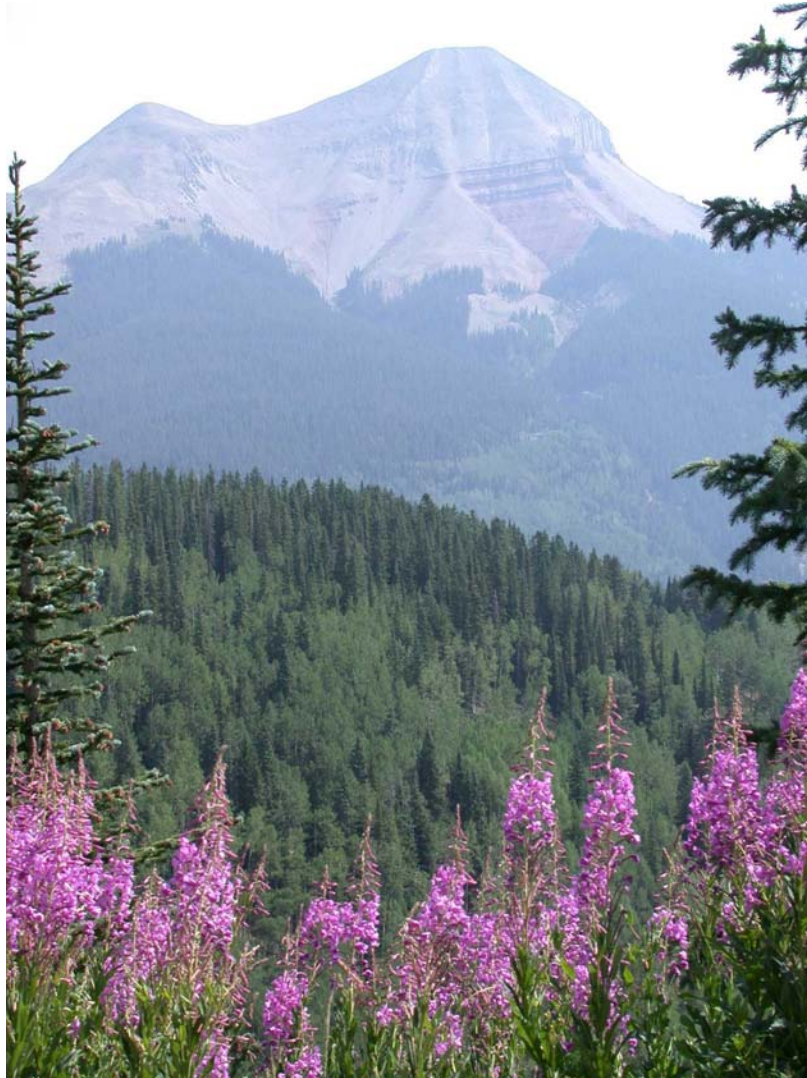


San Juan County Biological Assessment



Prepared for San Juan County
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Summary

Major assets of San Juan County, both economic and aesthetic, are its spectacular scenery and its natural and cultural heritage. It is more clearly understood today than ever before that this area possesses its own unique combination of plants, animals and natural plant communities, as well as geologic and cultural values, that deserves to be cherished and protected. A first step in preserving the elements of biological diversity is to identify what they are and where they are located. Then, determining which are of highest biodiversity significance and highest quality can lead to understanding how they may be protected or managed to maintain them, so that San Juan County will continue to be a place like no other in the world.

This project was undertaken to determine the elements of biological diversity in San Juan County, and to systematically evaluate their relative significance in order to help local governments, private landowners, federal and state agencies, and other organizations to appreciate and safeguard them.

The project was sponsored by the San Juan County Board of County Commissioners and funded by Great Outdoors Colorado! (GOCO), with additional funding supplied by the U. S. Forest Service and U. S. Bureau of Land Management.

Colorado Natural Heritage Program was contracted to carry out the survey. Work began in spring 2002 with collection of existing data and analysis to select and prioritize areas to be surveyed during the field season. Fieldwork was completed during July, August and September 2002. Over one hundred new or updated occurrences of plants, animals and natural plant communities were documented and evaluated.

This information was used to identify 48 Potential Conservation Areas. This report represents the findings of the survey, and is accompanied by a GIS coverage of the Potential Conservation Areas.

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I. Introduction

Colorado Natural Heritage Program performed a survey of critical biological resources of San Juan County in 2002. Support for the project came from a Great Outdoors Colorado! trust fund planning grant awarded to San Juan County; San Juan National Forest; and U. S. Bureau of Land Management. This report presents the results of that survey.

The Natural Heritage Network and Biodiversity

Colorado is well known for its rich diversity of geography, wildlife, plants, and plant communities. However, like many other states, it is experiencing a loss of much of its flora and fauna. This decline in biodiversity 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 it has been compared to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras (Wilson 1988). The need to address this loss in biodiversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country have not been based upon preserving biodiversity; instead, they have primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, science-based approach to preserving biodiversity, The Nature Conservancy developed the Natural Heritage Methodology in 1978.

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 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 began to realize that plant communities are equally important as individual species, this methodology has also 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. Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. It also enables 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 unicellular bacteria and protists, through multicellular plants, animals, and fungi. 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 among these levels. All levels are necessary for the continued survival of species and plant communities, and all are important for the well being of humans. It stands to reason that biological diversity should be of concern to all people.

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

1. **Genetic Diversity** -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable 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. This unique genetic information cannot be reclaimed.
2. **Species Diversity** -- the total number and abundance of plant and animal species and subspecies in an area.
3. **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 or even endemic to an area. It is within communities that all life dwells.
4. **Landscape Diversity** -- the type, condition, pattern, and connectedness of plant communities. A landscape consisting of a mosaic of plant 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 shortgrass 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. Humans and the results of their activities are integral parts of most landscapes.

The conservation of biological diversity must 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 are also linked to all levels of this hierarchy. We at the Colorado Natural Heritage Program believe that a healthy natural environment and human environment go hand in hand, and that recognition of the most imperiled species or communities is an important step in comprehensive conservation planning.

Colorado's 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 Colorado for fourteen years, the Program was relocated from the State Division of Parks and Outdoor Recreation to the University of Colorado Museum in 1992 and then in 1994 to the College of Natural Resources at Colorado State University.

CNHP's multi-disciplinary team of scientists and information managers gathers comprehensive information on 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. 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. Information management staff carefully plot the locations on 1:24,000 scale U.S.G.S. maps and enter it into the Biological and Conservation Data System (BCD). The data are also stored in a geographic information system (Arc/INFO and ArcView GIS). The database can be accessed through a variety of attributes, including taxonomic group, global and state rarity rank, federal and state legal status, source, observation date, county, quadrangle map, watershed, management area, township, range, and section, precision, and conservation unit.

CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System (BCD) developed by The Nature Conservancy. CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources and the Colorado Division of Wildlife, the U.S. Environmental Protection Agency, the U.S. Bureau of Land Management and the U.S. Forest Service. Numerous local governments and private entities also work closely with CNHP. Use of the data by many different individuals and organizations, including Great Outdoors Colorado, encourages a proactive approach to development and conservation thereby reducing the potential for conflict. Information collected by the Natural Heritage Programs around the globe provides a means to protect species before the need for legal endangerment status arises.

Concentrating on site-specific data for each species or community enables the evaluation of the significance of each location with respect to the conservation of natural biological diversity in Colorado and the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established for the protection of the most sensitive or imperiled sites. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

The Natural Heritage Ranking System

Each of the plant and animal species and plant communities tracked by CNHP is considered an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (e.g., 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because an element found in one place is more imperiled than something found in twenty-one places. Also considered in the ranking is the size of the geographic range, the number of individuals, trends in population and distribution, identifiable threats, and the number of already protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of 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 5 current locations in Colorado, is ranked G5S1. Naturita milkvetch, which is known from 37 locations in the Four Corners Area, is ranked a G3S3. Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1S1. CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to vulnerable (S1 - S3). Those with a ranking of S3S4 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", e.g., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N", e.g., 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.

Legal Designations

Natural Heritage imperilment ranks are not legal designations and should not be interpreted as such. 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 the abbreviations used by CNHP.

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plants and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category 1 (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28, 1996 notice, the Service will recognize as candidates for listing most species that would have been included in the former Category 1. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

Candidate species listed in the February 28, 1996 Federal Register are indicated with a "C". While obsolete legal status codes (Category 2 and 3) are no longer used, CNHP will continue to maintain them in its Biological and Conservation Data system for reference.

Table 1. Definition of Colorado Natural Heritage Imperilment Ranks.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. These ranks should not be interpreted as legal designations.	
G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making 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).
G/S4	Apparently secure globally/state, though it might be quite rare in parts of its range, especially at the periphery.
G/S5	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GX	Presumed extinct.
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 not verified for an extended period.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These species or subspecies are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not permanent 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.
Notes: Where two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the element falls between the two numbers.	

Table 2. Federal and State Agency Special Designations.

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Endangered; species or subspecies formally listed as endangered.
E(S/A)	Endangered due to similarity of appearance with listed species.
LT	Threatened; species or subspecies formally listed as threatened.
P	Potential Endangered or Threatened; species or subspecies formally Potential for listing as endangered or threatened.
PD	Potential for delisting
C	Candidate: species or subspecies for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
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: <ul style="list-style-type: none"> a. Significant current or predicted downward trends in population numbers or density. b. 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. This list does not include species that are listed endangered (LE) or threatened (LT).
State Status:	
1. Colorado Division of Wildlife	
	CO-E Endangered
	CO-T Threatened
	CO-SC Special Concern

Element Occurrence Ranking

Actual locations of elements, whether they be 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. In order to prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the estimated viability or probability of persistence (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 3 factors:

Size – a quantitative measure of the area and/or abundance of an occurrence such as area of occupancy, population abundance, population density, or population fluctuation.

Condition – an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include

reproduction and health, development/maturity for communities, ecological processes, species composition and structure, and abiotic physical or chemical factors.

Landscape Context – an integrated measure of the quality of biotic and abiotic factors, and processes surrounding the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include landscape structure and extent, genetic connectivity, and condition of the surrounding landscape.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If there is insufficient information available to rank an element occurrence, an EO-Rank is not assigned. Possible EO-Ranks and their appropriate definitions are as follows:

- A** Excellent estimated viability.
- B** Good estimated viability.
- C** Fair estimated viability.
- D** Poor estimated viability.
- E** Viability has not been assessed.
- H** Historically known, but not verified for an extended period of time
- X** Extirpated

Potential Conservation Areas

In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Conservation areas may include a single occurrence of a rare element or a suite of rare element occurrences or significant features. Not all element occurrences are included in PCAs. Sites are ordinarily drawn only for A to C ranked G1 to G3 and S1 or S2 elements or A ranked natural communities. Other lower ranked element occurrences may fall geographically within the site boundaries, and are thus included, but would not warrant a PCA on their own. In addition, sites may be drawn for lower ranked species that are of local conservation interest, *e.g.* Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*) which is a Forest Service sensitive species.

The goal of the process 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 of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses.

In developing Potential Conservation Area boundaries, CNHP staff consider a number of factors that include, but are not limited to:

- the extent of current and potential habitat for the elements present, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, e.g., by protecting recharge zones;
- land intended to buffer the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

The proposed boundary does not necessarily recommend the exclusion of all activity. It is hypothesized that some activities will prove degrading to the element or the processes on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based and other significant elements that fall within the site.

The boundaries presented here are 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 goals for 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 thoughtful land-use planning at all levels.

Off-Site Considerations

It is often the case that all relevant ecological processes cannot be contained within a Potential Conservation Area of reasonable size. For instance, while a PCA for Colorado River cutthroat trout may be drawn to include only the riparian zone of a river or creek, it should be remembered that activities in the entire watershed can affect water quality, which will in turn affect the trout population. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve countywide efforts as well as coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Potential Conservation Areas

Biodiversity Rank

One of the strongest ways that the CNHP uses element and element occurrence ranks is to assess the overall biodiversity significance of a site, which may include one or many element occurrences. If an element occurrence is unranked due to a lack of information the element occurrence rank is considered a C rank. Similarly, if an element is a GU or G? it is treated as a G4. Based on these ranks, each site is assigned a **biodiversity rank (B rank)**:

- B1** Outstanding Significance: the only site known for an element or an excellent occurrence of a G1 species.
- B2** Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.
- B3** High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.
- B4** Moderate or Regional Significance: good example of a community type, excellent or good occurrence of state-rare species.
- B5** General or Statewide Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g., agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land ownership or designation. The following codes are used to indicate the rating which best describes the urgency to protect the area:

- P1** Immediately threatened by severely destructive forces, within 1 year of rank date; protect now or never!
- P2** Threat expected within 5 years.
- P3** Definable threat but not in the next 5 years.
- P4** No threat known for foreseeable future.
- P5** Land protection complete or adequate reasons exists not to protect the site; do not act on this site.

A protection action involves increasing the current level of legal protection accorded one or more tracts of a potential conservation area. Protection strategies on private lands may

involve purchase, purchase of development rights, or conservation easements. On public lands, they may include special designations such as Wilderness, Research Natural Areas, or Areas of Critical Environmental Concern (ACEC). They 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. Protection in this sense does not include management actions. Threats that may require a protection action are as follows:

- 1) Anthropogenic forces that threaten the existence of one or more element occurrences at a site; e.g., development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence and timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- 2) The inability to undertake a management action in the absence of a protection action; e.g., obtaining a management agreement;
- 3) In extraordinary circumstances, a prospective change in ownership that will make future protection actions more difficult.

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate the time frame in which a change in management of the element or site must occur in order to ensure the element's future existence. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, 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, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). It may also include conducting further research or monitoring. Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

- | | |
|-----------|--|
| M1 | Management action required immediately or element occurrences could be lost or irretrievably degraded within one year. |
| M2 | New management action will be needed within 5 years to prevent the loss of element occurrences. |
| M3 | New management action will be needed within 5 years to maintain current quality of element occurrences. |
| M4 | Although the element is not currently threatened, management may be needed in the future to maintain the current quality of element occurrences. |
| M5 | No serious management needs known or anticipated at the site. |

II. Methods

The methods for assessing and prioritizing conservation needs over a large area are necessarily diverse. This study follows a general method that the Colorado Natural Heritage Program has and continues to develop specifically for this purpose. The San Juan County Biological Assessment was conducted in several steps summarized below.

Collect available information

CNHP databases were updated with information regarding the known locations of species and significant plant communities within San Juan County. A variety of information sources were consulted for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado and Fort Lewis College. Both general and specific literature sources were incorporated into CNHP databases, as either locational information or as biological data pertaining to a species in general. Such information covers basic species and community biology including range, habitat, phenology (timing), food sources, and substrates. This information was entered into CNHP databases.

Although no comprehensive biological survey had been done previously in San Juan County, this project is indebted to previous research by numerous scientists: William Baker conducted field surveys in the county in 1985; Colorado Natural Areas Program investigated iron fens; Tim Hogan surveyed the Needle Mountains in 1997, following up on a previous study by Joan Michener-Foote (Michener-Foote and Hogan 1997); San Juan National Forest Biologists, including Leslie Stewart, documented several rare plant locations. Results of current, continuing research were made available to us by Chris Schultz of the San Juan National Forest on Black Swifts and Boreal Owls, by Aaron Ellingson at Colorado State University on the Uncompahgre fritillary butterfly, and by David Cooper of CSU on iron fens. Sue Hirshman shared information and a photograph of a Black Swift. Collectors whose specimens from San Juan County are housed at herbaria include Joan Michener-Foote, Emily Hartman, Mary Lou Rottman, Tim Hogan, David Jamieson, Reed Rollins, and William Weber.

Identify rare or imperiled species and significant plant communities with potential to occur in San Juan County.

The information collected in the previous step was used to refine the potential element list and to identify our search areas. In general, species and plant communities that have been recorded from San Juan County or from adjacent counties are included in this list. Species or plant communities that prefer habitats that are not included in this study area were removed from the list.

The amount of effort given to the inventory for each of these elements was prioritized according to the element's rank. Globally rare (G1 - G3) elements were given highest priority, state rare elements were secondary.

Identify targeted inventory areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities. Known locations were targeted, and additional potential areas were chosen using a variety of information sources. Precisely known element locations were always included so that they could be verified and updated. Many locations were not precisely known due to ambiguities in the original data. In such cases, survey sites for that element were chosen in likely areas in the general vicinity. Areas with potentially high natural values were chosen using geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and preliminary roadside surveys by our field scientists. In addition, we took care that all major ecosystems, vegetation types and elevation zones in the area were included, as well as areas that are of particular local concern or interest for open space.

A public meeting was held in Silverton where information about targeted species and a draft of potential targeted inventory areas was presented for local input. In addition, individual meetings were held with members of our project advisory committee. Many helpful suggestions were received that guided our fieldwork.

Using the biological information stored in the CNHP databases, these information sources were analyzed for sites that have the highest potential for supporting specific elements. This process was used to delineate 52 areas that were believed to have relatively high probability of harboring natural heritage resources (Figure 1, Table 3). These areas vary in size from less than 10 to several thousand acres and include all major habitat types in the study area. At the request of the BOCC, we concentrated survey efforts on the Alpine Loop area, including tributaries of the northern Animas drainage.

Because of the overwhelming number of potential sites and limited resources, surveys for all elements were prioritized by the degree of imperilment. For example, all species with Natural Heritage ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage 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 as they were encountered.

An additional task was added, at the request of the BOCC, to document any occurrences of exotic plant species encountered in the back country. This complemented a survey done by Alan Carpenter that concentrated on major roadways. A draft weed report was delivered to the BOCC at the end of the field season, and is incorporated in this report (Chapter VII).

Contact Landowner

Obtaining permission to conduct surveys on private property was essential to this project. Because of the complex land ownership patterns and lack of reliable surveys in the Alpine Loop area, contacting landowners in advance of the survey was problematic. Major landowners were contacted, and when access was granted, these areas were visited. In cases where access was denied, properties were avoided. For the most part, surveys were conducted on public lands or from county roads and established trails that are open to the general public. However, private lands that were not visited may be included in Potential Conservation Areas if they are adjacent to and have similar habitats to public lands that were surveyed.

