers and fruits from July through August (Kettler 1993).

Habitat

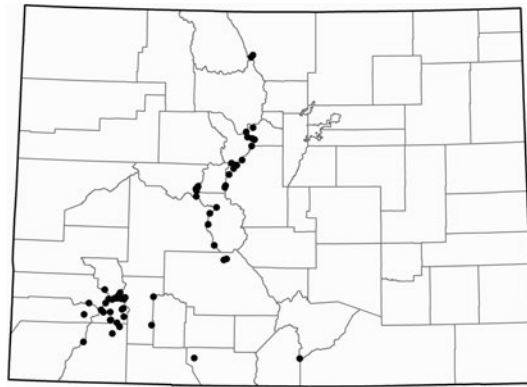
Found on finely weathered rock, loose soil, ridges, slopes, scree margins, fell-fields and cliffs from montane to alpine habitats (Price 1980).

Elevation Range Feet: 11,500 - 14,000

Elevation Range Meters: 3,505 - 4,267

Distribution

Global Range: A Colorado endemic, apparently restricted to areas above treeline in Colorado (16 counties) where it occurs at a number of localities in the San Juan Mountains and also in the Sawatch, Mosquito, and Front Ranges to the north (Price 1980).



Threats and Management Issues

Draba streptobrachia is somewhat protected by its often inaccessible habitat on high steep slopes, but may be threatened by recreational use and climate change.

References

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Version Date: 04/16/2009

State Name: *Epipactis gigantea* (helleborine)

Global Name: *Epipactis gigantea* (Giant Helleborine)

Taxonomy

Class: Monocotyledoneae

Order: Orchidales

Family: Orchidaceae

Taxonomic Comments: The only native member of its genus in United States and Canada (Brunton 1986). There is a variant of *Epipactis gigantea* native to California that has wine-red leaves.

Ranks and Status

Global Rank: G4

State Rank: S2

Federal Protection Status: USFS

Sensitive Species

State Protection Status: None



Description and Phenology

Giant Helleborine is a large perennial herb with leafy stems that are 30-100 cm tall and which arise from short rhizomes. The leaves are without petioles and up to 20 cm long; the lower are ovate, while the upper are lance-shaped. The herbage is rough to the touch or smooth and glabrous. The numerous flowers are borne singly in a long, narrow, leafy-bracted inflorescence located at the tops of the stems. The lance-shaped sepals are green with brownish stripes and approximately 15 mm long. The upper two petals are shorter and broader than the sepals. The lower petal is sac-like and longer and more reddish than the sepals. The nodding capsule is elliptic and bears many thousands of tiny seeds.

Diagnostic Characteristics: The tall stems with reddish flowers in the leaf axils make this species one of our most distinctive orchids. It is not easily confused with any other species.

Look Alikes: This is the only species of this genus occurring in Colorado; it should be readily distinguishable when in flower. Vegetatively, this species may resemble *Maianthemum stellatum*, but the leaves are "pleated" and a darker green. The flowers are conspicuous and greenish with purple-brown markings (Naumann 1990).

Phenology: Flowers in June and July, fruits August to September (Ryke et al. 1994).

Habitat

Epipactis gigantea occurs in moist situations (Harrington 1954), including streambanks, lake margins, springs and seeps, especially near thermal waters (Hitchcock and Cronquist 1973). It is frequently found within pinyon-juniper woodlands in seeps on sandstone cliffs, hillsides and springs at elevations from 4800 to 8,000 feet (Ryke et al. 1994).

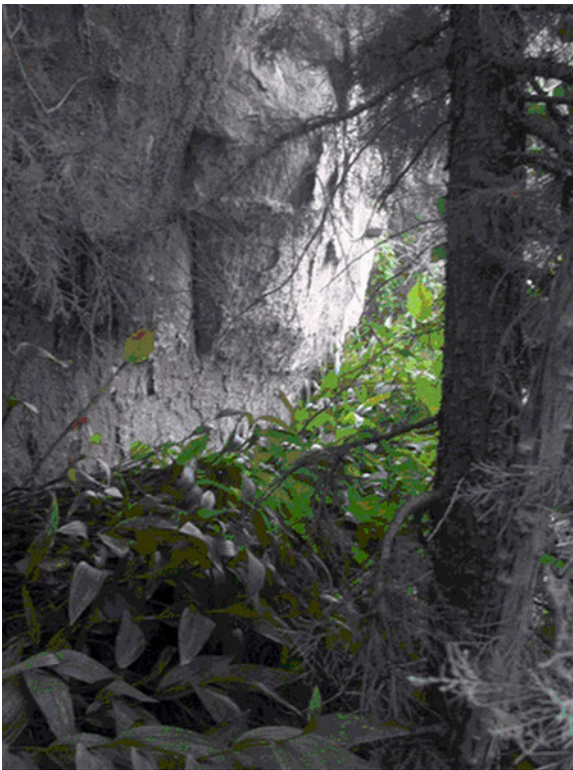
Elevation Range Feet: 4,800 - 8,000

Elevation Range Meters: 1,463 - 2,438

Distribution

Global Range: *Epipactis gigantea* grows from southern British Columbia in Canada to northern Mexico and eastwards in the United States to South Dakota and Texas. There has also been at least one collection made in central Mexico (San Luis Potosi).

Colorado State Range: Moffat, Montezuma, Mesa, Chaffee, Montrose, Delta, Archuleta, and Saguache Counties.



Threats and Management Issues

Changes in the hydrologic regime may threaten this species. One site is potentially threatened by grazing and future development, and one is impacted by grazing and road use.