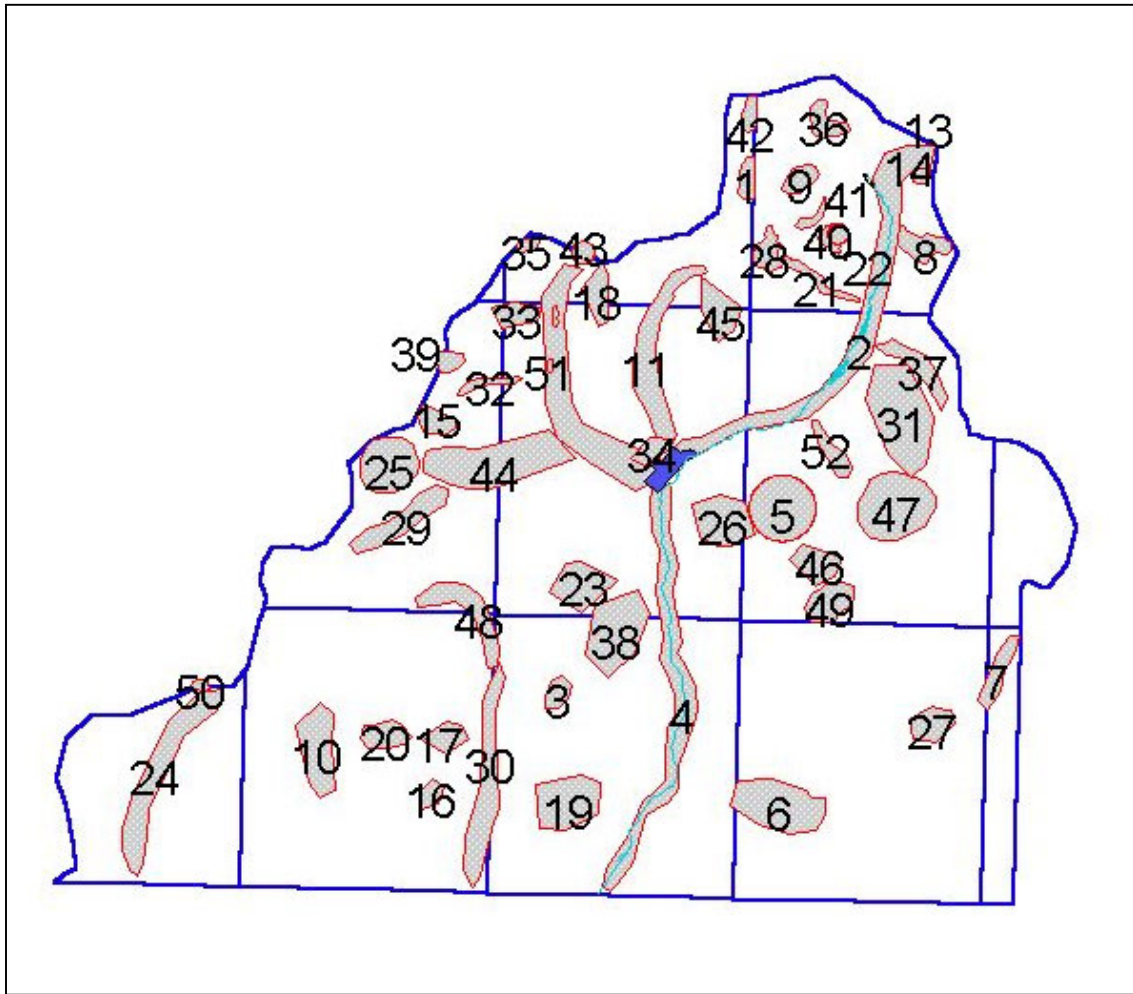


Figure 1. Targeted Inventory Areas.

Table 3. Key to Targeted Inventory Area Map.

Map key	TIA name	Major targets	Date surveyed
1	Alaska Basin	High elevation Plants	8-13-02
2	Alpine Loop	County request	7-1-02, + many
3	Andrews Lake	Carex viridula, Botrychiums	7-10, 7-12-02
4	Animas River South	Riparian	9-19-02
5	Arrastra Basin	High elevation Plants	8-27-02
6	Balsam Lake	Eriophorum, Parnassia updates	not
7	Bear Creek Headwaters	Wetlands	7-14-02
8	Burns gulch	Black Swift, High elevation Plants	7-5-02
9	California Gulch	Wetlands	7-27-02
10	Cascade Creek	Riparian	9-17-02
11	Cement Creek	Riparian	8-04-02
12	Chattanooga	Wetlands, mosses, lichens	8-06-02
34	Christ of the Mines Shrine	Weeds	7-24-02
13	Cinnamon Creek	Eriophorum	7-23-02
14	Cinnamon Mountain	Boloria	7-23-02
15	Clear Lake	Penstemon harbouri	7-07-02
16	Coal Bank Hill	Botrychiums	8-27-02
17	Coal Bank Pass	Draba, Besseyia	7-15-02
18	County Road 14	High elevation plants	7-22-02
19	Crater Lake	Draba graminea update	7-28-02
20	Engineer Mountain	High elevation plants	8-08-02
21	Eureka Gulch	High elevation plants	7-27-02
22	Eureka Mountain	Boloria	8-14-02
49	Fuller Lake	Boloria	7-09-02
23	Grand Turk	Draba strept, Mach colo.	7-14-02
24	Hermosa Creek	Riparian	8-06-02
25	Ice Lakes Basin	Draba graminea, Eriophorum, Asplenium	7-11-02
26	Kendall Mountain	High elevation plants	7-16-02
27	Kite Lake	Machaeranthera, Boloria	8-16-02
28	Lake Emma	Boloria	8-14-02
29	Lake Hope Trail	Draba graminea	8-27-02
30	Lime Creek	Riparian	7-9-02
31	Maggie Gulch	Black swift	8-05-02
32	Middle Fork Mineral Creek	Riparian	not
33	Mill Creek	Cryptogramma update	7-19-02
35	Mineral Basin	Tundra species, snow willow	7-02-02
36	Mineral Point	Wetlands	8-13-02
37	Minnie Gulch	Black swift	8-12-02
38	Molas Pass	Botrychiums	7-12 to 7-16 +
39	Ophir Pass	Drabas	7-04-02
40	Picayune Gulch	Wetlands	8-14-02
41	Placer Gulch	Tundra species	7-1-02
42	Poughkeepsie Gulch	Adiantum, Eriophorum	not
43	Red Mountain Pass	Draba graminea, D.spectabilis, D. fladnizensis	7-1-02
44	South Fork Cement Creek	High elevation plants	7-4-02
45	South Fork Mineral Creek	Riparian, wetlands	7-1-02
46	Spencer Basin	High elevation plants	7-26-02
47	Stony Pass	Draba streptobrachia, D. fladnizensis wetlands	7-19-02
48	West Lime Creek	Riparian	7-29-02
49	Highland Mary Lakes	Wetlands	9-15-02
50	Bolsam Pass	Wetlands	9-16-02
51	Burro Bridge	Iron fen	9-4-02
52	Cunningham Gulch	Wetlands	9-15-02

III. Results

CNHP began work on the San Juan County Biological Assessment in April 2002, by compiling existing data and identifying targeted inventory areas (TIAs) for field research. These sites were digitized and ownership was researched. Meetings were held with the county commissioners, advisory council members and the general public to explain the project and solicit guidance. Landowners were contacted for permission to access private land.

Fieldwork was completed in July, August and September 2002. Staff working on the project included Peggy Lyon, Botanist and upland ecologist; Denise Culver, Wetland Ecologist; and Lauren Hill, Zoologist. Approximately 75 areas were surveyed. Virtually all San Juan County roads were driven from beginning to end, and surrounding areas were searched on foot.

At the beginning of this survey, there were 87 records of plants, animals and natural communities in San Juan County in the CNHP data system. Of these, 28 were not ranked for quality of the occurrence, and 25 were based on historic records more than 20 years old. Historic records dated from 1911 to 1977. Only 54 records had precise location information.

As a result of this survey, 104 new or updated records were added. These included 71 plants, 9 animals and 24 natural communities. Thus, the information on biological diversity of the county was more than doubled. It should be noted that 2002 was a year of severe drought, and some plants failed to appear or to survive past early summer. Further surveys, especially for moonworts, are warranted in a wetter year.

Locations of these new occurrences were recorded with GPS and digitized in ArcView. These data were quality-control checked and entered into the CNHP data system. As a result of new findings from this survey, the rank of kittentails (*Besseyia ritteriana*) was changed from G2 S2 (imperiled) to G3 S3 (vulnerable).

Potential conservation areas were then identified and designed based on this information. Forty-eight potential conservation areas were identified, and are described in this report. They range in size from 15 to 2,769 acres. Each Potential Conservation Area is ranked on a scale of 1 to 5 for Biodiversity Significance. There are 10 B2 (Very High Significance), 20 B3 (High Significance), 11 B4 (Moderate Significance), and 7 B5 (General Significance) sites identified. These are listed below in order of biodiversity significance, and are described in Section VII, where they are listed alphabetically.

B2 PCAs:

Animas River Canyon
Burro Bridge Iron Fen
Cement Creek Iron Fen
Chattanooga Iron Fen
Crater Lake
Grand Turk South
Ice Lake Basin
Lake Como
South Fork Mineral Creek
Stony Pass

B3 PCAs:

Burrows Creek Uplands
California Gulch at Animas River
Cascade Creek at Purgatory
Cinnamon Pass
Clear Lake
Coal Bank Pass
Hermosa Creek
Howardsville
Kendall Mountain
Kite Lake
Lime Creek
Maggie Gulch
Mineral Basin
Mineral Point
Molas Pass
Picayune Gulch
Pole Creek
Ross Basin
South Fork Cement Creek
South Twilight Peak

B4 PCAs:

Balsam Lake
Burns Gulch
Coal Bank Hill
Elk Creek Headwaters
Middleton
Red Mountain Number One
Red Mountain Pass
Rolling Mountain
U. S. Basin
Vestal Lake
West Lime Creek

B5 PCAs:

Burrows Creek-Mineral Creek Headwaters
Coal Creek at Highway 550
East Fork Hermosa Creek
Mill Creek at Chattanooga
Ophir Pass
Placer Gulch
Spencer Basin

The Natural Heritage of San Juan County

Location and Ecoregion

San Juan County is located in southwestern Colorado, in the San Juan Mountain range. It falls within the Southern Rocky Mountain Physiological Province as defined by Bailey (1994), and the Colorado Rocky Mountains Ecoregion as defined by The Nature Conservancy (Figure 2). It is bordered by Ouray, San Miguel, Dolores, La Plata and Hinsdale counties. In the northern and western part of the county the boundaries follow the divides between major river drainages: on the west, the divide between the Animas River and the San Miguel and Dolores River drainages; on the north the divide between the Animas and Uncompahgre River; and on the northeast, the Continental Divide, separating the Animas from the Rio Grande River drainage. In the southern part of the county, political boundaries replace the natural hydrologic boundaries. The boundary between San Juan and La Plata counties is a straight east-west line, while the southern half of the eastern boundary between San Juan and Hinsdale counties is a straight north-south line.

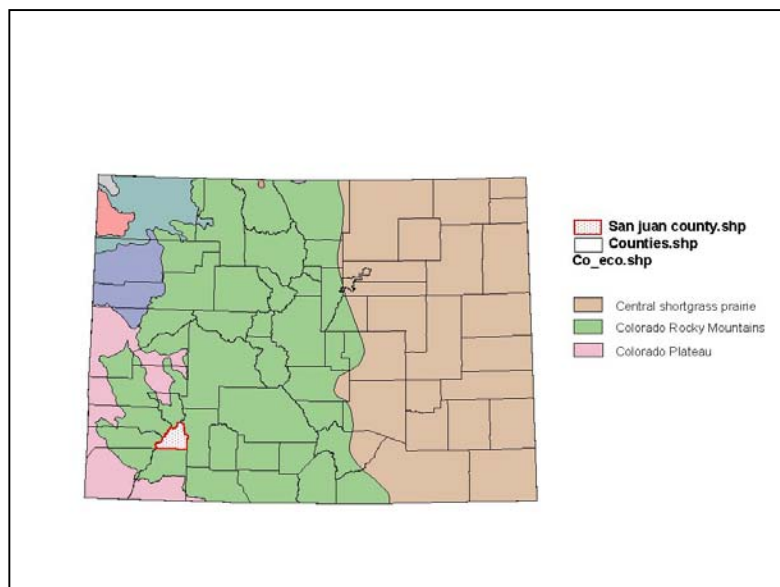


Figure 2. Ecoregions of Colorado. San Juan County is located in the Colorado Rocky Mountains Ecoregion, and

Size and Elevation

San Juan County encompasses 389 square miles, making it the third smallest county in Colorado (after Gilpin and Lake). Elevations in the county range from 8,275 feet at the point where the Animas River crosses into La Plata County at Needleton, to 13,894 feet at the summit of Vermilion Peak, on the border of San Juan and San Miguel counties. Although the county contains no peaks over 14,000 feet, it has more area above 13,000 feet than any other Colorado county.

Hydrologic units

The majority of the county is in the drainage of the Colorado River, west of the Continental Divide. Snowfall in the high mountains feeds the Animas River, which flows from north to south through the center of the county. The Animas is a tributary of the San Juan River, which in turn joins the Colorado River to flow to the Gulf of California. Lime Creek, Mineral Creek and Hermosa Creek are major tributaries of the Animas and drain large areas on the west side of the county. Smaller tributaries of the Animas within San Juan County include, from south to north, Ruby Creek, Noname Creek, Tenmile Creek, Elk Creek, Molas Creek, Whitehead Gulch, Deer Park Creek, Kendall Gulch, Cement Creek, Boulder Gulch, Arrastra Creek, Cunningham Creek, Maggie Gulch, Minnie Gulch, Eureka Gulch, and Cinnamon Creek. A small part of the county lies east of the Continental Divide in the drainage of the Rio Grande River, fed by tributaries Bear Creek and Pole Creek.

Climate

The climate of the Southern Rocky Mountain Province is a temperate semiarid steppe regime with average annual temperatures ranging from 35 to 45F (2 to 7C) in most of the region, but reaching 50F (10C) in the lower valleys (Bailey 1994). Climate is influenced by the prevailing west winds that carry storms from the Pacific, and the general north-south orientation of the mountain ranges. Winter precipitation varies with altitude. In the mountains, a considerable part of annual precipitation is snow, although permanent snowfields and glaciers cover only relatively small areas. Weather records from Silverton have been kept for 79 years. The coldest temperature recorded was -39 degrees F. Mean daily temperatures at Silverton range from a low of -1 to 34 degrees in January to 38 to 73 degrees F in July. Average annual precipitation is 25 inches. March generally has the highest snowfall, followed by April. Snowmelt begins in mid- to late May, peaking in early June. July and August bring the southwest monsoons, with frequent afternoon thunderstorms. September and October tend to be dry and sunny. Winter storms begin in November.

Geology

San Juan County has a complex geology resulting from a combination of mountain building (uplifting, volcanism) and erosion (weathering, glaciation). Exposed rock in the county spans the spectrum of geologic ages, from the Precambrian rock of the Needle Mountains to the extensive evidence of Quaternary Pleistocene (Ice Age) glaciation (Chronic 1980). The county is rich in spectacular geologic features such as sharp jagged peaks, contrasting flat, fragmented rock peaks, rolling high country, flat valley bottoms, U-shaped and steep canyon valleys, and rock glaciers.

The oldest rocks are Precambrian age, more than 570 million years old. Many cycles of uplifts and erosion occurred during this period. Precambrian rocks are exposed in the Grenadier Range, where they are composed of hard quartzites of the Uncompahgre Formation. The Needle and West Needle Mountains are uplifts of hard Precambrian granite, resulting in sharp peak summits and smooth rock faces that appear untouched by erosion (Blair 1996). Gneiss from the Precambrian era surfaces at Lime Creek.

During the Paleozoic Era, between 570 and 245 million years ago, sandstones, limestones and shale originated in periods of deposition of sediments by inland seas alternated with periods of erosion. South of Silverton these rocks are exposed. They include the Leadville limestone, Molas and Ouray formations visible in the Molas Pass area. Sedimentary rocks of the Hermosa formation from the Permian and Pennsylvanian Eras dominate the southern part of the county. Since they were deposited, these formations have been tilted, faulted and eroded.

Leadville limestone can be seen north of Molas Pass and on the south side of Coal Bank Hill. At Molas Lake, the top of the Leadville Limestone is exposed and forms an irregular karst surface containing fossils of the Mississippian Period. Molas Lake and several smaller ponds are formed from sinkholes in the karst. One of the striking features of the topography of San Juan County is the limestone ledges that occur at Molas Pass. Horizontal ledges formed from alternating layers of Pennsylvanian sandstone, shale and limestone, deposited in cycles as sea levels changed are visible from Highway 550 (Figure 3).



Figure 3. Ledges of limestone and sandstone on the slopes of Grand Turk Mountain, near Molas Lake.

The age of volcanism in the San Juans began in the Tertiary Period, between 30 and 35 million years ago, with the formation of large stratovolcanoes, similar to present day Mount Rainier. Explosive late Tertiary eruptions deposited thick layers of ash over the area. This caused the collapse of the stratovolcanoes, forming calderas, including the San Juan, Lake City, Uncompahgre and Silverton Calderas. Faults ringing the calderas were infused with mineral rich water, which precipitated gold, silver, lead and zinc deposits of the Colorado Mineral Belt. Present rivers, including the Animas River and Mineral Creek follow faults that rimmed the Silverton Caldera.

The landscape was again dramatically altered during the Pleistocene (Ice Age), which reached its last maximum about 18,000 years ago. The area was ice free about 15,000 years ago. Glacial features evident throughout the county include U-shaped valleys, cirques, horns and arêtes. Peaks such as Engineer, Grand Turk and Sultan are “nunataks” or peaks that survived glacial erosion. Post-glacial weathering by freezing and thawing of brittle volcanic rock has created rubble-topped mountains, extensive talus fields and rock glaciers (Figure 4), tongue shaped rock flows which may have old glacial

ice at their core (Blair 1996). Over 650 rock glaciers have been documented in the San Juans. Other post-glacial features that can be observed are stream erosion, deepening canyons and forming terraces, and mass wasting, including landslides, debris flows and avalanches. For more detailed information on the geology of the San Juans, an excellent source is The Western San Juan Mountains, Their Geology, Ecology, and Human History by Blair and others (1996).



Figure 4. Rock glacier at Engineer Mountain.

Soils

Soil orders occur in zones corresponding to vegetation. Soils in the spruce-fir zone are acidic, and often shallow and infertile, due to their recent origin, leaching and the acidic foliage. There is little bacterial activity at the low temperatures of this zone, and much of the carbon in the ecosystem is locked up in humus (Blair 1996).

Alpine soils tend to be shallow, poorly developed mineral soils with very limited organic matter. An exception is the accumulation of peat in fens, in low areas where soils are not washed away. Soils derived from volcanic tuff are highly erodable, and may provide habitat for some of the area's rare plants by continually opening up bare areas that are free from competition of other plants. Information about soils of specific areas is included in the descriptions of the Potential Conservation Areas.

Cultural Heritage and Economics

Gold was discovered in the San Juan Mountains in 1871, and thousands of mining claims were staked in the upper Animas River above Silverton within a short period. From the early 1900s until 1991, the Sunnyside Mine produced tremendous amounts of ore that was trucked from Gladstone to the Mayflower Mill east of Silverton. At its height it produced 800 tons of ore daily. The Denver and Rio Grande railroad was extended from Durango to Silverton in 1882 and ore production continued at various

levels until 1991 when the Sunnyside Mine was closed. Today San Juan County has the lowest population of any county in Colorado, at 558 (Colorado Counties online 2003). Recent population declines since the closure of the mines is of concern to residents, and forces novel solutions to economic challenges. Many residents hold more than one job. The school has adopted an innovative program that is suited to the low student numbers.

There is virtually no crop production in the county, due to the high elevation, cool climate and rugged topography. Cattle grazing is restricted to a very small area in the Hermosa Creek drainage. Sheep, however, are ubiquitous, and much of the public land is in grazing allotments.

Since the mine closures, the county has relied on tourism for its economic base. The mining heritage is a popular attraction, and county roads are often heavily traveled by four-wheel drive vehicles and all-terrain vehicles during the summer months. The most popular sightseeing area is known as the Alpine Loop, extending from Silverton to Lake City and over Engineer Pass to Ouray County, and then along Highway 550 back to Silverton. Highway 550 has been designated a scenic byway, part of the San Juan Skyway that makes a loop from Silverton to Durango, Cortez, Telluride, Ridgway and Ouray, and back to Silverton. Travelers who take the Durango-Silverton train disembark *en mass* in the summer, to enjoy the restaurants and shops of Silverton. Other recreational opportunities include hiking, camping, horseback riding, cross-country and downhill skiing, snowmobiling, and hunting.

Mine Reclamation

A community based effort to improve the quality of water and aquatic habitat in the Animas River has been underway since 1996. Low diversity and abundance of aquatic life is caused by chemical and physical impacts of metals and acidity from a combination of natural weathering of mineralized rock and discharges from historic mines (USDI 2000; USGS 2000). The high acid content allows the water to carry high levels of heavy metals such as zinc, copper, cadmium, arsenic, and mercury. The Animas River Stakeholders Group, which includes federal land management agencies, the county and city governments and many other entities, has led a four stage project to characterize and prioritize impacts, remediate high priority mines and monitor results. Studies conducted include biological surveys of fish and invertebrates and monitoring of copper and zinc levels at many locations. By intensive study of the sources of acid and metals, the number of mines requiring cleanup has been reduced from a potential of 1500 to about 100. Remediation is progressing, and tangible improvements in water quality have been documented. This is expected to be a long term project, extending for at least 20 years.

More information on mine cleanup is available from the Animas River Stakeholders Group website <http://www.waterinfo.org/arsg> and the BLM's website at <http://www.co.blm.gov/mines/upperanimas>.

Land ownership

San Juan County consists primarily of San Juan National Forest, BLM and private lands (Figure 5). The northeastern quarter of the county is a complex mosaic of BLM and private mining claims. Much of the land has never been surveyed, and property boundaries are questionable. There are approximately 3,650 individual claims, with an average size of about 10 acres. Mining claims are more sparse in the northwestern quarter and nearly absent in the south half. Much of the rest of the county is National Forest land, with some private inclusions. East of the Continental

Divide, the Rio Grande National Forest comprises an area of about 8000 Ha. The Weminuche Wilderness is located in the southeastern part of the county, and extends into La Plata and Hinsdale counties. A small area in the northeast is managed by the Gunnison National Forest.

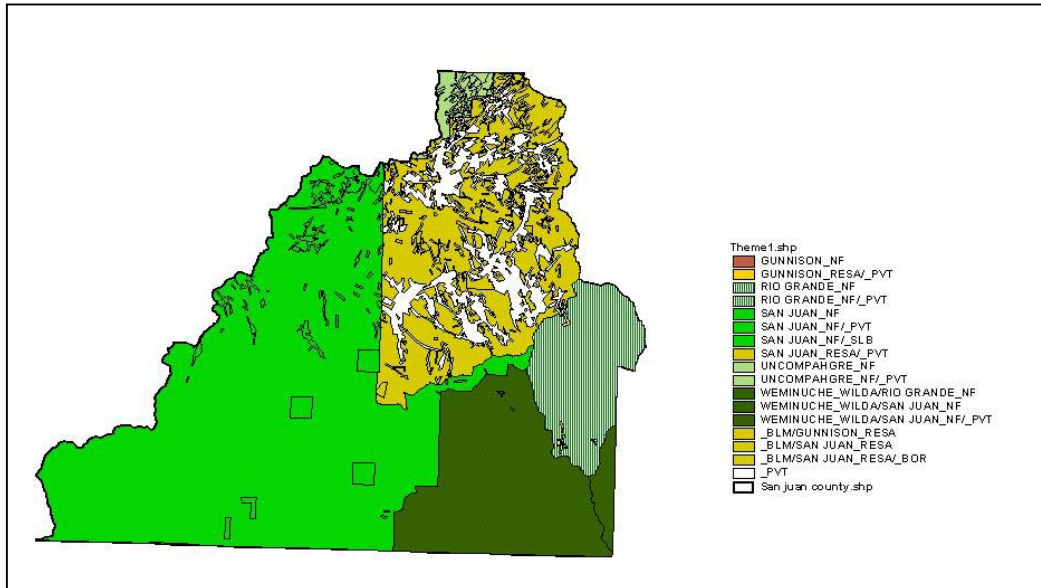


Figure 5. Land ownership in San Juan County. The northeastern quarter of the county is a complex mosaic of BLM lands and private mining claims, mostly unsurveyed. About three quarters of the county is San Juan National Forest land.

Threats to the Biodiversity of San Juan County

Development: Land ownership patterns in San Juan County differ from those in most Colorado counties, in that there are about 1500 deeded mining claims, averaging around 10 to 15 acres each, interspersed with public lands.

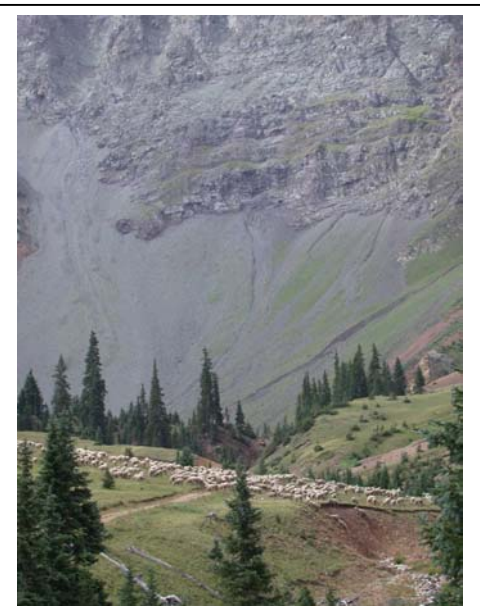
Development of many of these could seriously fragment the landscape and probably cause direct disturbance to plants, plant communities and wildlife.

However, many of these parcels are located in areas where building is precluded by steep terrain, lack of access, wetlands and avalanche danger. San Juan County does not face the prospect of subdivision of large ranches that is common in much of Colorado.



Figure 6. Advertising for real estate is the first thing that a visitor encounters when entering San Juan County from the north at Red Mountain Pass.

Water quality: Historic mining exacerbated the already acid and metal laden waters of the upper Animas River, making it unsuitable for fish or most invertebrates. Much work is in progress to alleviate this problem, and there is hope that a sustainable fishery will eventually be developed.



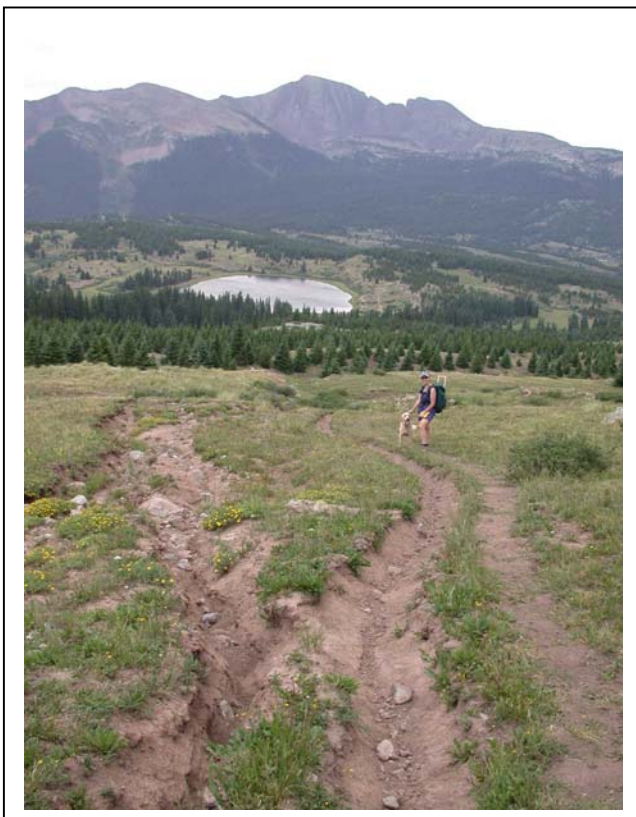
Livestock grazing: There is virtually no cattle grazing in the county. Sheep graze the high country above timberline in the summer. There are probably effects of grazing in changes in plant composition and erosion, but these are difficult to document without long term monitoring. Sheep can consume vegetation that holds the soil and cause erosion, and directly disturb soil by trailing. It has been suggested that the small population of the Uncompahgre fritillary butterfly at Cinnamon Pass has been reduced by reduction of floral diversity and trampling of the host plant (snow willow, *Salix reticulata* ssp. *nivalis*). Some areas observed during this survey were eroded by sheep (figure 7_.) Attentive herding to keep the sheep out of wetland areas will benefit the wetland communities.

Figure 7. Sheep at South Fork Cement Creek

Road building and maintenance: The county road system provides access to much of the scenic back country of San Juan County, and is an important asset of the tourist industry. Roads inevitably act as corridors for the spread of exotic species, directly disturb the vegetation and soils in their immediate vicinity and open up large areas to hikers and off-road vehicles. Dust and soil erosion can contribute to the load of pollutants in the Animas River. However, the high quality of the county roads probably reduces the impacts that would be incurred if old mining roads were not well maintained.

Off road vehicles: Motorcycles and 4-wheelers are abundant in the summer in San Juan County's high country. Most users stay on county roads and do not cause undue destruction. However, some areas, such as Poughkeepsie Gulch and Black Bear Pass have been severely damaged by vehicles creating new routes in addition to the established roads. Clearly marking the accepted route may help keep traffic off alternate routes. Continued public education is important to instill a conservation ethic and conserve the natural vegetation and scenery of the mountains.

Exotic species: Only a few instances of exotic species invasion into the back country were observed (see Exotic species section of this report). However, constant vigilance will be required to maintain the pristine condition.



Foot traffic: Some hiking trails and off-trail areas are showing erosion from foot traffic (Figure 8). Clearly marked trails and continued public education will help to keep traffic off fragile tundra areas.

Figure 8. Eroded hiking trail above Little Molas Lake

Vegetation

Vegetation of San Juan County falls into three major elevation zones: montane, subalpine and alpine. Missing are the lower elevation zones of shrub-steppe, pinyon-juniper, mountain shrub and ponderosa pine woodlands. Each zone may extend downward on cooler, north facing slopes or in ravines, or upward on warm, south facing slopes.

San Juan County lies within the Southern Rocky Mountain Ecoregion. CNHP classifies vegetation based on the USNVC (Anderson et al 1999). The Nature Conservancy's Southern Rocky Mountain Ecoregional Assessment (Neely *et al.* 2001), aggregates plant communities into Ecological Systems (dynamic assemblages or complexes of plant and/or animal communities that 1) occur together on the landscape; 2) are tied together by similar ecological processes, underlying abiotic environmental factors or gradients; and 3) form a readily identifiable unit on the ground). The Nature Conservancy lists 39 ecological systems for the Southern Rocky Mountains Ecoregion, which were described, along with specifications on viability, by Rondeau (2001). Of these, 14 occur in San Juan County (Table 4). Each is characterized as matrix (covering large areas and uniting the landscape within which smaller systems are included), large patch, small patch or linear (as in riparian systems). Some systems, such as alpine-subalpine wet meadows may fall into more than one elevation zone.

Each system may comprise one or several natural communities, or plant associations (PAs). For example, the alpine-subalpine wet meadow ecological system in San Juan County includes the *Carex buxbaumii* sedge wet meadow community, as well as similar sedge meadows dominated by *Carex vernacula*, *Carex praegracilis* and *Carex aquatilis*.

Table 4. Ecological Systems of San Juan County. (PAs indicates number of plant associations in system throughout its range)

	Patch size	PAs
Alpine Zone		
Alpine Substrate/Ice Field	Small Patch	4
Alpine Tundra Dry Meadow	Matrix	21
Alpine Tundra Fell-Field	Small Patch	1+
Alpine Dwarf Shrubland	Large Patch	3
Alpine/Subalpine Wet Meadow	Small Patch	27
Subalpine Zone		
Alpine/Subalpine Wet Meadow	Small Patch	27
Spruce-Fir Dry-Mesic Forest	Matrix	13
Spruce-Fir Moist-Mesic Forest	Matrix	7
Upper Montane Zone		
Aspen Forest	Matrix	22
Montane Moist-Mesic Mixed Conifer Forest	Matrix	10
Montane Dry-Mesic Mixed Conifer Forest	Matrix	7
Montane Grassland	Large Patch	15
Montane Fen	Small Patch	4
Upper Montane Riparian Forest and Woodland	Linear	20
Montane / Subalpine Riparian Shrubland	Linear	53

Vegetation of the Montane Zone is found from the lowest elevations in the county, at 8,274 feet, to about 10,000 feet, depending on factors such as slope and aspect. Forests of aspen (*Populus tremuloides*) and mixed conifers form the matrix systems of this zone, where they may be interspersed with grassy areas and wet meadows. Riparian communities in the montane zone are usually dominated by blue spruce (*Picea pungens*), narrowleaf cottonwood (*Populus angustifolia*), and tall willows such as mountain willow (*Salix monticola*) and Drummond's willow (*S. drummondiana*). Other trees that occur in the montane zone in San Juan County are white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), and New Mexican white pine (*Pinus strobiformis*).

In the subalpine zone, Engelmann spruce (*Picea engelmannii*) and subalpine or corkbark fir (*Abies lasiocarpa* var. *lasiocarpa* or var. *arizonica*) form the matrix systems, extending to treeline, which is usually around 11,500 feet. Engelmann spruce is the most common tree at this elevation. Subalpine and corkbark fir are most often found as subdominants, under the spruces. Although some ecologists theorize that fir will eventually dominate the spruce, given a long enough period with no disturbance, there are few fir-dominated areas to be found in the county. It may be that the two species will remain in their present relationship indefinitely. Aspen forests also extend into the subalpine zone, often as seral communities after fire or other disturbance.

Although fire is typically infrequent in this zone, when it does occur the forest may be very slow to recover. A catastrophic wildfire known as the Lime Creek Burn occurred in the Molas Pass area in 1879, and much of the area is still treeless. Lodgepole pine (*Pinus contorta*) which is not native to this area was planted with the hope that it would provide a nurse crop for spruce (Redders, USFS, personal comm.). However, the lodgepole has persisted to the present.

At the upper limit of this zone, trees become sparse and stunted, eventually forming krummholz, thickets of dwarfed trees buffeted by wind to become one-sided. Riparian communities in the subalpine zone most often have willows of smaller stature, such as planeleaf willow (*Salix planifolia*) and shortfruit willow (*S. brachycarpa*). Meadows and parks are interspersed with forested areas, and may result from a number of different causes. They may occupy old lakebeds; areas where the substrate will not support tree growth; or areas with cold air drainage.

Alpine ecological systems include dry meadows, wet meadows, dwarf shrublands, fellfields and rock outcrops or ice fields. The alpine tundra dry meadow ecological system is the matrix system of the Southern Rocky Mountains Ecoregion alpine zone. These dry meadows occur between 10,000 and 14,000 feet on gentle to moderate slopes, flat ridges, valleys, and basins, where the soil has become relatively stabilized and the water supply is more or less constant. The alpine tundra dry meadow system is commonly comprised of a mosaic of large patch plant communities that are dominated by sedges, grasses, and forbs. Dominant species include alpine sagebrush, blackroot sedge, dryspike sedge, rock sedge, whortleberry, tufted hairgrass, alpine fescue, alpine avens, kobresia, and alpine clover (*Artemisia scopulorum*, *Carex elynoides*, *C. foenea*, *C. rupestris*, *Vaccinium* sp., *Deschampsia cespitosa*, *Festuca brachyphylla*, *Geum rosii*, *Kobresia myosuroides*, and *Trifolium dasyphyllum*). Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season (Rondeau 2001).