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Version Date: 04/15/2009

State Name: *Erigeron lanatus* (woolly fleabane)

Global Name: *Erigeron lanatus* (Woolly Fleabane)

Taxonomy

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae

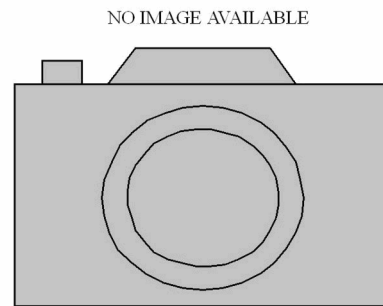
Ranks and Status

Global Rank: G3G4

State Rank: S1

Federal Protection Status: None

State Protection Status: None



Description and Phenology

Erigeron lanatus is a tap-rooted, mat-forming perennial with a single large flower head per stem, the numerous ray flowers are white, blue or pink; stems and leaves are woolly with long, soft hair (Spackman et al. 1997).

Look Alikes: Distinguished by its apetiolate leaves, which narrow to the base with at least some of them 3-toothed at the apex (Weber 1987).

Phenology: Flowers in late July through August (pers. comm. Jennings 1995).

Habitat

Open, rocky, alpine and subalpine habitats, often on limestone talus (Flora of North America 2009).

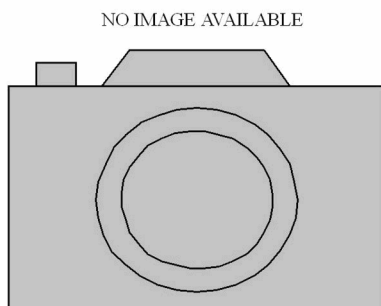
Elevation Range Feet: 12,500 - 13,500

Elevation Range Meters: 3,810 - 4,114

Distribution

Global Range: Occurs from southern British Columbia and Alberta to northwestern Montana, with disjunct populations in west-central Wyoming and central Colorado.

Colorado State Range: *Erigeron lanatus* is found in Pitkin, Gunnison, and Chaffee counties.



Threats and Management Issues

Proximity to hiking trails may pose a threat.

References

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Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by Colorado Natural Heritage Program.

Weber, W.A. 1987. Colorado Flora: Western Slope. Colorado Associated University Press, Boulder, Colorado. 530pp

Version Date: 04/15/2009

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' is 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

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 exerted from the flower (Anderson 2006).

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

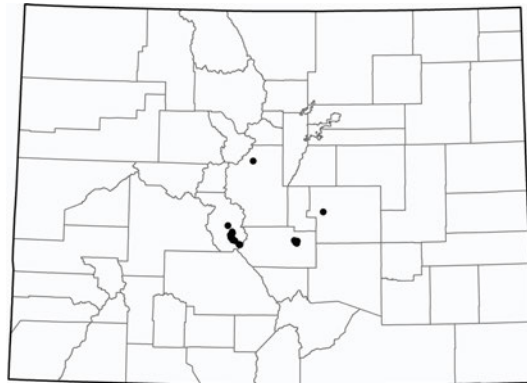
Occurrences of *Eriogonum brandegeei* are limited mostly to outcrops of the Dry Union Formation (in Chaffee County) and lower members of the Morrison Formation (in Fremont County), or to Quaternary strata that are derived from these formations (O'Kane 1988, Spackman et al. 1997, Anderson 2006). The unifying 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 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 officinale*, and *Bouteloua curtipendula* (Johnston et al. 1981).

Elevation Range Feet: 5,800 - 7,840

Elevation Range Meters: 1,767 - 2,389

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

The primary threat at this time is considered to be off road vehicle use (Anderson 2006, CNHP Scorecard 2008). 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

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- 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.
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- 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: *Eriogonum coloradense* (Colorado wild buckwheat)

Global Name: *Eriogonum coloradense* (Colorado Wild Buckwheat)

Taxonomy

Class: Dicotyledoneae

Order: Polygonales

Family: Polygonaceae

Ranks and Status

Global Rank: G2

State Rank: S2

Federal Protection Status: BLM

Sensitive Species

State Protection Status: None



Description and Phenology

Densely matted perennial. Flowering stems scapose, bearing 3-4 involucre per head.

Flowers white to pinkish, 2.5-3.5 mm long, stamens exserted. Plants 6-10 cm tall.

Look Alikes: Looks like *E. brandegeei* which does not co-occur with it. These two species may be distinguished by their leaves, *E. coloradense* is not tomentose on both sides; and by their flowering stems, *E. coloradense* is shorter (6-10cm vs. 10-25cm in *E. brandegeei*) (pers. comm. Coles 1994; pers. comm. Jennings 1995).

Phenology: Flowering July and August (Kettler et al. 1993).

Habitat

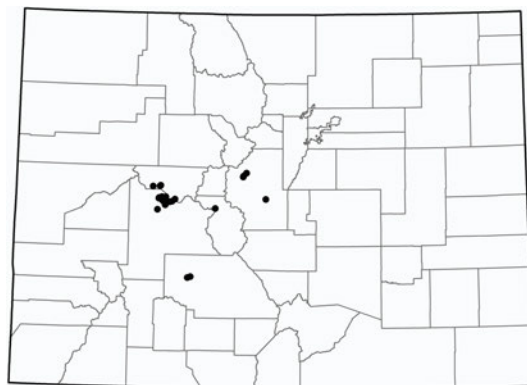
Gravels and clays of high mountain parks up to talus slopes of the alpine (Weber and Wittmann 1996). Gravelly or sandy soil, often subalpine and alpine slopes, sometimes montane grasslands (Spackman et al. 1997).

Elevation Range Feet: 8,500 - 12,500

Elevation Range Meters: 2,590 - 3,810

Distribution

Global Range: Endemic to Colorado; known from Gunnison, Park, Pitkin, and Saguache counties. Estimated range is 9,318 square kilometers (3,598 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

Recreational uses are considered to be the primary threat to the species at this time (Anderson 2004, CNHP Scorecard 2008). The species is also threatened by grazing and its secondary effects, right-of-way management, residential development and human population growth, exotic species invasion, effects of small population size, mining, rust, global climate change, and pollution. Some threats are more urgent at some sites than at others (Anderson 2004).