Within each of these zones and systems a number of recognized natural communities or plant associations are named according to the dominant species of each

layer. For example, a common plant community in the Subalpine Zone, Spruce-fir Dry-Mesic Forest system, in San Juan County is *Abies lasiocarpa/Vaccinium myrtillus*, or subalpine forests. A plant community may occur in more than one zone. CNHP tracks all occurrences of plant communities that are considered to be imperiled. In addition to rare plant communities, we have documented excellent quality examples of the more common plant communities found here. Plant communities documented in San Juan County that are represented in Potential Conservation Areas are listed in Table 5. Descriptions of each community follow. Much of the information on riparian and wetland plant communities was derived from the Colorado Wetland Classification (Carsey *et al.* 2003).

Table 5. Natural Communities documented from San Juan County arranged by global rank.

Scientific name	Common name	Global rank	State rank	Potential Conservation Area
<i>(Picea engelmannii)/Betula glandulosa/Carex aquatilis/Sphagnum angustifolium</i>	Iron fen	G2	S2	Chattanooga fen, Cement Creek, South Fork Mineral Creek, Burro Bridge
<i>Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum</i>	Montane riparian forests	G2	S2	
<i>Abies lasiocarpa/Trautvetteria carolinensis</i>	Subalpine fir/Carolina tasselrue	G3	S2?	Balsam Lake
<i>Abies lasiocarpa/Vaccinium myrtillus</i>	Subalpine forests	G5	S5	Balsam Lake
<i>Abies lasiocarpa-Picea engelmannii/Salix drummondiana</i>	Montane riparian forest	G5	S4	Lime Creek
<i>Abies lasiocarpa-Picea engelmannii-Populus angustifolia/Lonicera involucrata</i>	Montane riparian forest	G4	S3	Lime Creek
<i>Calamagrostis canadensis</i>	Montane wet meadows	G4	S4	California Gulch
<i>Cardamine cordifolia-Mertensia ciliata-Senecio triangularis</i>	Alpine wetlands	G4	S4	Ice Lake Basin
<i>Carex aquatilis</i> (common community not included in CNHP database, but typical of San Juan County wetlands.	Montane wet meadows	G5	S4	(no PCA)
<i>Carex buxbaumii</i>	Buxbaum's sedge wet meadow	G3	SU	Molas Pass
<i>Carex praeegracilis</i>	Clustered sedge wetland	G3G4	S2	California Gulch
<i>Carex vernacula</i>	Alpine wetlands	G3?	S3?	Ice Lake Basin, Elk Creek Headwaters, U. S. Basin, Cinnamon Pass
<i>Danthonia intermedia</i>	Montane grasslands	G2G3	S2S3	Burrows Creek Uplands
<i>Danthonia parryi</i>	Montane grasslands	G3	S3	Howardsville
<i>Festuca thurberi-Lathyrus leucanthus</i>	Montane grasslands	G4	S4	West Lime Creek
<i>Picea pungens/Alnus incana</i>	Montane riparian forests	G3	S3	Animas River Canyon
<i>Populus angustifolia/ Salix (monticola, drummondiana)</i> woodland	Narrowleaf cottonwood/Mixed willows montane riparian forests	G3	S3	Lime Creek
<i>Populus angustifolia-Picea pungens/Alnus incana</i>	Montane riparian forests	G4	S4	Lime Creek
<i>Populus angustifolia-Pseudotsuga menziesii</i>	Montane riparian forest	G3	S2	Animas River Canyon
<i>Salix boothii</i> /mesic forb	Booth's willow/mesic forb	G3	S3	Pole Creek
<i>Salix brachycarpa</i> /mesic forb	Alpine willow scrub	G4	S4	Molas Pass
<i>Salix drummondiana/Calamagrostis canadensis</i>	Lower montane willow carrs	G3	S3	South Fork Mineral Creek, Middleton
<i>Salix geyeriana-Salix monticola/Calamagrostis canadensis</i>	Montane willow carrs	G3	S3	South Fork Mineral Creek
<i>Salix planifolia/Calamagrostis canadensis</i>	Subalpine riparian willow carr	G4	S3	Chattanooga Fen
<i>Salix planifolia/Caltha leptosepala</i>	Subalpine riparian willow carr	G4	S4	Vestal Lake

In addition to the above, several other communities that have not been documented are known or expected to be present in San Juan County. These include:

Aquilegia coerulea-Cirsium scopulorum (Alpine fellfields) GU SU
Betula glandulosa/mesic forb-mesic graminoid (Subalpine riparian shrubland) G3G4 S4
Caltha leptosepala (Montane wet meadows) G4 S4
Carex illota (Alpine wetlands) GUQ S1?
Carex microptera (Montane wetland) G4 S2?
Carex elynoides-Oreoxis spp. (Dry alpine meadows) G4 S4
Carex scopulorum/Caltha leptosepala (Alpine wetlands) G4 S4
Carex utriculata (Beaked sedge montane wet meadows) G5 S4
Deschampsia cespitosa (Mesic alpine meadow) G4 S4
Deschampsia cespitosa-Caltha leptosepala (Mesic alpine meadows) G4 S4
Deschampsia cespitosa-Geum rossii (Mesic alpine meadows) G5 S5
Geum rossii-Polygonum bistortoides (Alpine meadows) G4G5 S4S5
Geum rossii-Sibbaldia procumbens (Mesic alpine meadows) GU SU
Geum rossii/Trifolium spp. (Alpine meadows) G3 S3S4
Polemonium viscosum (Alpine meadows) G3G4 S3S4
Populus tremuloides/Festuca thurberi (Aspen forests) G4 S4
Populus tremuloides/tall forbs (Montane aspen forest) G5 S5
Salix planifolia/Deschampsia cespitosa (Subalpine riparian willow carr) G2G3 S3
Salix planifolia/mesic forbs (Planeleaf willow/mesic forbs) G4 S4
Sedum rhodanthum (Alpine wetland) GU SU
Senecio taraxacoides-Oxyria digyna (Alpine talus) GU SU
Sibbaldia procumbens (Mesic alpine meadows) G3? SU

(Picea engelmannii)/Betula glandulosa/Carex aquatilis/Sphagnum angustifolium
Iron Fen
G2 S2

Iron fens are peatlands with acidic waters and high concentrations of dissolved ions. Fens are distinguished from bogs, marshes, swamps by the presence of undecomposed organic material (peat), typically 40 cm. or more deep; a water source from springs or groundwater; and vegetation dominated by sedges and grasses.

Two of the most striking characteristics of iron fens are their limonite ledges and their characteristic suite of acid-tolerant plants. Limonite ledges form when iron precipitates into the substrate, usually thick layers of peat, and solidifies the substrate, forming hard rock ledges many meters thick (Figure 10). Springs often bubble up from the tops of the ledges, continually depositing more iron. Iron fens often have networks of small pools and ponds (CNHP 2003). Water sources for these fens originate on hillsides of iron pyrite-rich fractured bedrock and talus (Cooper *et al.*, unpublished).

This plant association usually occurs on very wet, gentle, lower slopes in fairly wide valleys in the subalpine zone (Cooper *et al.*). The San Juan County sites, Chantangooga Fen (Figure 9), Burro Bridge, Cement Creek and South Mineral Creek, all conform to this typical terrain. Common associated vegetation includes *Betula glandulosa* (bog birch), *Carex aquatilis* (water sedge), *C. utriculata* (beaked sedge), *Vaccinium scoparium*, *V. myrtillus*, *V. caespitosum* (the heaths and huckleberries), *Gaultheria humifusa* (creeping wintergreen) and/or *Kalmia microphylla* (swamp-laurel). *Calamagrostis canadensis* (bluejoint reedgrass) is also common in the understory. Patches of *Picea engelmannii* (Engelmann spruce), *Abies lasiocarpa* (subalpine fir), or *Pinus contorta* (lodgepole pine) may occur in areas raised slightly above the level of standing water (CNHP). See the descriptions in the PCA profiles section of this report for associated species at each of the San Juan County fens.

Iron fens have been documented only from Colorado, all in its mineral belt, but may occur in other Rocky Mountain states (CNHP 2003). Mineralized zones in Idaho, Montana, Wyoming, and South Dakota may contain similar wetland communities. This association is similar to the *Betula glandulosa* / Mesic Forb – Mesic Graminoid type, but is distinguished from it by water chemistry, limonite deposits and the presence of *Sphagnum* moss.

The community is ranked G2 globally, and S2 in Colorado, imperiled because of rarity (5-20 occurrences). There are 13 iron fens known in Colorado, four of which are in San Juan County.

This uncommon community appears to be stable and long-lived. Iron-saturated peat layers may be up to 10 to 15 feet deep. As long as iron-rich waters flow from springs in these sites, deeper layers of peat will continue to accumulate, acidic conditions will prevail, and the same suite of plants will persist. Drier conditions could lead, over time, to a reduction in the acidity of soils and to replacement of the iron fen community with the surrounding spruce-fir forest.

Some iron fens were mined to extract iron early in the 1900s. Although the mining altered sites considerably, where iron-rich springs still flow, fens persist and continue to regenerate. Iron fens are typically too wet to be used for grazing, recreation,

or development. It may be necessary, however, in some areas where recreational use is significant, to protect fens with fences or signing. In at least one fen evaluated in Colorado, vehicle tracks were found through a significant portion of the fen. Such tracks will drain and dry out parts of the fen, potentially changing the plant association (CNHP 2003). Mine reclamation projects, where contaminated water is diverted to prevent pollution of streams, should not affect the San Juan County fens unless the source of the springs feeding them is altered. The fens existed long before the days of mining. However, if mines above any of the four iron fens in San Juan County are reclaimed, it would be advisable to study the associated hydrology to assure that the source of the fens' water will not be dried up.



Figure 9. Iron fen at Chattanooga.



Figure 10. Limonite ledges at Burro Bridge.

Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum
Montane riparian forests
G2 S2

Abies concolor - *Picea pungens* - *Populus angustifolia* / *Acer glabrum* (white fir - blue spruce - narrowleaf cottonwood / Rocky Mountain maple) is a global and state imperiled (6 to 20 occurrences) montane riparian forest. This community is known from fewer than 20 stands in the San Juan and Sangre de Cristo Mountains of southern Colorado. (CNHP 2003). It is documented in San Juan County in the Animas River Canyon.

This plant association is a diverse, mixed conifer-deciduous forest occurring on active floodplains and streambanks of montane valley floors. The presence of *Abies concolor* distinguishes it from the more common *Populus angustifolia* - *Picea pungens* / *Alnus incana* (narrowleaf cottonwood-blue spruce/thinleaf alder) plant association, and is characteristic of the southern-most mountains in Colorado. Blue spruce (*Picea pungens*) is often an upper canopy component, but it is not present in all stands.

Forage productivity for this plant association can be high and very palatable. Cottonwood seedlings and saplings and the associated shrub species are frequently browsed. This plant association also provides excellent hiding and thermal cover for mammals and birds (Hansen *et al.* 1995).

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. One example is upstream dams stabilizing stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that allow cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by upland species, such as conifers in montane areas or other, more drought tolerant species in the foothill and plains environments (Hansen *et al.* 1995). The Animas River Canyon PCA contains an unusual, unaltered river flow, allowing for the natural regeneration of cottonwoods and the native plant associations. Other disturbances, such as excessive grazing or other modes of weed introduction are also absent, or reduced, by the limited accessibility of the canyon. Weed introduction from the railroad, hikers and horse packing are thought to be minimal at this time.

Abies lasiocarpa/Trautvetteria caroliniensis
Subalpine fir/Carolina tasselrue
G3 S2?

Until recently, the *Abies lasiocarpa/Trautvetteria caroliniensis* plant association was known only from northwestern states, Washington, Oregon and Idaho. There are now three documented occurrences in Colorado. It was observed in Archuleta County during a CNHP survey for the San Juan National Forest in 2001, and in San Juan and La Plata counties by Tim Hogan in 1997 (Michener-Foote and Hogan 1997).

Large trees on very moist sites typify this association. Elevations range between 4000-5000 feet in the northwest, but it is found from 10,900 to 11,300 feet in Colorado. Aspects are variable. Soils are silt loams and silt that are relatively deep. Hogan took plot data at Balsam Lake. The community occurred in small patches within the matrix of the more common *Abies lasiocarpa/Vaccinium myrtillus* plant association. The association occupied sites that are more moist than the surrounding forest with dwarf blueberry (*Vaccinium myrtillus*) in the understory. A deep organic layer, more than 8 inches thick, was present. The site was thought to be subject to considerable wind and snow accumulation. Deadfall constituted about 20% coverage. Most of the trees were fairly small, less than 20 inches in diameter. Engelmann spruce (*Picea engelmannii*) was present in the plot in about equal abundance as the subalpine fir, 25 to 50% each. Other species present were alpine groundsel (*Senecio amplexans*) 5 - 25%, and 1-5 % each of narcissus anemone (*Anemone narcissiflora*), bluejoint reedgrass (*Calamagrostis canadensis*), osha (*Ligusticum porteri*), small-flowered woodrush (*Luzula parviflora*), chiming bells (*Mertensia ciliata*), sweet cicely (*Osmorhiza depauperata*), parrots beak (*Pedicularis racemosa* ssp. *alba*), Jacob's ladder (*Polemonium pulcherrimum*), and arrowleaf groundsel (*Senecio triangularis*).

Subalpine fir is the mostly widely distributed fir in North America, spanning more than 32 degrees of latitude (Alexander *et al* 1984). It occurs chiefly in mountainous areas from the Yukon interior near treeline and along the coast of southeastern Alaska south through western Alberta and British Columbia to southern Colorado and scattered mountain ranges of Arizona and New Mexico (Henderson 1982). Subalpine fir generally occupies cold, high elevation mountain forests with short growing seasons and heavy snowpack. Engelmann spruce (*Picea engelmannii*) is usually associated with subalpine fir. It occurs as either a climax codominant or as a persistent, long-lived seral species in most subalpine fir habitat types (FEIS 2003). Understory vegetation in subalpine fir forests is extremely variable, changing with elevation, exposure, and soil moisture.

Carolina tasselrue (*Trautvetteria caroliniensis*) is an attractive member of the Ranunculaceae family, with white flowers that have exserted stamens. It has dark green, deeply lobed leaves, and grows to about 18 to 36 inches. It has been used in horticulture in the east, where it is reported that it thrives in light to medium shade, in soil that is rich in organic matter (Glick, 2003). It is widely distributed, with two varieties distinguished. While var. *caroliniensis* occurs in southeastern United States, var. *occidentalis* is found in all western continental states except Nevada, and on the west coast of Canada (USDA PLANTS 2003).

Abies lasiocarpa/Vaccinium myrtillus
Subalpine forests
G5 S5

The *Abies lasiocarpa/Vaccinium myrtillus* plant association is a common type in the San Juan Mountains. It is similar to the uncommon association above, but grows on drier sites.

Subalpine fir is the mostly widely distributed fir in North America, spanning more than 32 degrees of latitude (Alexander *et al* 1984). It occurs chiefly in mountainous areas from the Yukon interior near treeline and along the coast of southeastern Alaska south through western Alberta and British Columbia to southern Colorado and scattered mountain ranges of Arizona and New Mexico (Henderson 1982). Subalpine fir generally occupies cold, high elevation mountain forests with short growing seasons and heavy snowpack. Engelmann spruce (*Picea engelmannii*) is usually associated with subalpine fir. It occurs as either a climax codominant or as a persistent, long-lived seral species in most subalpine fir habitat types (FEIS 2003). Although the community is classified as subalpine fir/dwarf bilberry, its most common expression in San Juan County is characterized by Engelmann spruce as the dominant species. Understory vegetation in subalpine fir forests is extremely variable, changing with elevation, exposure, and soil moisture.

Vaccinium myrtillus (dwarf bilberry) occurs throughout the Rocky Mountains from British Columbia and Alberta to northern New Mexico and southern Arizona (Vander Kloet 1988). The species reaches its greatest abundance in the Southern Rockies.



Figure 11. Engelmann spruce forest at Cement Creek is typical of drier spruce-fir forests that constitute the matrix in the subalpine zone. Clear cut is for new ski area lift.

Johnston (1987) states that the *Abies lasiocarpa/Vaccinium myrtillus* plant association is the normal upland community in the spruce-fir zone, occupying steep, north, east, and southeast facing slopes, from 8,400 to 10,600 feet in Colorado. Some frequently associated species are Engelmann spruce, aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), twinberry honeysuckle (*Distegia involucrata*), wild rose (*Rosa woodsii*), common juniper (*Juniperus communis*), parrots beak (*Pedicularis racemosa*), heartleaf arnica (*Arnica cordifolia*), bluejoint reedgrass (*Calamagrostis canadensis*), and small-flowered woodrush (*Luzula parviflora*).

Plot data from the site at Balsam Lake describes the site as a relatively dry bench about 150 meters above the stream (Tenmile Creek). Soil consisted of an organic layer of about one inch, over a light brown sand loam of about six inches. Dead and down trees were frequent.

Abies lasiocarpa*-*Picea engelmannii*/*Salix drummondiana
Montane riparian forest
G5 S4

The *Abies lasiocarpa* - *Picea engelmannii* / *Salix drummondiana* (subalpine fir-Engelmann spruce/Drummond's willow) plant association is in the *Abies lasiocarpa* temporarily flooded alliance. In Colorado, this association is ranked S4, apparently secure in the state with more than 100 occurrences. Globally ranked G5, this is a common plant association well documented by Rocky Mountain researchers.

The community is a heavily forested type found along steep, narrow second and third-order streams above 9,000 ft (2,700 m), where subalpine fir-Engelmann spruce forests occur on adjacent hillsides. *Populus tremuloides* (quaking aspen) may be intermixed with the adjacent communities as well. Tall *Alnus incana* (thinleaf alder) and *Salix drummondiana* (Drummond's willow) typically grow in a thick band along the edge of the stream. Other associated shrubs, which are not always present, include several other willow species, *Lonicera involucrata* (twinberry honeysuckle), *Alnus incana* (thinleaf alder), and *Cornus sericea* (red osier dogwood). The herbaceous undergrowth is typically dense and can have a high species diversity.

Many first- and second-order streams run through subalpine spruce-fir forests providing habitat for obligate riparian shrubs, forbs, and grasses, forming a number of riparian subalpine fir-Engelmann spruce plant associations. Although *Abies lasiocarpa* and *Picea engelmannii* are not obligate riparian species, the two species strongly influence subalpine riparian ecosystems.

Succession in this forest is slow (200 + years) and many factors can alter its path. Some ecologists suggest that *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) are in equilibrium and form a stable climax community (Peet 1981). Others suggest that the two species coexist in non-equilibrium and that given enough time, either *Abies lasiocarpa* or *Picea engelmannii* will dominate the overstory (Aplet *et al.* 1988). Current literature suggests that the spruce-fir forest will never become a single-species dominated "climax" forest, but rather is a perpetually changing mosaic of patches that are of different ages and composition. The successional dynamics of the forest are a complex interaction of the life history traits of spruce and fir, local site physical characteristics, and disturbance from fire, wind-throw, or insect outbreak at both large (entire stand) and small (individual trees) scales.

Forage value is high in this plant association when forb growth is abundant. However, grazing during wet periods can churn wet soil and destroy plant cover (Hansen *et al.* 1995). This riparian association is sensitive to timber harvesting activities due to high soil moisture content. It is also poorly suited for roads, trails, or other developments. Protection of water resources is a major consideration for any management activity (TNC 1992).

Abies lasiocarpa-Picea engelmannii-Populus angustifolia/Lonicera involucrata
Montane riparian forest
G4 S3

Abies lasiocarpa-Picea engelmannii-Populus angustifolia/Lonicera involucrata (subalpine fir-Engelmann spruce-narrowleaf cottonwood/twinberry honeysuckle) is an unusual combination occurring at the upper elevation limits of narrowleaf cottonwood, and is generally restricted to the southern parts of the Colorado Rockies. It is ranked G4, apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery. In Colorado, this association is ranked S3, rare in the state (21 to 100 occurrences). Eleven stands have been documented in the San Juan Mountains. An additional 20-50 are estimated to occur in Colorado.

The community occurs on active floodplains of larger rivers in the upper montane valleys, on terraces or elevated stream benches between 1.5-7 ft above the active channel. The overstory is typically a mix of *Picea engelmannii* (Engelmann spruce) and *Populus angustifolia* (narrowleaf cottonwood). Other tree species that may be present include *Abies lasiocarpa* (subalpine fir), *Abies concolor* (white fir) seedling and saplings, and *Pseudotsuga menziesii* (Douglas fir). Overall, shrubs are not abundant and provide less than 50% cover. Shrub species may include *Lonicera involucrata* (twinberry honeysuckle), *Acer glabrum* (Rocky Mountain maple), *Alnus incana* (thinleaf alder), *Salix geyeriana* (Geyer's willow), and *Symphoricarpos rotundifolius* (roundleaf snowberry). Herbaceous cover is sparse and no species is consistently present. The most typical species include *Bromus canadensis* (Canadian brome), *Festuca rubra* (red fescue), *Fragaria virginiana* (Virginia strawberry), *Heracleum lanatum* (common cow parsnip), *Maianthemum stellatum* (starry false Solomon's seal), and *Geranium richardsonii* (Richardson's geranium).

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. One example is upstream dams stabilizing stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that allow cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late seral, or in this case, conifer communities (Hansen *et al.* 1995). The Animas River Canyon PCA contains an unusually, unaltered river flow, allowing for the natural regeneration of cottonwoods and the native plant associations. Other disturbances, such as excessive grazing or other modes of weed introduction are also absent, or reduced, by the limited accessibility of the canyon. Weed introduction from the railroad, hikers and horse packing are thought to be minimal at this time.

The *Abies lasiocarpa* - *Picea engelmannii* - *Populus angustifolia* / *Lonicera involucrata* (subalpine fir-Engelmann spruce-narrowleaf cottonwood/twinberry honeysuckle) plant association is a mid- to late-seral community. Narrowleaf cottonwood will continue to co-occur with conifer species where fluvial activity (*e.g.*, flooding, channel migration, sediment deposition, and scouring) persists. Higher elevations and cool, shaded canyon bottoms create an environment for subalpine fir and Engelmann spruce. The active channel flooding and sediment deposition allows

narrowleaf cottonwood to perpetuate. On higher terraces that no longer experience flooding, subalpine fir and Engelmann spruce may become the climax tree species. Some authors suggest mixed riparian stands will eventually become dominated by conifer species (see Padgett *et al.* 1989, Hansen *et al.* 1995). In Colorado, observations indicate that with continued fluvial processes, cottonwood will persist on the streambanks and floodplain. The presence of conifer species on an active floodplain is not necessarily an indication of their future “climax” dominance within the riparian area.



Figure 12. Riparian vegetation at Lime Creek, with Engelmann spruce, subalpine fir and narrowleaf cottonwood.

Calamagrostis canadensis
Montane wet meadows
G4 S4

The *Calamagrostis canadensis* (bluejoint reedgrass) plant association (Figure 8) occurs in Colorado (CNHP 2003), Montana (Hansen *et al.* 1995), Idaho, Wyoming (Bourgeron and Engelking 1994), Utah (Padgett *et al.* 1989) and widely throughout mountainous areas of the western United States (see NVC 2001). This association is ranked G4Q, widespread, abundant, and apparently secure globally, though it may be quite rare in parts of its range. This montane wet meadow community is supposedly not vulnerable in most of its range, but may be of long-term concern. In Colorado, this association is ranked S4, well represented in the state with more than 100 occurrences (CNHP 2003).

The *Calamagrostis canadensis* plant association is a relatively small meadow association typically occurring in broad glaciated valleys, openings in moist forests, silted-in beaver ponds, and narrow floodplains of lower montane canyons. It generally has few shrubs and a fairly dense cover of grasses. There is usually a dense cover, 15 to 90%, of *Calamagrostis canadensis*. Other graminoids present can be abundant, but never exceed the cover of bluejoint reedgrass. Examples of frequently occurring graminoid species are *Carex aquatilis* (water sedge) and *Equisetum arvense* (field horsetail). Forb cover is usually minor. A few shrubs and trees may occur in or near the



Figure 13. *Calamagrostis canadensis* montane wet meadows at California Gulch PCA.

stand, usually with less than 10% individual cover. This montane meadow plant association often intergrades with adjacent *Carex aquatilis* (water sedge) meadows and shrublands dominated by *Salix drummondiana* (Drummond's willow), *S. planifolia* (planeleaf willow), *S. brachycarpa* (shortfruit willow), or other *Salix* (willow) species (CNHP 2003). In the California Gulch PCA the community wetlands support *Eriophorum altaicum* (Altai cottongrass) and *Carex praegracilis* (clustered sedge) with *Salix brachycarpa* (shortfruit willow) and *Salix planifolia* (planeleaf willow) present as well.

Bluejoint reedgrass is moderately to highly palatable to livestock depending on the season and the availability of other species. With excessive grazing, other graminoids, such as non-native *Poa pratensis* (Kentucky bluegrass) and less palatable *Juncus balticus* (Baltic rush) may begin to dominate. In order to limit the impacts from livestock, areas should be grazed when seed heads are mature and soils are moderately dry. This is usually mid- to late summer depending on elevation and current year's precipitation. Early season grazing should be restricted due to high soil moisture, especially along stream banks where sloughing can occur (Hansen *et al.* 1995).

Cardamine cordifolia-Mertensia ciliata-Senecio triangularis
Alpine wetlands
G4 S4

The *Cardamine cordifolia-Mertensia ciliata-Senecio triangularis* (heartleaf bittercress-mountain bluebells-arrowleaf ragwort) alpine wetland association occurs in Colorado (Johnston 1987, Komarkova 1976, Cooper 1993, CNHP 2003) and is expected to occur in subalpine and alpine regions throughout the western states. Although it is common in the upper subalpine and lower alpine of the Colorado Rocky Mountains, it has not been reported outside of Colorado. This association is ranked G4, apparently secure globally, though it may be quite rare in parts of its range. The state rank is S4, apparently secure in the state with more than 100 occurrences. An excellent example of this community was documented at Ice Lakes Basin in San Juan County.

The generally small stands of the *Cardamine cordifolia - Mertensia ciliata - Senecio triangularis* (heartleaf bittercress-mountain bluebells-arrowleaf ragwort) plant association are found in and near running water of small streams, seeps, and springs. In many cases this habitat probably experiences a long period of snow cover (Sanderson and Kettler 1996).

The community is usually easy to recognize. It is a narrow band of forbs and mosses with one or more of the following three forb species being abundantly present: *Cardamine cordifolia* (heartleaf bittercress) (1-70% cover), *Mertensia ciliata* (mountain bluebells) (1-62%), and/or *Senecio triangularis* (arrowleaf ragwort) (1-50%). Any one or all of these species may be present. Other forb species commonly found in this community are king's crown (*Sedum integrifolium*), rose crown (*Sedum rhodanthum*), and Indian paintbrush (*Castilleja rhexifolia* and *C. sulphurea*). Stands generally have at least fifteen species, and often have as many as 45 forb species present. *Salix planifolia* (planeleaf willow) and *Salix brachycarpa* (shortfruit willow) shrublands can occur both up- and downstream, along broader, less steep reaches.

Perennial wet soils, steep gradients, and a short growing season make this association vulnerable to heavy disturbance. Forage value and productivity are low. Excessive grazing by sheep may convert this association to one dominated by various increaser species (Padgett *et al.* 1989). Wet soils are susceptible to compaction and churning. If possible, it is best to keep livestock out of these very wet areas (Hansen *et al.* 1995).



Figure 14. Alpine wetland at Clear Lake, with typical forb species, including *Mertensia ciliata* (bluebells).

Carex aquatilis
Montane Wet Meadows
G5 S4

The *Carex aquatilis* (water sedge) montane wet meadow community is widespread and abundant throughout the Rocky Mountain region. It occurs in Colorado (CNHP 2003), eastern Idaho, western Wyoming (Youngblood *et al.* 1985a), Montana (Hansen *et al.* 1988), Utah (Johnston 1987, Padgett *et al.* 1989) and other western states (see NVC 2001). It is the most common sedge meadow community in San Juan County.

The association is ranked G5, demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery. In Colorado, this association is ranked S4, well represented in the state with more than 100 occurrences. Because it is extremely common, it is not included in the CNHP database. However, it is included here because it is representative of much of the wetland area in San Juan County.

The *Carex aquatilis* (water sedge) plant association typically occurs as large meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations. This plant association is found on soils that are typically wet throughout the growing season, where livestock hoof-action can often cause compaction, pitting and hummocking of the soil (Padgett *et al.* 1989). It is suggested that grazing of sedge dominated areas be executed with deferred and rest rotation systems so as to not graze while soils are wet (Hansen *et al.* 1995) but to rest the area and allow for shoot as well as root regeneration (Kovalchik and Elmore 1992).



Figure 15. *Carex aquatilis* meadow at Bear Creek.



Figure 16. *Carex aquatilis*. Photo © USDA, NRCS, 1997 - Northeastern Wetlands Flora

Carex buxbaumii
Buxbaum's Sedge Wet Meadow
G3 SU

This plant community has previously been found in fens and wet meadows in the mountains of Utah, Idaho, Montana, and western Wyoming, where it occurs at a broad range of elevations between 5,500 and 10,400 feet. The occurrence documented at Andrews Lake in San Juan County in 2002 marks the first for Colorado.

Typically, sites are flat and range from moderately broad valley bottoms to forest openings. The size of the wetland is dependent on the presence of permanently saturated soils, and it often occurs along streams and in the wettest portion of the wetland complex. It has mineral soils derived from alluvium with accumulations of well-decomposed organic matter throughout the upper soil horizon (20-50 cm deep).

Stands have a dense perennial graminoid layer characterized by 25% or more cover of *Carex buxbaumii*. *Carex aquatilis*, *Carex saxatilis* and *Carex utriculata* are usually present and occasionally codominant. At Andrews Lake, the community consisted of 70% *Carex buxbaumii*, with 10% other sedges. Soils are acidic (pH 6.4) due to the presence of iron pyrite. The site is rich in sedge species, including *Carex capillaris*, *C. viridula*, *C. microglochin*, *C. capillaris*, *C. interior*, and *C. aurea*. Narrowleaf cottongrass (*Eriophorum angustifolium*), tufted hairgrass (*Deschampsia cespitosa*), elephantella (*Pedicularis groenlandica*) and marsh marigold (*Caltha leptosepala*) and *Sphagnum* mosses also inhabit the site.



Figure 17. *Carex buxbaumii* meadow at Andrews Lake, Molas Pass PCA.



Figure 18. *Carex buxbaumii*. Photo © USDA, NRCS, 1997 Northeastern Wetlands Flora

Carex praegracilis
Clustered sedge wetland
G3G4 S2

The *Carex praegracilis* (clustered sedge) wetland association is known from several western states, although few stands have been well documented. Plant associations dominated or co-dominated by this species occur in Montana (Hansen *et al.* 1988), Idaho, Utah (Bourgeron and Engelking 1994), Wyoming (Jones and Walford 1995), New Mexico (Durkin *et al.* 1994), and Colorado (CNHP 2003). In Colorado, this association is found along small creeks of the Pawnee National Grassland and is likely to occur throughout the eastern plains (Kittel *et al.* 1997, CNHP 2003), as well as in fens at higher elevations in Summit and San Juan counties.

The *Carex praegracilis* community is ranked G3, very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences) and threatened throughout. This association's state rank is S2, imperiled in state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state.

The *Carex praegracilis* plant association forms small meadows in swales and along stream channels on the short-grass prairie in eastern Colorado, and in similar habitats in other Rocky Mountain states. In southwestern Montana, *Carex praegracilis* (clustered sedge) forms large meadows. This sedge is considered to have medium to high forage value for horses and cattle, especially early in the grazing season (Hermann 1970). Soils of this association are susceptible to compaction if grazed in early spring and summer when saturated.

Carex praegracilis may be an effective stabilizer of degraded, wet meadows. It has long, creeping rhizomes that quickly produce a tall, dense canopy of aboveground shoots (Hansen *et al.* 1988).

Vegetation usually completely covers the ground in narrow bands following the streambed dominated by *Carex praegracilis* (clustered sedge). There are typically no trees or shrubs present. In San Juan County, the community was found at California Gulch, where it occurred in a "quaking fen" with water sedge and mosses.



Figure 19. *Carex praegracilis*.
Photo © USDA, NRCS.
<http://Plants.usda.gov>

Carex vernacula
Alpine wetlands
GU SU

The species, *Carex vernacula* (native sedge), is known to occur from Wyoming and Colorado to Washington (Hermann 1970). However, stands of the *Carex vernacula* (alpine wetland) plant association have not been documented outside of Colorado.

Prior to this survey, this plant association had only been documented in two stands in the San Juan National Forest in Archuleta and San Juan counties (Richard *et al.* 1996). More information is required to determine the status of this association.

This plant association has been observed to occur along narrow and sinuous stream channels in gently sloping, glaciated, alpine basins. *Carex vernacula* dominates the vegetation cover with *Caltha leptosepala* (marsh marigold) and *Deschampsia cespitosa* (tufted hairgrass) as common sub-dominants. *Caltha leptosepala* (marsh marigold) has been observed as the only forb with significant cover. We found this community to consist of nearly pure stands of *Carex vernacula*. In San Juan County, the community was documented from Elk Creek Headwaters, Ice Lake Basin, U. S. Basin and Cinnamon Pass PCAs.



Figure 20. *Carex vernacula* meadow at Cinnamon Pass.

Danthonia intermedia
Montane grasslands
G2G3 S3S4

Timber oatgrass is a native, strongly caespitose, perennial bunchgrass with a shallow and fibrous root system [Hitchcock *et al* 1969; Volland and Dell 1981]. The erect culms are densely tufted and generally reach 4 to 20 inches (10-50 cm) in height (Uresk and Lowery 1984). Leaves are mainly basal, flat or involute (Welsh *et al* 1987). The old sheaths and blades are often persistent and wither at the base of the plant (Hitchcock *et al* 1969). The inflorescence is a narrow panicle, often 1-sided, with short mostly erect branches generally bearing 4 to 9 spikelets (Cronquist *et al* 1977; Hitchcock *et al* 1979). One- to 2-flowered spikelets occasionally occur in the axils of the lower leaves (Welsh *et al* 1987).

The grass grows in a wide range of habitats including rock outcrops, sphagnum bogs, dry meadows, grassy balds, and on alluvial flats of river floodplains (Beetle 1961; Koturba 1967; Koterba and Habeck 1971; Singer 1975). It occurs on dry to moist sites from the prairies and grasslands to rocky alpine ridges (Hitchcock and Cronquist 1973). In parts of the northern Rocky Mountains timber oatgrass is locally common in subalpine meadows in the fir-spruce zone (Mosely and Bernatus 1992; Root and Habeck 1972). At high elevations timber oatgrass is most abundant in subalpine and alpine parks and meadows but also occurs in openings in upper elevation coniferous types, including fir-spruce and lodgepole pine communities (Stutz and Carlson 1985; Vallentine 1961; Welsh *et al* 1987). In San Juan County it was found to be a frequent component of grassland communities in the spruce-fir zone, and was the dominant species in some areas above timberline.

Timber oatgrass is widely distributed in North America from Alaska eastward to Newfoundland and south to northern California, Arizona, and New Mexico (Cronquist *et al* 1977; Hitchcock and Cronquist 1973). According to Beetle (1961), timber oatgrass is "indicative of long-standing stability in the vegetation."

In Colorado, the variations of the community with sub-dominants of tufted hairgrass (*Deschampsia cespitosa*), varileaf cinquefoil (*Potentilla diversifolia*) or Letterman needlegrass (*Stipa lettermannii*) have been documented from the Gunnison, White River and Roosevelt National Forests (Johnston 1987). The occurrence at Burrows Creek is the first in the CNHP database for San Juan County. Although the community is ranked G2G3 (imperiled to vulnerable) globally, additional research may prove it to be more common.