References

- Anderson, D.G. (2004, October 14). *Eriogonum coloradense* Small (Colorado buckwheat): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available:
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Version Date: 04/15/2009

State Name: *Heuchera hallii* (Front Range alum-root)

Global Name: *Heuchera hallii* (Front Range Alum-root)

Taxonomy

Class: Dicotyledoneae

Order: Rosales

Family: Saxifragaceae

Ranks and Status

Global Rank: G3

State Rank: S3

Federal Protection Status: None

State Protection Status: None



Description and Phenology

Heuchera hallii has broadly ovate basal leaves, cordate at the base, with serrate or serrulate margins. The creamy-white campanulate flowers are in spikes, or the lower ones paniculate. Stamens are shorter than the sepals.

Habitat

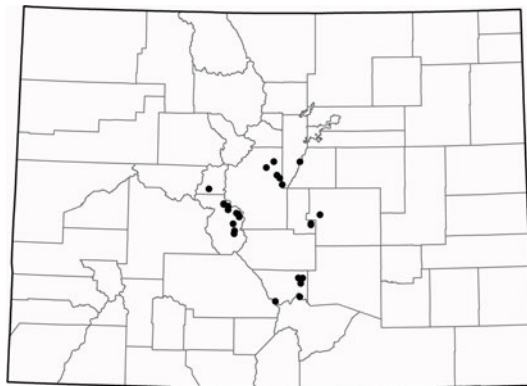
Mountains, often on rocky slopes or cliffs (Harrington, 1964).

Elevation Range Feet: 6,250 - 10,800

Elevation Range Meters: 1,905 - 3,291

Distribution

Global Range: Colorado endemic, known from south central Colorado in Chaffee, Custer, El Paso, Huerfano, Jefferson, Park, and Teller counties.



Threats and Management Issues

No threats have been documented.

References

Harrington, H.D. 1954. Manual of the plants of Colorado. Swallow Press, Chicago. 666 pp.

Weber, W.A., and R.C. Wittmann. 1996. Colorado flora: Eastern slope. Revised edition. Univ. Press of Colorado, Niwot, Colorado. 524 pp.

Version Date: 04/13/2009

State Name: *Listera borealis* (northern twayblade)

Global Name: *Listera borealis* (Northern Twayblade)

Taxonomy

Class: Monocotyledoneae

Order: Orchidales

Family: Orchidaceae

Ranks and Status

Global Rank: G4

State Rank: S2

Federal Protection Status: BLM

Sensitive Species

State Protection Status: None



Description and Phenology

Perennial, 4-26 cm tall; two narrowly ovate leaves at apex of stem; flowers greenish with an oblong corolla lip which is broadest at the base and slightly cleft (Spackman et al. 1997, Flora of North America 2002).

Look Alikes: *Listera cordata* ssp. *nephrophylla* stem leaves are broad and heart-shaped, and *L. convallaroides* stem leaves are broadly ovate (almost round), while those of *L. borealis* are narrowly ovate. All three *Listera* species have 2-cleft corolla lips, but the lip of *L. borealis* is oblong and broadest at the base, while that of *L. convallaroides* is broadest at the apex and that of *L. cordata* ssp. *nephrophylla* is narrow and 2-cleft for half its length (resembling a snakes tongue). At some sites, all three *Listera* species can be found growing together.

Phenology: Flowers late June through July.

Habitat

Moist, shady spruce forests in mossy places along small streams (Cronquist et al. 1977).

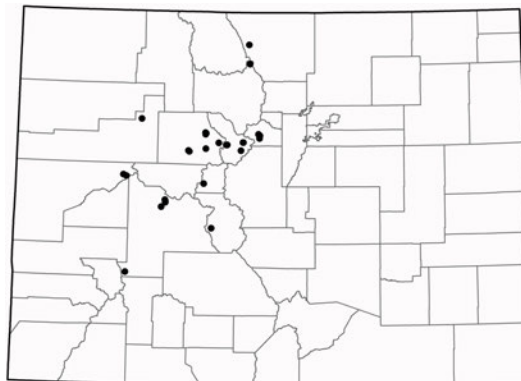
Elevation Range Feet: 8,700 - 10,500

Elevation Range Meters: 2,651 - 3,200

Distribution

Global Range: Canada and the U. S. in Alaska, Colorado, Idaho, Montana, Oregon, Washington, Utah and Wyoming.

Colorado State Range: *Listera borealis* is known from ten Colorado counties: Chaffee, Clear Creek, Eagle, Garfield, Grand, Gunnison, Lake, Larimer, Mesa and Summit.



Threats and Management Issues

Recreation, both motorized and non-motorized, are potential threats, as are any hydrologic alterations.

References

Cronquist, A., A. H. Holmgren, N. H. Holmgren, J. L. Reveal and P. K. Holmgren.
1977. Intermountain Flora Vascular Plants of the Intermountain West, USA: vol. 6.
New York Botanical Garden, Bronx, NY.

Version Date: 04/15/2009

State Name: *Machaeranthera coloradoensis* (Colorado tansy-aster)

Global Name: *Machaeranthera coloradoensis* (Colorado Tansy-aster)

Taxonomy

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae

Ranks and Status

Global Rank: G2

State Rank: S2

Federal Protection Status: USFS

Sensitive Species

State Protection Status: None



Description and Phenology

A perennial herb that forms leafy tufts, about 4-10 cm high. Leaves are coarsely-toothed, spoon-shaped to linear, 1-4 cm long, and densely hairy. Large, showy flower heads are borne singly on short stalks (not very high above the leaves). The flower heads have rose-colored or purple rays surrounding a yellow disk.

Look Alikes: *Machareanthera tanacetifolia* has once or twice pinnately lobed leaves and tall, leafier stems. *M. coloradoensis* is distinguished from other species by its deep purple flowers, short stems, and toothed leaves (Spackman et al. 1997).

Phenology: Flowers in July through early August; begins to set seed in early August.

Habitat

Gravelly areas in mountain parks, slopes and rock outcrops up to dry tundra (Spackman et al. 1997).