A variety of forbs and grasses occur with timber oatgrass in grasslands and shrublands. Associated species in San Juan County included false strawberry (*Sibbaldia procumbens*), tufted hairgrass (*Deschampsia cespitosa*), alpine avens (*Geum rossii*), subalpine fleabane (*Erigeron peregrinus*), Drummond's rush (*Juncus drummondii*), arnica (*Arnica mollis* and *Arnica parryi*), ragwort (*Ligularia bigelovii*), yarrow (*Achillea lanulosa*), and cinquefoil (*Potentilla sp.*).

Timber oatgrass provides some forage for all classes of livestock and wildlife. It is especially valued as spring forage because it greens up before many other plants begin

growth (Stutz and Carlson 1985). It is rated as fair for palatability to domestic sheep. It is more tolerant of grazing than many other grasses. A community dominated by timber oatgrass was documented in San Juan County in the Burrows Creek-Mineral Creek PCA.



Figure 21. *Danthonia intermedia* grassland at Burrows Creek Uplands PCA.

Danthonia parryi
Montane grasslands
G3 S3

Danthonia parryi (Parry oatgrass) is a native perennial bunchgrass that is known from a narrow strip running north and south through British Columbia, Alberta, Montana, Wyoming, Colorado and New Mexico (USDA PLANTS database; Stubbendieck *et al* 1992). It is distinguishable in the field by its rather broad, soft looking leaves and long glumes and lemmas (Figure 10, 11). It is typically found in open grasslands, woods and valleys, most abundant at relatively high altitudes, in coarse textured soils (Stubbendieck *et al* 1992).

This plant association most commonly occurs in coniferous forest or woodland openings, in montane meadows or parks, and on isolated buttes at the western edge of the Great Plains. Stands occur from 7,400 to 9,880 feet in elevation. Soil textures are described as deep loam or deep sandy loam. Aspect is usually south to southeast with few reports of northeastern exposures (Hess 1981) and slopes are gentle (0% to 20%).

In Colorado this plant community is known from over 30 locations in fourteen counties, all east of the Continental Divide, except for one other on the border of Archuleta and Hinsdale counties. The site at Howardsville is the only documented occurrence in San Juan County.

Plant associations dominated by Parry oatgrass in Colorado include combinations with sun sedge (*Carex heliophila*), Arizona fescue (*Festuca arizonica*) and Idaho fescue (*Festuca idahoensis*) (Johnston 1987). The grassland observed in San Juan County is similar to the latter two, but with Thurber fescue (*Festuca thurberi*) and wooly cinquefoil (*Potentilla hippiana*) as the primary associated species.

It is suspected that the range and extent this plant association has been greatly reduced. Most remaining stands are small and/or have been impacted by anthropogenic activities, and are degraded to some degree. Several occurrences of this plant association are located in areas that are somewhat inaccessible.



Figure 22. *Danthonia parryi* grassland at Howardsville.



Figure 23.
Danthonia parryi
from mounted
specimen, photo
courtesy of Gay
Austin, USFS.

Festuca thurberi
Montane grasslands
G4 S4

Thurber fescue (*Festuca thurberi*) is the most abundant bunch grass in the subalpine zone in San Juan County. It is a robust, cool-season, native, perennial bunchgrass (Figure 12). It is densely tufted and produces thick mats of persistent, dried sheath and culm bases (Cronquist *et al* 1977). Culms are erect and typically grow from 15.7 to 37.4 inches tall (Welsh *et al* 1987). Leaves are scabrous and mostly basal. On undisturbed sites plants can form large diameter bunches.

Thurber fescue is more restricted in distribution than most western fescues. It occurs from southern Wyoming southward through Colorado, southeastern Utah, and northern New Mexico (Cronquist *et al* 1977). Its greatest development occurs on the Colorado Plateau, usually at elevations between 8,000 and 12,000 feet.

It is a climax species in a number of non-forested and forested communities. On grassland sites it often occurs as the climax dominant and has been used as a series indicator (Baker 1984). Common associated species include Idaho fescue (*Festuca idahoensis*), Arizona fescue (*F. arizonica*), Parry's oatgrass (*Danthonia parryi*), and American vetch (*Vicia americana*). Shrublands where Thurber fescue is an important



Figure 24. Thurber fescue at West Lime Creek.

understory component include mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), mountain silver sagebrush (*A. cana* ssp. *viscidula*), and mountain snowberry (*Symphoricarpos oreophilus*). Forested sites with Thurber fescue may be dominated by Colorado blue spruce-Douglas-fir (*Picea pungens*-*Pseudotsuga menziesii*), and aspen (*Populus tremuloides*).

Although not highly palatable, Thurber fescue, due to its sheer abundance, contributes significantly to the forage resource of many mountain bunchgrass communities in the Colorado Plateau region (Paulson 1969). In its area of best development in Colorado, Thurber

fescue forms dense stands and often represents 53 to 94 percent of the total grass cover.

Self-perpetuating stands of Thurber fescue are characteristic of climax or late seral mountain grassland communities. Dense stands apparently represent an edaphic climax in that soils typify a mature grassland profile (Paulson 1969).

Thurber fescue commonly occupies openings in spruce and aspen forests in San Juan County, usually on moderate to steep slopes. Although it is a common community, ranked G4S4, it was documented in San Juan County to show the range of plant communities present. An excellent example of the type is included in the West Lime Creek PCA. Other good examples were seen at Maggie Gulch, interspersed with talus slopes below the wetland area, and along Highway 550 below Red Mountain Pass.

Picea pungens/Alnus incana
Montane riparian forests
G3 S3

The *Picea pungens/Alnus incana* (Colorado blue spruce/thinleaf alder) montane riparian forest association is known from Wyoming to New Mexico. This association is ranked G3, very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). Fewer than 100 stands are documented in Colorado, and very few of these are in pristine condition. Stands are not large and are threatened by development, road building and maintenance, heavy recreational use, improper livestock grazing, and stream flow alterations.

The blue spruce/thinleaf alder plant association occurs in montane riparian areas in Colorado. It inhabits deep, shaded canyons and narrow valleys along relatively straight stream channels from 6,100 to 10,650 ft. It generally forms small patches, but can be continuous for several river miles.

Picea pungens (blue spruce) dominates the overstory, and often there are many seedlings and saplings as well as mature trees. *Abies lasiocarpa* (subalpine fir) is usually present. Other tree species that may occur within this community are *Picea engelmannii* (Engelmann spruce), *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine) and *Pinus ponderosa* (ponderosa pine). The thick shrub understory is typically confined to a narrow band lining the stream channel. *Alnus incana* (thinleaf alder) is present and other shrub species can vary widely but may include several different *Salix* species (willow), *Cornus sericea* (red osier dogwood), *Ribes lacustre* (prickly currant), *Acer glabrum* (Rocky Mountain maple), and *Vaccinium* spp. (blueberry). The forb layer is typically thick, with up to 50% total cover, and displays a high richness (often more than 40 species represented in one stand).

Due to heavy shading, this plant association provides low forage value for livestock. Dense stands of *Alnus incana* (thinleaf alder) hinder livestock access into this plant association. *Alnus incana* is not particularly palatable, but can be trampled as animals search for more palatable species. Open stands may provide moderate forage and shade in the summer (Hansen *et al.* 1995).

Excellent (A ranked) examples of this community were documented in San Juan County in the Animas Canyon, Cascade Creek and Hermosa Creek PCAs (Figure 13).

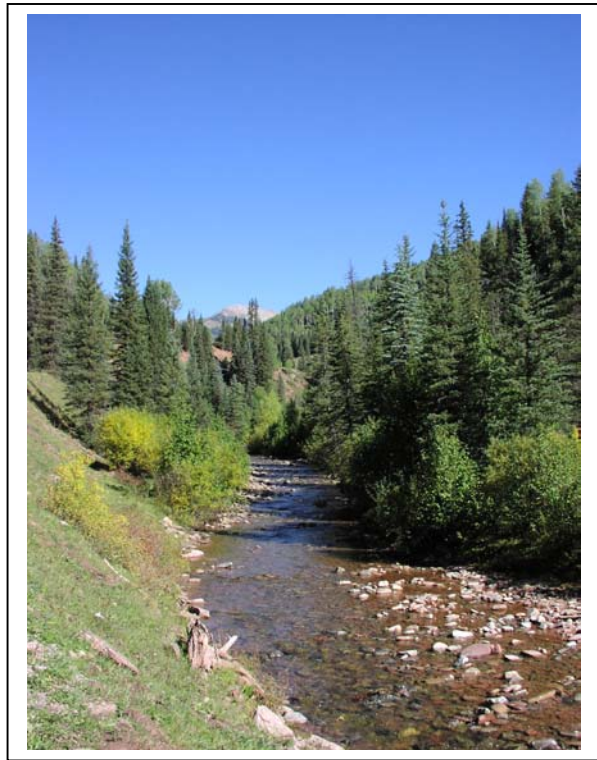


Figure 25. *Picea pungens/Alnus incana* riparian forest at Hermosa Creek PCA

***Populus angustifolia*/ *Salix* (*monticola*, *drummondiana*) woodland**
Narrowleaf cottonwood forest
G3 S3

The *Populus angustifolia*/mixed *Salix* species or narrowleaf cottonwood forest association is known from the Colorado Plateau and the San Juan Mountains. It probably occurs in Utah and Nevada (Manning and Padgett 1995). In Colorado, it is known only from the San Juan Mountains of southwestern Colorado (CNHP 2003).

This association is ranked G3, very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). Prior to this survey, the community was recorded from only four stands in the San Juan Mountains, but at least 25-50 more are expected to be in the area (CNHP 2003). The narrowleaf cottonwood/mixed willow plant association is thought to be an early to mid-seral stage of more mature *Populus angustifolia* dominated plant associations. This community occurs on active floodplains, stream benches and low terraces from elevations of 7,900 to 8,880ft.

The upper canopy is dominated by narrowleaf cottonwood, represented by mostly young trees or saplings. The understory has a consistent mixture of two or more willow species, which can include *Salix exigua* (coyote willow), *S. eriocephala* var. *ligulifolia* (strapleaf willow), *S. monticola* (mountain willow), *S. lucida* ssp. *caudata* (greenleaf willow), *S. drummondiana* (Drummond's willow), and *S. geyeriana* (Geyer's willow). Other, non-willow shrubs are usually present as well. The herbaceous undergrowth is generally low in total cover.

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. One example is upstream dams stabilizing stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that would allow cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral, communities (Hansen *et al.* 1995). Disturbances by flooding and scouring help create the bare ground cottonwoods need for seed reproduction. The size and age structure of a specific cottonwood patch are heavily dependent on the time since the last disturbance. Annually disturbed sites at the channel margin, for example, may never progress beyond young seedlings. Sites undisturbed by an extreme event, or sites that become safe through accretion or channel migration, may support pole and tree size cottonwood. At a larger spatial scale, the riparian forest comprises a mosaic of patches with different ages of cottonwood and different histories of disturbance.

Forage productivity for this plant association is high and very palatable to livestock. Cattle frequently browse cottonwood seedlings and saplings and young shoots of *Salix* (willow) species. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. 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).

An excellent (A ranked) example of this community was documented in San Juan County in 2002 in the Lime Creek PCA.

Populus angustifolia-Picea pungens/Alnus incana
Montane riparian forest
G4 S4

The *Populus angustifolia-Picea pungens/Alnus incana* (narrowleaf cottonwood-Colorado blue spruce/thinleaf alder) plant association is reported only from Colorado; however, closely related communities occur in Wyoming, New Mexico (Johnston 1987), and Utah (Padgett *et al.* 1989). This is a common community in Colorado (about 100 known stands) and is likely to occur in other Rocky Mountain states. However, it is ranked local throughout its range because of its narrow ecological setting, and because high quality examples are unusual.

This montane riparian plant association is characterized by co-dominant tree species, *Populus angustifolia* (narrowleaf cottonwood) and *Picea pungens* (blue spruce) with a shrub understory that is typically dense and diverse. *Alnus incana* (thinleaf alder) is always present in the shrub canopy. Frequently, other conifer trees are present, but not as abundant as *Picea pungens*. This association occurs in montane valleys with narrow to moderately wide floodplains, and in deep canyons. The elevation range is from 7,300 to 9,000ft (CNHP 2003).

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. One example is upstream dams stabilizing stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that would allow cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities, in this case, conifer species (Hansen *et al.* 1995). The Animas River Canyon PCA contains an unusually, unaltered river flow, allowing for the natural regeneration of cottonwoods and the native plant associations. Other disturbances, such as excessive grazing or noxious weed introduction are also absent, or reduced, by the limited accessibility of the canyon. Weed introduction from the railroad, hikers and horse packing are thought to be minimal at this time.

This mixed deciduous-evergreen plant association is a mid-seral community. Narrowleaf cottonwood will continue to co-occur with blue spruce where fluvial activity (*e.g.*, flooding, channel migration, sediment deposition, and scouring) persists. Stream channels that have overbank flow and sediment deposition favor establishment of narrowleaf cottonwood. Blue spruce is favored along reaches in deep valleys with steep canyon walls that provide conditions for strong cold-air drainage. If the floodplain is no longer active, then cottonwoods will eventually die and the conifers may persist.

Some authors suggest mixed riparian stands will eventually become dominated by conifer species (see Padgett *et al.* 1989, Hansen *et al.* 1995). In Colorado, observations indicate that with continued fluvial processes, cottonwoods will continue to persist on the streambanks and floodplain. The presence of conifer species on an active floodplain is not necessarily an indication of future "climax" dominance.

An excellent (A ranked) example of this community was documented in San Juan County in the Animas Canyon near Needleton.

Populus angustifolia-Pseudotsuga menziesii
Montane riparian forest
G3 S2

The *Populus angustifolia-Pseudotsuga menziesii* (narrowleaf cottonwood-Douglas fir) plant association is reported from Colorado (Kittel *et al.* 1996, Walford 1993, Johnston 1987). Closely related, if not synonymous, communities also occur in Nevada (Manning and Padgett 1995) and Utah (Padgett *et al.* 1989). This association is ranked G3, globally vulnerable, with 25 to 100 occurrences.

The plant association is limited to narrow canyon bottoms and V-shaped valleys where a northern or protected aspect creates a cool micro-environment. It naturally occurs in small stands, as a transition community from lower montane to upper montane habitats. Nearly all stands observed have an adjacent north-facing slope with *Pseudotsuga menziesii* (Douglas fir) forests. Growing in wash bottoms and on immediate streambanks, cobble bars, and terraces, the small stands are highly threatened by development, stream flow alterations, and improper livestock grazing.

Douglas fir is a non-obligate riparian species, and in Colorado riparian communities dominated by this species are uncommon. The plant association is composed of mature trees, appears to be late seral and limited to narrow canyon bottoms where upland Douglas-fir forests grade into the riparian corridor or occur on terraces. Along broader, meandering rivers, Douglas fir can occur on upper terraces with stands of narrowleaf cottonwood. These stands likely represent a drier occurrence of a narrowleaf cottonwood community where Douglas fir is not an indicator of riparian condition. However, at lower elevations and in narrow valleys with cold air drainage, as in the Animas River Canyon, Douglas fir, co-dominating with *Populus angustifolia* (narrowleaf cottonwood) on streambanks and floodplains, represents a perpetual riparian community.

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. One example is upstream dams stabilizing stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that would allow cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral, communities (Hansen *et al.* 1995). The Animas River Canyon PCA contains an unusually, unaltered river flow, allowing for the natural regeneration of cottonwoods and the native plant associations. Other disturbances, such as excessive grazing or noxious weed introduction are also absent, or reduced, by the limited accessibility of the canyon. Weed introduction from the railroad, hikers and horse packing are thought to be minimal at this time.

***Salix boothii*/mesic forbs**
Booth's willow/mesic forbs
G3 S3

The *Salix boothii* / mesic Forbs (Booth's willow/mesic forbs) plant association occurs in Idaho, Wyoming (Youngblood *et al.* 1985a), Utah (Padgett *et al.* 1989) and Colorado (CNHP 2003). It is ranked G3 S3, rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). This association is common in the northern half of Colorado, with over 50 stands expected to occur in the state. Improper livestock grazing, stream flow alterations, and heavy recreational use threaten it.

The Booth's willow/mesic forbs plant association is a tall (4-5 ft) shrubland that often forms extensive thickets, or willow carrs, on broad montane floodplains, from 7,400 to 10,300ft. Booth's willow forms large stands with a canopy ranging from 20-80% cover. Other shrub species can be as abundant but do not exceed that of Booth's willow, nor are they consistently present. The undergrowth of *Salix boothii* (Booth's willow) dominated associations varies according to the substrate and water regime. Wetter stands have an understory of sedges, while drier stands may have reedgrass and various forb species (Hansen *et al.* 1988). There is often a sparse to lush forb layer growing on raised hummocks, usually with no single species dominant. Forb species typically include *Swertia perennis* (star gentian), *Pedicularis groenlandica* (elephant head), *Polygonum bistortoides* (American bistort), *Heracleum lanatum* (cow parsnip), and *Achillea lanulosa* (yarrow). Graminoid cover is typically low (CNHP 2003). In the Pole Creek PCA the understory includes *Carex aquatilis* (water sedge), *Juncus balticus* (Baltic rush), *Fragaria virginiana* (strawberry) and common dandelion (*Taraxacum officinale*).

As with most willow species, *Salix boothii* (Booth's willow) is an effective streambank stabilizer and can be successfully planted to rejuvenate degraded riparian areas. Prescribed burning can also be a useful tool for rejuvenating dying and non-regenerating stands of *Salix boothii* since it rapidly sprouts after fires. Hot, quick fires are most effective because more plants sprout and fewer are killed (Hansen *et al.* 1988).

A good (B ranked) example of this community occurs in the Pole Creek PCA.