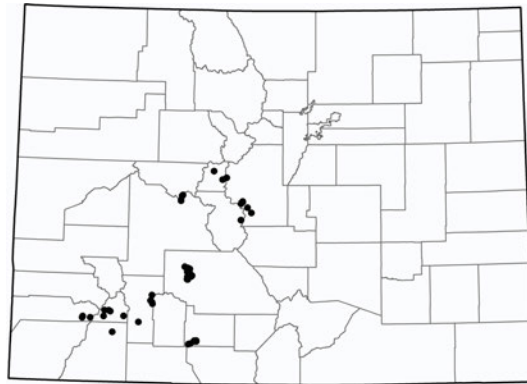
Elevation Range Feet: 8,500 - 12,000

Elevation Range Meters: 2,590 - 3,657

Distribution

Global Range: Known from central Colorado and southern Wyoming (Beatty et al. 2004).

Colorado State Range: Known from Dolores, Gunnison, Hinsdale, La Plata, Lake, Park, Pitkin, Rio Grande, Saguache, and San Juan counties in Colorado. Estimated range is 20,738 square kilometers (8007 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

The primary threat at this time is considered to be recreation/hiking (CNHP Scorecard 2006). It is not known if all of the occurrences are or are not threatened by these activities. *Machaeranthera coloradoensis* is vulnerable because of its restricted geographic range and small number of documented occurrences. Direct or indirect negative impacts to *M. coloradoensis* populations or habitats by human-related activities could occur from motorized and non-motorized recreation, trail or road construction and maintenance, reservoir expansion, housing development, changes to natural disturbance regimes, domestic livestock activities, invasive species introduction, or small-scale mining. Lower elevation populations and those populations closest to roads and trails are likely at the most risk. Other environmental or biological threats to populations or habitats of *M. coloradoensis* could include inadequate pollination, genetic isolation, herbivory, landscape fragmentation, hybridization, global climate changes, or changes to the natural disturbance regime that would affect natural succession, erosion, or precipitation patterns (Beatty et al. 2004).

References

- Beatty, B.L., W.F. Jennings, and R.C. Rawlinson (2004, January 30). *Machaeranthera coloradoensis* (Gray) Osterhout (Colorado tansyaster): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/machaerantheracoloradoensis.pdf> [March 2006].
- Ryke, N., D. Winters, L. McMartin and S. Vest. 1994. Threatened, Endangered and Sensitive Species of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands. May 25, 1994.
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Version Date: 04/16/2009

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

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

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 - 2,286

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

Recreational use is considered to be the primary threat to the species at this time (CNHP Scorecard 2008). 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. 2008. Biotics database.
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- 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

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

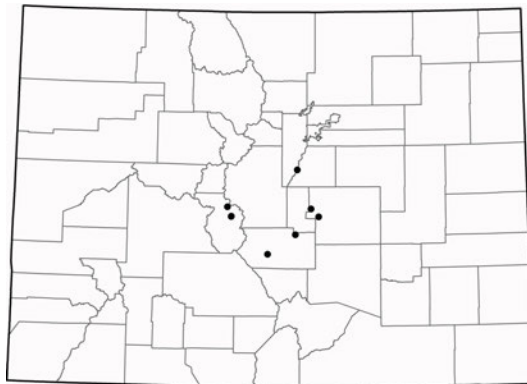
The habitat for this species has not been clearly defined. Many of the occurrences are found in sandy soils derived from granitic parent materials within pinyon-juniper woodlands. Plants have also been documented in gravel and ash soils, and in association with Ponderosa pine, Douglas fir, and Gambel's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

Elevation Range Feet: 6,280 - 9,000

Elevation Range Meters: 1,914 - 2,743

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

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: *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

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 dehiscent 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). 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

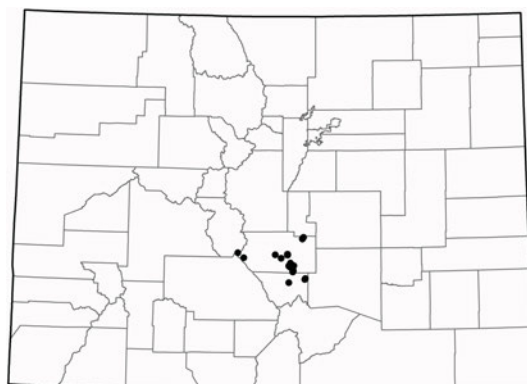
This species is found in open pinyon-juniper woodlands and montane grasslands, in rocky soils with igneous bedrock. The plants grow mainly near the rim of canyons, and also in cracks of large rock slabs, in full sun or shade. Associated species include *Arabis divaricarpa*, *Quercus gambelii*, *Bromus 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 - 2,895

Distribution

Global Range: A Colorado endemic, this species is known from Fremont, Custer, and Chaffee counties. 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

Motorized recreation is considered to be the primary threat to the species at this time (CNHP Scorecard 2008). *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. 2008. Biotics database.
- 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: *Ranunculus gelidus* ssp. *grayi* (tundra buttercup)

Global Name: *Ranunculus karelinii* (Arctic Buttercup)

Taxonomy

Class: Dicotyledoneae

Order: Ranunculales

Family: Ranunculaceae

Ranks and Status

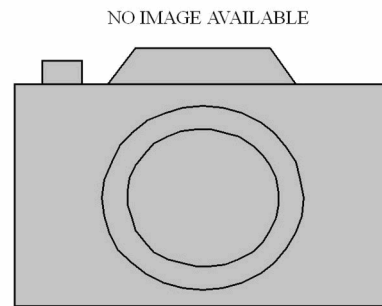
Global Rank: G4G5

State Rank: S2

Federal Protection Status: USFS

Sensitive Species

State Protection Status: None



Description and Phenology

Small perennial 4-12 cm tall, stems curved horizontally and spreading, with most of the plant buried in loose scree; flowers yellow with petals greatly exceeding the sepals; basal leaves are biternately dissected with 3-13 lobes (Spackman et al. 1997, Panjabi and Anderson 2006).

Look Alikes: *Ranunculus pygmaeus* is smaller (less than 5 cm tall) with 3-lobed leaves and petals only equaling the sepals. It also has significantly smaller flowers and fruit (petals are 1.5-3.5 mm long and 1-2.8 mm wide; achenes are 1 mm long with 30-50 in an ovoid head 2-4 mm long) than *R. gelidus* ssp. *grayi*. It could also be confused with *R. pedatifidus* (pers. comm. Spackman 94-11-09) which has stem leaves with linear divisions. The larger *R. karelinii* has leaves more dissected and petals greatly exceeding the sepals (Kettler et al. 1993).

Phenology: Flowers in July, fruit in August.

Habitat

Ranunculus gelidus ssp. *grayi* (*karelinii*) occurs in alpine tundra on the highest mountains in Colorado. Sites are often rocky, sparsely vegetated windy ridgetops.

Elevation Range Feet: 13,000 - 14,000

Elevation Range Meters: 3,962 - 4,267

Distribution

Global Range: U. S. (Colorado, Idaho, Montana and Utah) and Canada (British Columbia, Alberta, Northwest Territories).

Colorado State Range: Central mountains of Colorado in Chaffee, Clear Creek, Gunnison, Lake, Park, Pitkin, and Summit counties.



Threats and Management Issues

Recreation poses threats in some areas. Several sites are on or near routes to fourteeners and may be threatened by climbers. Most populations are small, and could be decimated by a few hikers (Panjabi and Anderson 2006).

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Kettler, S. M., N. D. Lederer, D. Bacher, and S. Spackman. 1993. Final Report: Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands, Plants of Special Concern. Colorado Natural Heritage Program, Fort Collins, CO.

Panjabi, S.S. and D.G. Anderson. (2006, April 5). *Ranunculus karelinii* Czern. (ice cold buttercup): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/ranunculuskarelinii.pdf> [March, 30 2009].

Welsh, S. L. 1974. Anderson's Flora of Alaska and Adjacent Canada. Brigham Young University Press, Provo, UT.

Version Date: 04/15/2009

State Name: *Sisyrinchium pallidum* (pale blue-eyed grass)

Global Name: *Sisyrinchium pallidum* (Pale Blue-eye-grass)

Taxonomy

Class: Monocotyledoneae

Order: Liliales

Family: Iridaceae

Ranks and Status

Global Rank: G2G3

State Rank: S2

Federal Protection Status: BLM

Sensitive Species

State Protection Status: None



Description and Phenology

Pale blue-eyed grass is an herbaceous monocot with grass-like leaves and six pale blue tepals.

Diagnostic Characteristics: The pale-blue flower color is taxonomically significant in distinguishing *S. pallidum* from western members of the genus which typically have blue-violet flowers. Because *S. pallidum*, *S. montanum* and *S. idahoense* are sympatric, the distinctive flower color and wetland habitat of *S. pallidum* help separate it from these species. The outer bract length can also be compared to discern between the different species. The outer bract length of *S. pallidum* (28-38 mm long) is intermediate between *S. idahoense* (less than 30 mm long) and *S. montanum* (greater than 40 mm long) (Cholewa and Henderson 1984).

Look Alikes: Impossible to distinguish from other species of *Sisyrinchium* except in flower. This species has been observed growing with *S. montanum* (pers. comm. Coles 1994). *S. montanum* and *S. idahoense* var. *occidentalis* have deep blue flowers as opposed to the pale blue flowers of *S. pallidum*; the outer bract of *S. idahoense* var. *occidentalis* is subequal to the inner bract. *S. demissum* also has pale flowers but it usually has more than one pedunculate spathe (bract below the inflorescence) arising from the axil of a leaflike bract on the stem, while *S. pallidum* has a single sessile spathe.

Phenology: Flowering occurs from about mid June through mid July and likely depends on annual growing conditions, especially the availability of water. Mature fruits are present from near the end of June into early August (Hartman 1992).

Habitat

Sisyrinchium pallidum occurs on wet meadows often where ample fresh, often standing water is available at least through June or early July. These include stream, lake and river margins up slope from the most hydrophytic sedges and rushes, seep areas down stream from earthen dams, and irrigated hay meadows (Hartman 1992). It grows especially on alkaline soils, often with *Juncus arcticus* and *Carex aquatilis* (pers. comm. Coles 1994).

Distribution

Global Range: Regional endemic, restricted to southeastern Wyoming and seven counties in north-central Colorado.

Colorado State Range: Known from Chaffee, Fremont, Gilpin, Jackson, Larimer, Park, and Saguache counties in Colorado. Estimated range is 18,928 square kilometers (7308 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences. Also known from Wyoming.



Threats and Management Issues

The primary threat at this time is considered to be alteration of wetland habitat through peat mining and water diversion projects. Often wetlands are drained to facilitate the extraction of peat. In the past, peat mining at High Creek Fen has disturbed potential habitat of *S. pallidum*. Jennings (1990) notes that if all the peat is removed the wetland is destroyed. Ground water changes could ultimately alter the quality of wetlands favored by *S. pallidum* and ownership of water rights could permit diversion of surface water. Because of the uncertainty of how changes in the hydrological regime affect the long-term viability of the plants, modification of the wetland hydrology remains a serious threat. It is not known if all of the occurrences are or are not threatened by these activities.

References

Coles, J. 1994. Personal communication about Rare Plant Guide Species.

Hartman, R.L. 1992. Report on the status of *Sisyrinchium pallidum*, a candidate threatened species. Unpublished.

Jennings, W.F. 1990. Status Report on *Sisyrinchium pallidum*. Unpublished Report for The Nature Conservancy, Colorado Field Office, Boulder, Colorado.

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

Version Date: 04/16/2009

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: S2

Federal Protection Status: None

State Protection Status: None



Description and Phenology

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 primarily in August to early September.