***Salix brachycarpa*/mesic forbs**
Alpine willow scrub
G4 S4

The *Salix brachycarpa*/mesic forbs (shortfruit willow/mesic forbs) alpine willow scrub association occurs in Colorado (CNHP 2003, Baker 1989, Johnston 1987). This association has not been documented outside Colorado, however it is expected to occur in other Rocky Mountain states. This association is ranked G4, apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery. In Colorado, this association is ranked S4, well represented in the state with more than 100 occurrences.

This association is common in the subalpine and alpine areas (8,600-11,200 ft) throughout Colorado. Typically, the *Salix brachycarpa* / mesic forbs plant association occurs on well-drained slopes in subalpine valleys, usually on the drier fringes of broad, glaciated basins and along broad, straight streams. This association is often considered part of a *Salix planifolia* - *Salix brachycarpa* (planeleaf willow-shortfruit willow) mixed type. However, shortfruit willow occurs on slightly drier sites and is often adjacent to wetter, pure stands of planeleaf willow. The two species typically intermix at the ecotone between the wetter and drier sites. Forbs dominate the herbaceous undergrowth (exceeding the graminoid cover), where no single species is dominant.

This plant association appears to be stable, but little is known about its successional trends. It is sometimes heavily grazed by sheep, which may alter the species composition. It is often found adjacent to an abundance of mosses and lichens.

Because this is a common community, not all occurrences are recorded. A good (B ranked) example was documented at Molas Pass. However, it was also observed at many other sites in San Juan County, including Animas Forks, South Fork Mineral Creek, and Ice Lake Basin.

***Salix drummondiana*/*Calamagrostis canadensis* shrubland**
Lower montane willow carrs
G3 S3

The *Salix drummondiana*/*Calamagrostis canadensis* (Drummond's willow/bluejoint reedgrass) plant association occurs in Montana (Hansen *et al.* 1995) and Colorado (CNHP 2003). This lower montane willow carr is ranked G3, very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences) and S3 in Colorado, rare in state (21 to 100 occurrences). There are currently 24 occurrences documented in the CNHP data system. This association may have been reduced from its historic abundance by heavy livestock grazing at the turn of the century. Remaining stands are threatened by continued improper livestock grazing, altered stream flows, and heavy recreational use.

A dense canopy of Drummond's willow and a thick undergrowth of bluejoint reedgrass characterize the association. Other shrubs, possibly present and abundant, are *Salix planifolia* (planeleaf willow) and *Alnus incana* (thin-leaf alder). Other common graminoids may include *Carex aquatilis* (water sedge), *Carex utriculata* (Northwest Territory sedge), and *Glyceria striata* (fowl mannagrass). Forb cover is typically low. This community is often associated with beaver activity along streams. It can also occur within the riparian mosaic with *Abies lasiocarpa* - *Picea engelmannii* (subalpine fir-Engelmann spruce) forests. It typically occupies small, isolated patches in forest and shrubland openings along channels in narrow valley bottoms from 7,800 to 10,200 ft. Although it is usually found along steep, narrow stream margins, it can occasionally be found along low-gradient streams.

Salix drummondiana is highly palatable to livestock and wildlife (Kovalchik 1987). *Calamagrostis canadensis* (bluejoint reedgrass) is moderately to highly palatable when foliage is young. With high grazing pressure, production and vigor of both species will decrease. Overgrazing by livestock can dry sites, increase non-native grass cover, and result in decreased vigor of willow root structure and eventually eliminate them from the site (Hansen *et al.* 1995).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. It is suggested that land managers consider maintaining beaver rather than removing them (Hansen *et al.* 1995).

The rhizomatous growth habit makes *Calamagrostis canadensis* (bluejoint reedgrass) a valuable species for stabilizing or rehabilitating mountain streams. *Salix drummondiana* (Drummond's willow) is also useful for revegetating streambanks (Hansen *et al.* 1995).

In San Juan County, this community has been documented from the Middleton and South Fork Mineral Creek PCAs.

Salix geyeriana-Salix monticola/Calamagrostis canadensis
Montane willow carr
G3 S3

Salix geyeriana-Salix monticola/Calamagrostis canadensis (Geyer's willow-mountain willow/bluejoint reedgrass) plant association has been documented only in Colorado (CNHP 2003). This association is ranked G3 globally and S3 in the state because it is very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). Currently there are 14 documented locations in the CNHP data system, but it is expected to occur in at least thirty to forty stands. It is highly threatened by improper livestock grazing, inappropriate stream flow alterations, and heavy recreational use.

This plant association is a tall (5-8 ft), deciduous shrubland that occurs in small and large stands interspersed with wet meadows, open stream channels, and beaver ponds from 8,200 to 9,200 ft. The willow canopy is nearly a homogeneous mix of Geyer's willow and mountain willow. Other shrubs that may be present include: *Salix planifolia* (planeleaf willow), *S. drummondiana* (Drummond's willow), *Lonicera involucrata* (twinberry honeysuckle), and *Ribes inerme* (gooseberry currant). The undergrowth, generally dominated by *Calamagrostis canadensis*, can be patchy. Other herbaceous species that may be present include *Carex aquatilis* (water sedge), *Geum macrophyllum* (largeleaf avens), and *Heracleum lanatum* (cow parsnip).

The wet and often saturated soils of this plant association are vulnerable to compaction. 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).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. It is suggested that land managers consider maintaining beaver rather than removing them (Hansen *et al.* 1995).

Stands dominated by *Salix geyeriana* (Geyer's willow) appear to be stable, long-lived communities. *Salix geyeriana* is most stable where the water table remains within 3 ft of the surface. It appears to be 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 (Padgett *et al.* 1989).

The community was documented in good condition in the South Fork Mineral Creek PCA, where it occurs in a mosaic with other willow communities.

Salix planifolia/Calamagrostis canadensis
Subalpine riparian willow carr
G4 S3

The *Salix planifolia/Calamagrostis canadensis* (planeleaf willow/bluejoint reedgrass) plant association is a common community known throughout the Rocky Mountain states. In Colorado, however, it is ranked S3, vulnerable in the state. It appears to have been more abundant historically and is continually threatened by improper grazing, road improvements and maintenance, and heavy recreational use.

This subalpine riparian willow carr usually occurs in broad, glacial valleys and swales where direct snowmelt is the primary moisture source throughout the growing season. The *Salix planifolia/Calamagrostis* plant association is the least common of the *Salix planifolia* (planeleaf willow) plant associations. It is frequently grazed to the point of shifting the dominant undergrowth grasses to non-native, invasive species.

The vegetation is characterized by *Salix planifolia* (planeleaf willow) forming a dense shrub layer, with *Calamagrostis canadensis* (bluejoint reedgrass) dominating the dense and sometimes rich herbaceous layer. Other willow species may be present as well as several sedge species. The forb layer can be diverse, but generally has less than 10% total cover.

Salix planifolia is highly palatable to wildlife and livestock. The forage value of *Calamagrostis canadensis* is moderate to high when shoots are young. With high grazing pressure, the height and density of *Salix planifolia* will decrease and the growth of *Calamagrostis canadensis* will decline (Hansen *et al.* 1995, Girard *et al.* 1995). *Salix planifolia* also grows at elevations below the subalpine, and becomes a much taller willow due to a longer growing season. In the montane zone it is often a co-dominant in *Salix monticola* (mountain willow) plant associations. Even though *Salix planifolia* is not rhizomatous, it can be stimulated to produce ten times more shoot biomass by browsing, and twice as much root biomass as *Salix monticola* (Cottrell 1995). This may explain why *Salix planifolia* is so abundant in the upper reaches of most mountain watersheds in Colorado. It is important for management to consider that low-stature *Salix planifolia* willow carrs are sensitive to trampling and soil compaction by livestock due to saturated conditions throughout the growing season (Girard *et al.* 1995). However, livestock may avoid the wettest sites until August or September. If season-long grazing does occur, the plants and soils will be damaged (Hansen *et al.* 1995).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. It is suggested that land managers consider maintaining beaver rather than removing them (Hansen *et al.* 1995).

Salix planifolia*/*Caltha leptosepala
Subalpine riparian willow carr
G4 S4

The *Salix planifolia* / *Caltha leptosepala* (planeleaf willow/white marsh marigold) plant association is a common and abundant upper montane and subalpine community occurring on very wet to saturated soils. It is known from throughout the Rocky Mountains. This association is characterized by low-stature shrubs, less than 1.5 ft tall, and a thick carpet of forbs in the undergrowth. There may be scattered patches of other willow species present, but the dominant species is *Salix planifolia*.

This subalpine riparian willow carr typically occurs in wide, glaciated valleys adjacent to streams. It is found in swales, depressions, and on slopes where snowmelt runoff saturates soils for much of the growing season. The ground may be flat or uneven with raised hummocks.

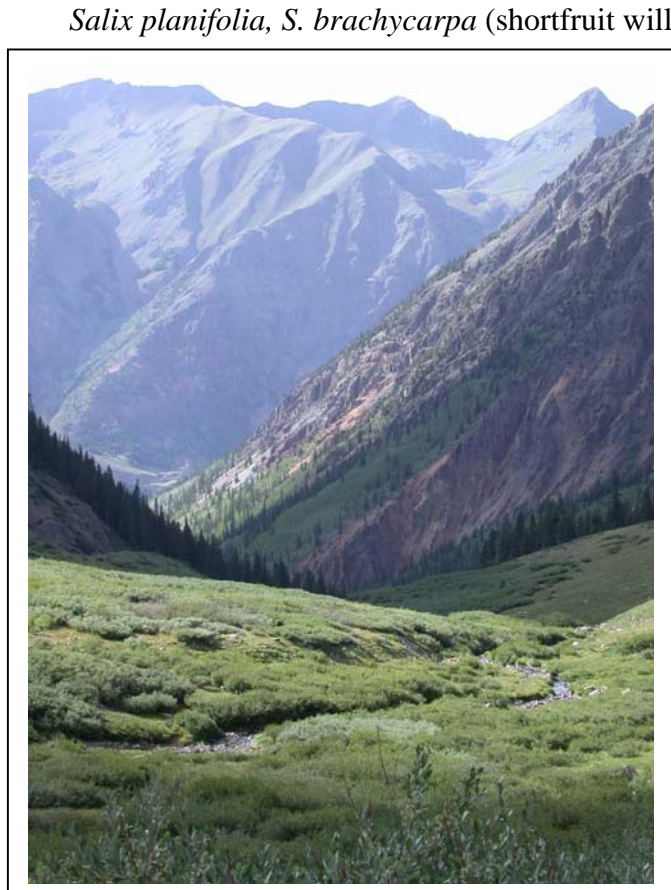


Figure 26. Mosaic of planeleaf willow and shortfruit willow at Spencer Basin.

Salix planifolia, *S. brachycarpa* (shortfruit willow), and *S. wolfii* (Wolf's willow) are abundant low-stature (1-3 ft, 0.3-1 m) 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 microhabitats on peat soils, although it can grow well on mineral soils. *Salix brachycarpa* is often found in microhabitats that are slightly drier and more permeable than those of *S. planifolia* (Kittel 1994).

This community is common in San Juan County. It was documented at the Vestal Lake PCA, but was also observed in the South Fork of Mineral Creek, Red Mountain Pass, Clear Lake, Andrews Lake, Ice Lakes, California Gulch, Maggie Gulch, Chattanooga fen, and Picayune Gulch.

Rare and Imperiled Plants of San Juan County

Plants may be rare for a variety of reasons. They may have a narrow geographic range, or be widespread but sparsely distributed, never forming large populations, or have very specific habitat requirements (e.g. specific soil substrates) that are not often met. Any one or a combination of these factors can describe the rarity of a particular plant species. Some plants were never abundant, while others have suffered major declines due to loss of habitat, climate change, detrimental land uses, and other causes. Likewise, threats to rare species vary. For instance, in Hawaii, where 90% of native plants are considered rare, a major threat is displacement by exotic species. Several of the rare plants of San Juan County are survivors of a former cooler climate and are threatened by global warming. Others like the ferns *Cystopteris montana* and *Cryptogramma stelleri* are restricted to a very specific habitat that is uncommon in Colorado. Much more research is needed to understand all of the reasons for rarity and the ecological needs for most of our rare species. Pollination vectors, seed dispersal mechanisms, relation to soil chemistry, and many other factors remain unknown. Finding the locations of rare plants and assessing their abundance and condition is a prerequisite to further study. This project has contributed to that first step.

Twenty-four species that are rare or imperiled, globally or in Colorado, have been documented from San Juan County during the last ten years. They are described below, and most are included in Potential Conservation Areas (PCAs).

Table 6. Vascular plants tracked by CNHP found in San Juan County. (See page 5 for ranking explanation)

Scientific Name	Common Name	Global Rank	State Rank	State/ Federal Status
<i>Besseyia ritteriana</i>	Kittentails	G3	S3	
<i>Botrychium echo</i>	Reflected moonwort	G3	S3	FS sensitive
<i>Botrychium hesperium</i>	Western moonwort	G3	S2	
<i>Botrychium minganense</i>	Mingan moonwort	G4	S1	
<i>Botrychium pallidum</i>	Pale moonwort	G3	S2	FS sensitive
<i>Botrychium pinnatum</i>	Northern moonwort	G4?	S1	
<i>Carex limosa</i>	Mud sedge	G5	S2	
<i>Carex viridula</i>	Green sedge	G5	S1	
<i>Cryptogramma stelleri</i>	Slender rock-brake	G5	S2	BLM sensitive
<i>Cystopteris montana</i>	Mountain bladder fern	G5	S1	
<i>Draba borealis</i>	Northern rockcress	G4	S2	
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3	
<i>Draba fladnizensis</i>	Arctic draba	G4	S2S3	
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2	
<i>Draba porsildii</i>	Porsild draba	G3G4	S1	
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Draba	G3?T3Q	S3	
<i>Draba streptobrachia</i>	Colorado divide whitlow-grass	G3	S3	
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	FS sensitive
<i>Hippochaete variegata</i>	Variegated scouring rush	G5	S1	
<i>Machaeranthera coloradoensis</i>	Colorado tansy-aster	G2	S2	FS sensitive
<i>Parnassia kotzebuei</i>	Kotzebue grass-of-parnassus	G4	S2	
<i>Penstemon harbourii</i>	Harbour beardtongue	G3G4	S3S4	
<i>Stellaria irrigua</i>	Altai chickweed	G4?	S2	
<i>Townsendia rothrockii</i>	Rothrock townsendia	G2	S2	

Besseyia ritteriana**Kittentails****G3 S3**

A member of the snapdragon family, *Besseyia ritteriana* is found only in the San Juan Mountains of Colorado. Its dark green leaves with sharply toothed edges are easily identified. The plant produces a stalk of lemon-yellow flowers that supposedly resembles kittens' tails. It is also known as Ritter's coral drops. The flowers are striking when fresh, but soon turn brown. By July 2002, a year of drought, all flowers seen were brown, and in most cases no flowers were produced at all.

Besseyia ritteriana may be found both above and below timberline, in wet meadows or on dry hillsides. It often occurs in conjunction with another rare plant, *Draba spectabilis* var. *oxyloba*. Other associated species include false hellebore (*Veratrum tenuipetalum*), Richardson's geranium (*Geranium richardsonii*), alpine avens (*Geum rossii*), paintbrushes (*Castilleja occidentalis* and *C. rhexifolia*), orange sneezeweed (*Dugaldia hoopsii*), Whipple's penstemon (*Penstemon whippleanus*) and bistort (*Bistorta bistortoides*).

CNHP began tracking this species in 2002, so records on abundance and locations are sparse. Specimens at the University of Colorado Herbarium are from Delta, Gunnison, La Plata, Montezuma, Montrose, Ouray, San Miguel and San Juan counties. Previously ranked G2? (believed imperiled), the rank was changed to G3 (vulnerable) as a result of the San Juan County Assessment in 2002, where it was found to be locally abundant. It is present in 12 PCAs in San Juan County. Four of these sites had excellent (A ranked) occurrences: Coal Bank Pass, Grand Turk South, Ice Lakes Basin, and Kendall Mountain.



Figure 27. *Besseyia ritteriana*

Botrychium echo**Reflected moonwort****G3 S3****FS sensitive**

Botrychiums, commonly called moonworts or grape ferns, are minute (3 to 15 cm. tall) perennial ferns of the Adder's tongue family, *Ophioglossaceae*. The plants consist of a green leaf (the trophophore) and a taller, erect spore-bearing spike (the sporophore). Both arise from a common stalk and can be thought of as a single, highly modified fern frond. Determining the species of a *Botrychium* can be challenging. *B. echo* tends to have a reddish brown stripe along the common stalk from the base of the trophophore stalk, and a shiny leaf. It produces clusters of minute, spheric gemmae at the root bases. Leaves appear in June and die in September. (Flora of North America 1993).

B. echo occurs on disturbed sites such as avalanche chutes, rock streams, unstable moraines, gravel bars, roadcuts, and logged areas. Although it is somewhat tolerant of, and even thrives on some disturbance, it cannot withstand trampling from sheep grazing and it can be forage for animals. It usually is found at elevations between 9,500 ft and 11,500 ft.



Figure 28. *Botrychium echo*

Botrychium echo is known from locations scattered across northern Utah and central Colorado. The majority of documented occurrences (42) are from Colorado, in 23 counties. There is also an unverified report of the species in northern Arizona.

Many occurrences consist of fewer than ten individuals. However, since the plants are extremely small and difficult to find, numbers may actually be much higher. As with all *Botrychiums*, the number of above ground stems does not necessarily indicate the number of plants in the population because a root system may not send up a stem every year. In order to evaluate an occurrence of *Botrychiums* several years of observation are required. This species hybridizes with western moonwort, *B. hesperium* (see below). Often, several species of *Botrychiums* will be found growing together in the same site.

Strategies for protection and management of this rare species include monitoring known occurrences for changes in population size; determining the effects of grazing; further documenting of the abundance of population and trends; and protecting the highest quality occurrences.

There are three known occurrences of *Botrychium echo* in San Juan County: two in the Molas Pass area and one south of Coal Bank Pass. It is represented in the Molas Pass and Coal Bank Hill PCAs.