Habitat

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

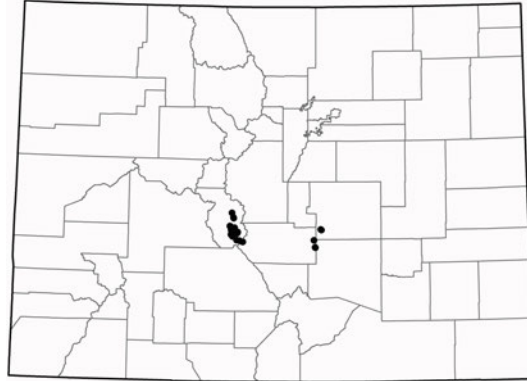
Elevation Range Meters: 1,615 - 2,377

Distribution

Global Range: This species is known from Colorado and New Mexico (Kartesz and

BONAP 1998). In Colorado it has been documented in Chaffee, El Paso, Fremont, and Pueblo counties. 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: Known from Chaffee, El Paso, Fremont, and Pueblo counties in the upper Arkansas River drainage between Pueblo and Buena Vista (Weber and Wittmann 2001).



Threats and Management Issues

The primary threat at this time is considered to be housing/urban development. 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

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).

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

Version Date: 03/19/2007

Western Toad (*Bufo boreas boreas*)

Taxonomy:

Class: Amphibia
Order: Anura
Family: Bufonidae
Genus: *Bufo*

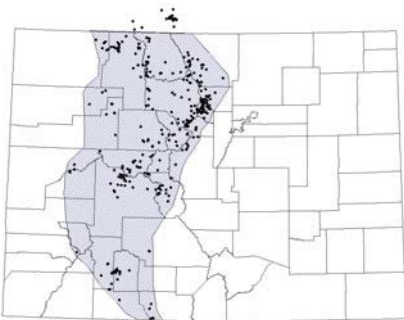


Taxonomic Comments: Prior to the 1990s, morphological, biogeochemical, and vocal differences were noted between toads of the *Bufo boreas* complex in the southern Rocky Mountains and those in the Pacific Northwest (Burger and Bragg 1947, Hubbard 1972). Goebel (1996) described *Bufo boreas* in the southern Rocky Mountains as genetically distinct from those in the Pacific Northwest. These differences may warrant recognition as one or more distinct species. Until this change is formally accepted, Hammerson (1999) has offered the common name of Mountain Toad for the interim, and suggests that the Latin name may become *Bufo pictus*. For the purposes of this report, we are referring all naming to boreal toad (*Bufo boreas boreas*).

CNHP Ranking: G4T1Q, S1

State/Federal Status: State Endangered/USFWS candidate for listing (warranted but precluded)/USFS Sensitive

Habitat Comments: The boreal toad breeds in still or slowly moving water such as can be found in marshes, ponds, and lakes. Successful breeding generally requires permanent or semi-permanent water sources. Post breeding, one may find the boreal toad in more terrestrial environments. Though they still tend to linger near water in damp environments, some females will use drier, more densely vegetated areas. Rocks, logs and rodent burrows provide cover while away from water during periods of inactivity (Hammerson 1999).



Distribution: The southern Rocky Mountain population of boreal toads is likely distinct from other populations (A. Goebel, unpubl. data). Although relationships among populations of this toad are not resolved, recent genetic evaluations suggest that the southern Rocky Mountain population ranges from southern Idaho to New Mexico (Goettl 1997; Steve Corn pers. comm.; A. Goebel unpubl. data). In Colorado, this species occurs throughout the mountains above approximately 8,000 feet in elevation. There are approximately 206 historical localities for the

boreal toad in Colorado, while currently there are just 35 known active breeding sites.

Important Life History Characteristics: Boreal toads are long-lived, reaching ages of nine years or more (Campbell 1976). Reproductive maturity does not occur until age four in males and six in females (Carey 1976). Other important considerations include sensitivity to toxicants, relatively short breeding season (starting as the winter snowpack begins to thaw), and slow metabolic rates of the larvae (Hammerson 1999).

Known Threats and Management Issues: The boreal toad is currently found in 67 known Colorado breeding locations comprising 32 populations, only two of which are considered viable (T. Jackson, CDOW, pers. comm.). This species has disappeared from 83 percent of its historic locations in Colorado, 94 percent in Wyoming, and is believed to be extirpated from New Mexico (USFWS 2004). The boreal toad was once known from 25 counties in Colorado, including Grand County, where it was considered common. Its distribution in Colorado is now restricted to 14 counties. Available information suggests that boreal toad populations continue to decline (Keinath and McGee 2005). Reasons for the declining toad population are still being investigated. Proposed causes include chytrid fungus (*Batrachochytrium dendrobatidis*), acid rain, drought, pollution, increased UV radiation, natural population flux, or some synergistic combination of these and/or other factors (USFWS 2004). The major source of decline is believed to be chytrid fungus, which has been linked to major declines in proximate areas such as Rocky Mountain National Park (Muths et al. 2003, USFWS 2004). Examinations of infected toads show that chytrid fungus suppresses the immune system to a point that a secondary infection (e.g. red-leg disease) is usually the ultimate cause of death (USFWS 2004). Researchers hypothesize that one or a combination of environmental stressors is reducing the toads' ability to survive this pathogen (Loeffler 2001). At this time, researchers do not know whether or not populations can persist in the presence of chytrid fungus. Research is on-going, but it may be several more years before this question can be answered (T. Jackson, CDOW, pers. comm.).

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Boreal Owl (*Aegolius funereus*)

Taxonomy:

Class: Aves

Order: Strigiformes

Family: Tytonidae

Genus: *Aegolius*

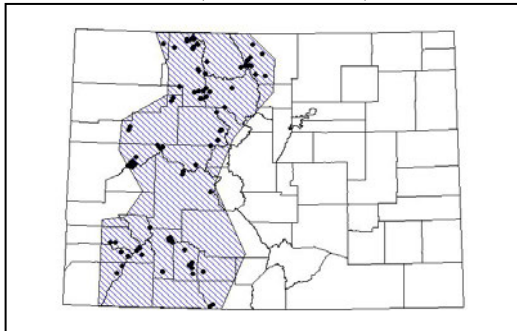
Taxonomic Comments: All Boreal owls in North America belong to one subspecies: *Aegolius funereus richardsoni*.

CNHP Ranking: G5, S2

State/Federal Status: none



Habitat Comments: In Colorado, boreal owls occur mainly in mature to old-age (150+ years) Englemann spruce and subalpine fir above 9500 feet in elevation, but also frequent higher-elevation lodgepole pine and aspen stands (Hayward and Hayward 1993). They prefer wet areas near streams or bogs because these often have good populations of small rodents (CBBA 1998).



Distribution: The boreal owl inhabits spruce-fir/lodgepole pine forests from the Rocky Mountains of Colorado northwest into Canada and Alaska (National Geographic Society 1987). Scattered populations also occur in northern Minnesota, the Cascade ranges, and south in the Rocky Mountains into north-central New Mexico. Field workers have found boreal owls in most Colorado mountain ranges,

including the Elk, San Juan, Sangre de Cristo, and Wet mountain ranges, as well as the Grand Mesa, Park Range, and Flat Tops areas (CBBA 1998).

Important Life History Characteristics: In Colorado, nest initiation for boreal owls range from late-May to late-June. The summer home ranges of three radio marked adults near Cameron Pass averaged 731 acres, while the winter ranges averaged 2796 acres (CBBA 1998). Boreal Owls do not migrate, but they are nomadic in response to cyclic prey populations. Nesting is initiated as early as mid April and most young leave the nest by mid June. The diet consists of small mammals, especially red-backed voles.

Known Threats and Management Issues: No population trends are available for the Colorado boreal owls since large areas remain unsurveyed for this species. However, Stokes Field Guide (1996) reports a small downward trend for the boreal owl based on Christmas Bird Count data. There are few obvious threats to this species, except where development alters nesting habitat.

The distribution and abundance of Boreal Owls is largely tied to nest cavity availability (they require large trees and snags for nesting) and prey populations. The principal prey species, the red-backed vole, prefers mature, mesic forests with high canopy closure and large downed woody material; it is absent from clearcut areas, but local populations appear largely unaffected by patch cuts (<1.2 ha; 3 ac) or selection cuts (Martell 1983).

Boreal Owls require large areas of mature spruce-fir forest--home ranges in Colorado have been measured at about 1500 ha (3,700 ac) (Palmer 1986). By protecting habitat for Boreal Owls, managers will ensure habitat protection for other spruce-fir species. Boreal Owls are classified as a Sensitive Species in U.S. Forest Service Region 2. Due to this species' nocturnal habits and early nesting season, no data from Breeding Bird Survey or other long-term monitoring projects are available.

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Gunnison's Prairie Dog (*Cynomys gunnisoni*)

Taxonomy

Class: Mammalia

Order: Rodentia

Family: Sciuridae

Genus: *Cynomys*

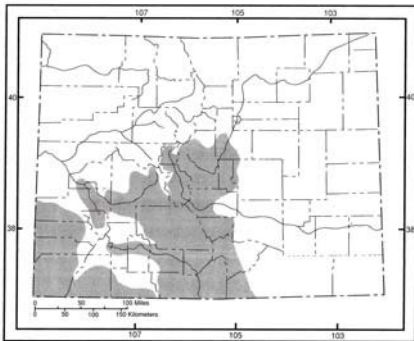
Taxonomic Comments: The subspecies *Cynomys gunnisoni gunnisoni*, which is extinct over most of its former range, inhabits southern La Plata County. Gunnison's prairie dog exhibits low within-population genetic diversity and significant differentiation between colonies (Travis et al. 1997).

CNHP Ranking: G5 S5

State/Federal Status: Forest Service sensitive



CO Division of Wildlife Photo



Gunnison's prairie dog distribution in Colorado (from Fitzgerald et al. 1994)

Phenology: Mating occurs shortly after emerging from hibernation in late May and April with birthing occurring in late May and early June. Pups will appear above ground in July.

Global Range: Gunnison's prairie dogs inhabit the montane valleys and high plateaus of the "Four Corners" area of Colorado, Utah, Arizona, and New Mexico, where they occur at elevations from 6,000 to 12,000 ft (1,830 to

distribution. *Cynomys gunnisoni zuniensis* occurs in parts of all four states, but *C. g. gunnisoni* occurs only from central Colorado through north-central New Mexico (Pizzimenti and Hoffmann 1973).

State Range: Gunnison's prairie dogs occupy southwestern Colorado and the valleys in the central and south-central Rocky Mountains within the state. South Park, Colorado marks the northern limit of the range of Gunnison's prairie dog (Pizzimenti and Hoffmann 1973).

Habitat Comments: Suitable habitat for Gunnison's prairie dogs includes grasslands and semidesert and montane shrublands (Fitzgerald et al. 1994). Flat or gently rolling terrain with friable soils (to allow excavation of burrow systems) is preferred. The presence of prairie dog towns greatly increases biological diversity by providing vertical structure (the burrows and mounds), which affords sites for vertebrates and invertebrates to forage, breed, rest, and seek shelter (i.e., Wilcomb 1954, Clark et al. 1982).

Important Life History Characteristics: All five species of North American prairie dogs are diurnal, terrestrial, colonially-dwelling herbivores that excavate elaborate burrow systems for shelter and protection from predators (Nowak 1999). Gunnison's prairie dogs differ from the more common and widespread black-tailed prairie dogs (*Cynomys ludovicianus*) in several ways. Gunnison's prairie dogs are smaller-bodied, have a whitish (rather than blackish) tail tip, and hibernate (Pizzimenti and Hoffmann 1973, Rayor et al. 1987, Hoogland 1995). Less social than *C. ludovicianus*, Gunnison's prairie dogs have a relatively limited social behavioral repertoire and less well-developed cohesive behavior (Rayor 1988). Burrow and mound construction are less complex and colonies are smaller and less densely settled than in black-tailed prairie dogs (Fitzgerald et al. 1994). Gunnison's colonies are characterized by the presence of more protective plant cover than colonies of black-tailed prairie dogs because the latter species clips standing vegetation (non-food plants) to enhance detection of approaching predators (King 1955, Fitzgerald et al. 1994).

Distribution/Abundance: Gunnison's prairie dog is declining throughout its range, although the extent of the decline is unknown.

Known Threats and Management Issues: Extermination programs (public and private) have targeted Gunnison's prairie dogs for more than 100 years (Pizzimenti and Hoffmann 1973). Classified as a small game species in Colorado, Gunnison's prairie dogs receive no protection from harvest, and so poisoning and shooting campaigns continue unabated. Plague (caused by the bacillus *Yersinia pestis* and transmitted by fleas) historically has greatly influenced the distribution of this species in Colorado (Lechleitner et al. 1962, 1968; Rayor 1985, Fitzgerald et al. 1994) and will likely continue to do so. As in the past, however, the greatest threats to the Gunnison's prairie dog will come from humans due to real or perceived conflicts with agricultural economics.

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Townsend's Big-eared Bat (*Corynorhinus townsendii pallescens*)

Taxonomy

Class: Mammalia
Order: Chiroptera
Family: Vespertilionidae
Genus: *Corynorhinus*

Taxonomic Comments:

The generic name was recently changed from *Plecotus* to *Corynorhinus*.

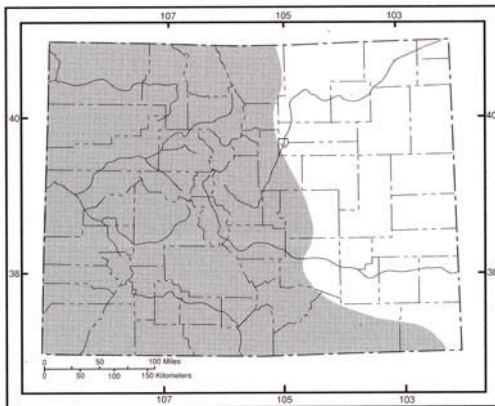
CNHP Ranking: G4T4 S2



Photo by J. Siemers, CNHP

State/Federal Status: BLM sensitive;
USFS sensitive; state species of undetermined status (Colorado).

Habitat Comments: Townsend's big-eared bats occur in a wide range of habitats



Townsend's big-eared bat distribution in Colorado (from Fitzgerald et al. 1994)

including semi-desert shrublands, pinyon-juniper woodlands, and dry coniferous forest (Fitzgerald et al. 1994). Because they naturally roost (and hibernate) in caves, their presence is strongly correlated with the availability of caves or cave-like roosting sites (Pierson et al. 1999). Population densities are highest in areas with substantial surface exposures of cavity-forming rock (i.e., limestone, sandstone, gypsum, or volcanic) and in old mining areas (Pierson et al. 1999). Hibernacula generally are characterized by stable low temperatures and moderate airflow (Colorado Division of Wildlife 1984) and they are thought to be a population limiting factor for Townsend's big-eared bats (Fitzgerald et al. 1994).

Distribution: The two western subspecies of *C. townsendii* are widely distributed throughout western North America; in several northwestern states there are extensive zones of intergradation of the two subspecies (Pierson et al. 1999). *C. t. pallescens* occurs throughout Colorado except on the eastern plains, and is found in mines, caves, and human-made, cave-like structures at elevations up to 9,500 ft (2,930 m) (Colorado Division of Wildlife 1984). Only 11 maternity roosts and 30 hibernacula have been documented in Colorado (Pierson et al. 1999). Almost all known colonies in Colorado are very small (< 30 bats); known historical records of big-eared bats in Colorado include only about 350 individuals (Pierson et al. 1999). Available evidence suggests that

dramatic declines in the sizes of Colorado colonies of big-eared bats may have occurred historically (Pierson et. al 1999).

Important Life History Characteristics: Big-eared bats emerge from their daytime roosts after dark and feed on insects (especially moths) which they capture in flight or glean from foliage (Colorado Division of Wildlife 1984, Nowak 1999). Much of their feeding occurs over water or sagebrush, or along the edges of patches of vegetation (Fitzgerald et. al 1994). After the young are born in May or June (only one offspring per female) the females congregate in nursery colonies where they share metabolic heat; warm nursery sites are critical for the survival of the young (Humphrey and Kunz 1976). No long-distance migrations have been reported for *C. townsendii* (Barbour and Davis 1969, Clark and Stromberg 1987, Fitzgerald et. al 1994). Site fidelity is high: individual bats tend to return each year to the same hibernation (Humphrey and Kunz 1976) and nursery (Pearson et. al 1952) roosts. Nonetheless, during hibernation there is much movement of bats within a cave and among caves as environmental conditions fluctuate and the animals seek more favorable microclimatic conditions (Bee et. al 1981, Schwartz and Schwartz 1981, Fitzgerald et. al 1994).

Known Threats and Management Issues: Townsend's big-eared bats have very specific habitat requirements with regard to temperature and humidity levels at roosting sites; relatively few sites offer conditions appropriate for roosting by these bats (see refs. cited by Pierson et. al 1999). Moreover, *C. townsendii* is highly vulnerable to human disturbance (Colorado Division of Wildlife 1984, Clark and Stromberg 1987, Nowak 1999). Unlike many other species of bats, Townsend's big-eared bats do not seek shelter in protected crevices when roosting, but instead they cluster in highly visible locations (i.e., cave ceilings) where they are easily disturbed (Handley 1959, Barbour and Davis 1969). In Colorado, human visitation and disturbance rates at nursery and hibernation caves are very high (Pierson et. al 1999). In addition to human disturbance, other factors that threaten *C. townsendii* include the closure of abandoned mines (loss of roosting habitat), the impoundment of toxic materials (direct mortality), pesticide spraying (reduction of insect prey base), vegetation conversion and livestock grazing (loss of foraging habitat), and timber harvesting (loss of foraging and roosting habitats) (Pierson et. al 1999).

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