Botrychium hesperium

Western moonwort

G3 S2

Botrychium hesperium is similar in size and appearance to *B. echo*, above, but tends to have a more dull gray-green leaf color and more closely spaced pinnae (leaflets). It is nearly always found growing intermixed with other species of grape ferns. Like other *Botrychiums*, it is often found in sites with natural or human caused disturbance such as roadsides and clear-cuts.

Although it can occur in large numbers in pure stands, it more often occurs as one or a few individuals scattered among plants of other *Botrychium* species. This species can remain dormant for long periods and root bases may not produce an aboveground leaf every year (Lesica and Ahlenslager 1995). Because *B. hesperium* is small and inconspicuous, it may at times be overlooked and underrepresented by population surveys.

Botrychium hesperium occurs in both eastern and western North America. In the West it is widely distributed in the Rocky Mountains, ranging from the southern Rocky Mountains in Arizona through Colorado to the northern Rockies in western Montana, southwestern Alberta, and Saskatchewan. In eastern North America, western moonwort occurs from northern Lower Michigan and Upper Michigan to localities along the shore of Lake Superior in southern Ontario. According to Karen Myhre (Minnesota HP Botanist 9/22/98), experts plan to separate the eastern (Michigan and Minnesota) plants of *B. hesperium* from the western (Colorado) plants and call the eastern plants *B. michiganense*.

There are 27 occurrences from 13 counties in Colorado documented in the CNHP database. Two of these are in San Juan County, in the Molas Pass area, and are included in the Molas Pass PCA.

Threats to *B. hesperium* are not well understood. Because this species occurs in both naturally and artificially disturbed sites, threats include natural plant succession as well as the same human activities (recreation, road and trail maintenance activities, selection of grazing areas) that have also apparently resulted in suitable habitat. Agriculture and forestry activities may also threaten this species in some areas.

Strategies for the protection of this species include determining its specific habitat requirements and its sensitivity to disturbance. Long term monitoring would help to determine its life history characteristics, population stability, and dynamics over time.

***Botrychium minganense* Mingan moonwort G4 S1**

Botrychium minganense is one of the most widespread moonworts in North America, occurring across most of Canada, into Alaska, and south into the United States in almost all of the western states. It shares the same habitat requirements, including some natural disturbance, as the other *Botrychium* species described here. It is rare in each state and province throughout its range, but its distribution is wide enough that it is considered to be globally secure. In Colorado, there are records from 14 counties, but most of these are unranked, and abundance is not known.

In San Juan County, its only known location is at Molas Pass, where it occurs with several other moonworts. It is included in the Molas Pass PCA.

***Botrychium pallidum* Pale moonwort G3 S2 FS sensitive**

Botrychium pallidum is a small perennial fern that produces a leaf (the trophophore) with a waxy-appearing, pale-green to whitish blade that is more or less folded longitudinally and is up to 4 cm long. A longer, spore-bearing spike (the sporophore) arises from the common stalk. Leaves appear in late spring or early summer. Gametophytes are subterranean and mycorrhizal. This species reproduces both sexually and vegetatively via minute gemmae that are clustered densely at the root bases.

B. pallidum habitat is generally a large, open, grassy field maintained by some disturbance such as fire or erosion, where successional plant species have not yet invaded.

The range of *Botrychium pallidum* is broad but highly disjunct. This species occurs in Michigan, Colorado (in twelve counties), Montana, Minnesota, and is reported from Maine. In Canada it is found in Ontario, Saskatchewan, Manitoba, and historically in Quebec. In the U. S., there are thirteen element occurrences in Colorado and three in Minnesota. Due to its small size and inconspicuous appearance, this species may have been overlooked, and its range may be more continuous than our present knowledge indicates.

Abundance is difficult to determine because each root base does not send up a stem every year. The maximum number of individuals is currently estimated at 480.

The primary threat to *Botrychium pallidum* is the loss of its open, grassy habitats to successional overgrowth, as it is vulnerable to shading by other plants.

In San Juan County, the one known occurrence is at Molas Pass, and is included in the Molas Pass PCA.

***Botrychium pinnatum* Northern moonwort G4? S1**

Botrychium pinnatum has a bright shiny green frond with numerous lobes. It shares the habitat requirements of the other *Botrychiums* of San Juan County, and is subject to the same threats. It often occurs along with other moonwort species.

Botrychium pinnatum is known from Alaska and the Yukon, south to California, Arizona, and Colorado. Although its range is extensive, it is rare and local over almost its entire range. In Colorado there are eleven occurrences in nine counties. Two of these are in San Juan County, in the Coal Bank Hill and Ophir Pass PCAs.

***Carex limosa* Mud sedge G5 S2**

This graceful sedge has culms extending above its basal leaves, with pistillate spikes nodding on long pedicels. The terminal spike is staminate and erect. Its reddish brown scales contrast with the light green perigynium. It has long, slender rhizomes. It is similar in appearance to the more common *C. magellanica*, but has shorter scales. It grows in wet meadows and fens throughout the northern and western U. S. and is in all Canadian provinces. In Colorado it was known from nine occurrences in five counties. This year San Juan County was added to the list, with occurrences at Burrows Creek and Crater Lake. At Burrows Creek, it was found in a large wet meadow just below 12,000 ft. elevation, dominated by water sedge (*Carex aquatilis*). Other associated species were marsh marigold (*Caltha leptosepala*), star gentian (*Swertia perennis*), fewseeded bog sedge (*Carex microglochin*) and Merten's rush (*Juncus mertensianus*). The second location in San Juan County was at a small un-named lake in the spruce-fir forest northeast of Crater Lake, where it rimmed the edge of the lake, adjacent to a stand of common buckbean (*Menyanthes*

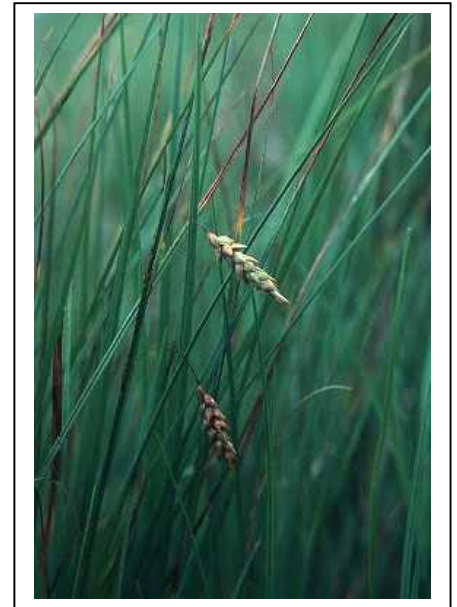


Figure 29. *Carex limosa*. Photo Wisconsin State Herbarium

trifoliatum). Other species here were water sedge (*Carex aquatilis*), elephant head (*Pedicularis groenlandica*), and spike rush (*Eleocharis* sp.). It is included in the Burrows Creek-Mineral Creek Headwaters and the Crater Lake PCAs.

Carex viridula

Green sedge

G5 S1

Green sedge forms small bunches on wet stream banks and the edges of ponds. Its light yellow-green spikes are subtended by a long, slender leaf-like bract. The pistillate scales are shorter and narrower than the perigynium. It is reported from the northern and western U. S. and all of Canada, but its abundance is unknown. It is rare in Colorado, with only six records from Gunnison, Jackson and Park counties prior to 2002. Now, three new locations from the Molas Pass area in San Juan County have been added. Populations were found in wetlands both north and south of Andrews Lake and north of Molas Lake, where it occurred on the edges of small



Figure 30. *Carex viridula*

depressions with tall cottongrass (*Eriophorum angustifolium*) and *Sphagnum* mosses, in a community dominated by Buxbaum's sedge (*Carex buxbaumii*). Other species in the wetland included hairlike sedge (*Carex capillaris*), alpine bistort (*Polygonum viviparum*), elephant head (*Pedicularis groenlandica*) and star gentian (*Swertia perennis*). It is included in the Molas Pass PCA.

Cryptogramma stelleri

Slender rock-brake

G5 S2

BLM Sensitive



Figure 31. *Cryptogramma stelleri*

Slender rock-brake is a small, delicate fern with leaves scattered along the length of a creeping rhizome. Like its more common relative, American rock-brake (*Cryptogramma acrosticoides*), it has two different kinds of fronds, sterile and fertile. It grows in horizontal crevices of moist, shaded cliffs, often associated with waterfalls. These habitats tend to be mossy, and support other ferns such as brittle bladderfern (*Cystopteris fragilis*) and American rock-brake.

This species is extremely widespread, with a nearly circumpolar distribution and a high number of occurrences, although its habitat requirements are very specific and its abundance may not be great at any single location. In Colorado, it is known from sixteen occurrences in Archuleta, Conejos, Grand, Gunnison, Ouray, San Juan, San Miguel, and

Summit counties. In San Juan County, it was found at South Fork Mineral Creek, West Lime Creek, and Mill Creek, and is included in those PCAs.

Cystopteris montana

Mountain bladder fern

G5 S1

Mountain bladder fern has a broadly triangular shaped frond, with three main branches. It grows in moist, shaded spruce forests, often in canyons near waterfalls where the spray adds extra moisture. It is distributed across Canada, but is disjunct in Colorado. There are eleven known occurrences in Colorado, in Chaffee, Conejos, Grand, Gunnison, Ouray, Pitkin, San Juan and Summit counties. In San Juan County, it occurs in a deep shady canyon of the South Fork of Mineral Creek where there is a series of several waterfalls. It was found both on a mossy north facing slope with brittle bladderfern (*Cystopteris fragilis*), and in a seep with chiming bells (*Mertensia ciliata*), brook saxifrage (*Saxifraga odontoloma*), and showy goldeneye (*Heliomeris multiflora*). There is also a historical occurrence from No Name Basin reported in 1961 that has not been verified since. It is included in the South Fork Mineral Creek PCA.



Figure 32. *Cystopteris montana*

Draba borealis

Northern rockcress

G4 S2

Draba borealis is one of seven rare species and four common species of *Draba* found in San Juan County. Like all *Drabas*, it is a member of the Mustard Family (*Brassicaceae*), and has four petals, four sepals, and six stamens, four long and two short. The flowers are white, and there are two or more leaves on the stem, with 4- to 6-armed stellate hairs. It grows at high elevations, usually over 12,000 ft. in dry alpine tundra. It is distributed throughout Alaska and Canada, and makes its way into the lower 48 states in Washington, Montana, Wyoming and Colorado. In Colorado it is known from seven locations in Summit, Park, and San Juan counties. All of the ranked occurrences have small numbers of individuals. It is included in the Stony Pass and Red Mountain Number One PCAs.

Draba crassa**Thick-leaf whitlow-grass****G3 S3**

Thick-leaf whitlow-grass is yellow flowered mustard, larger than most other *Drabas*, with shiny, almost succulent leaves. It is often found in sheltered rock crevices, in both dry and moist sites at elevations above 12,000 ft. It is a regional endemic known from the mountains of Colorado, the Uinta Mountains of northeastern Utah, northwestern and west-central Wyoming, and Montana. In Colorado there are 43 occurrences in 13 counties. Six new occurrences were located in San Juan County in 2002, bringing the total to 8 for the county. All populations were small, with 50 or fewer individuals. *Draba crassa* is included in the Burns Gulch, Cinnamon Pass, Lake Como, Maggie Gulch, Ophir Pass, Picayune Gulch and Stony Pass PCAs.



Figure 33. *Draba crassa*.

Draba fladnizensis* var. *pattersonii**Arctic draba****G4 S2S3**

Another white-flowered *Draba*, Arctic draba is a caespitose perennial with very short styles. Its one or two stem leaves are reduced, and its basal leaves ciliate margined. It grows at high elevations, usually above 12,000 ft., among rocks or in dry meadows, often in areas with some bare ground and little competing vegetation. Its global distribution is circumpolar, but it usually occurs in small numbers. It is found in Alaska, Canada, Montana, Idaho, Wyoming, Utah and Colorado. In Colorado it is known from 31 occurrences in eleven counties. Two new occurrences were found in San Juan County in 2002, bringing the total for the county to seven. It is included in the Burns Gulch, Mineral Basin, Ophir Pass and Stony Pass PCAs.

Draba graminea**San Juan whitlow-grass****G2 S2**

The rarest of San Juan County's *Draba* species, San Juan whitlow-grass is a yellow flowered perennial with small green leaflike bracts beneath each flower. Its basal leaves are narrow with ciliate margins and glabrous surfaces. It may have up to two reduced leaves on its flower stem. It prefers cool areas with gravelly soils near late-melting snowbanks above 12,000 ft. The plants depend on the depth and



Figure 34. *Draba graminea*

longevity of the snowpack, stability of the soil, and presence or absence of appropriate pollinators. Continued drought or warmer climate could be extremely detrimental to the long-term survival of this species.

San Juan whitlow-grass is endemic to the San Juan Mountains of Colorado, where there are 25 occurrences in Hinsdale, La Plata, Ouray, San Juan and San Miguel counties. Six new occurrences were found in San Juan County in 2002, and two more previous records were updated. It is included in the Crater Lake, Ice Lake Basin, Kite Lake, Lake Como, Mineral Basin and South Twilight Peak PCAs.

Draba porsildii

Porsild draba

G3G4 S1

Porsild draba is a small white-flowered, caespitose perennial with two or fewer leaves on the flower stem, and a mixture of simple, forked and stellate hairs on its leaves. It is known from Alaska, western Canada, Montana, Wyoming and Colorado. There are twelve known occurrences in Colorado, from Boulder, Chaffee, Clear Creek, Gilpin, Gunnison, Lake, Park, Pitkin, San Juan and Summit counties. In San Juan County, the only known location is in Burns Gulch, where it was collected in 1982. It was not relocated in 2002, but may have been affected by this year's drought. It is included in the Burns Gulch PCA.

Draba spectabilis* var. *oxyloba

Showy whitlow-grass

G3?T3Q S3

Showy whitlow-grass is a yellow-flowered plant, taller than other San Juan County *Drabas*, and found at generally lower elevations. It has bright green leaves and one to several flowering stems with an elongated inflorescence of 30 to 60 flowers. Its global rank (G3?T3Q) reflects some uncertainty about the validity of the variety. Rollins (1993) distinguishes it from variety *spectabilis* by the presence of appressed cruciform or malpighiaceus hairs on the lower stems, rather than the simple hairs of the var. *spectabilis*. The two varieties are similar, and their ranges overlap in Colorado, but var. *spectabilis* occurs from southwestern Colorado west to Utah, while var. *oxyloba* extends north to Wyoming (Rollins 1993).

The plants grow in spruce-fir forests or in open meadows, along streams or on wet slopes, sometimes in the shade of willows or, in San Juan County, false hellebore.

All of the known occurrences except one at the Wyoming border are in Colorado. There are 44 known occurrences in Colorado, in 12 counties. Six new occurrences were located in San Juan County in 2002. The largest population is from Coal Bank Pass, where it grows on a wet hillside with false hellebore (*Veratrum tenuipetalum*), kittentails

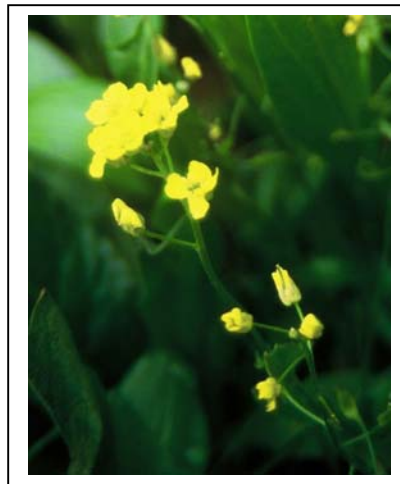


Figure 35. *Draba spectabilis* var. *oxyloba*

(*Besseyia ritteriana*) and a high diversity of mesic grasses and forbs. Maggie Gulch and South Fork Cement Creek also boast large populations. It is represented in the Burns Gulch, Coal Bank Pass, Maggie Gulch, Molas Pass, Placer Gulch, Red Mountain Pass, and South Fork Cement Creek PCAs.

Draba streptobrachia

Colorado Divide whitlow-grass

G3 S3



Figure 36. *Draba streptobrachia*

Colorado Divide whitlow-grass is another yellow-flowered caespitose perennial that most closely resembles the San Juan whitlow-grass (*Draba graminea*), but can be distinguished from it by the absence of bracts below the flowers, and the presence of stellate hairs on the leaves.

The plants are often found growing in or below rock outcrops in alpine tundra between 11,500 ft. and 13,500 ft. Associated species often include alpine avens (*Geum rossii*), snow willow (*Salix reticulata*), false strawberry (*Sibbaldia procumbens*), and alpine bistort (*Bistorta bistortoides*).

D. streptobrachia is a Colorado endemic known from 47 occurrences in fifteen counties, including fifteen occurrences in San Juan County. Eight of these were new occurrences found in 2002. The plants receive some natural protection due to inaccessibility of their habitat. However, they are still vulnerable to direct disturbances such as trampling.

D. streptobrachia is included in the Burns Gulch, Grand Turk South, Kite Lake, Lake Como, Maggie Gulch, Mineral Basin, Ophir Pass, Picayune Gulch, Red Mountain Number One, Ross Basin and Stony Pass PCAs.

***Eriophorum altaicum* var. *neogaeum* Altai cottongrass G4?T3T4 S3 FS sensitive**

Altai cottongrass, also known as bog sedge or bog wool, is a striking plant that resembles a cottonball on a tall stem. The plants are rhizomatous, with solitary white fleecy heads and lack well-developed leaf blades (Weber 1996). A more common, closely related plant, the narrowleaf cottongrass, has multiple heads and leaf blades nearly as long as the stems. It grows in patches in wetlands at high elevations, often associated with water sedge (*Carex aquatilis*), marsh marigold (*Caltha leptosepala*), elephant head (*Pedicularis groenlandica*) and tufted hairgrass (*Deschampsia cespitosa*). In San Juan County, it is sometimes associated with iron fens.

Eriophorum altaicum var. *neogaeum* is the New World variety of this circumpolar species, and is reported to occur from British Columbia to Utah and Colorado. There are 38 known occurrences in ten Colorado counties, including four new occurrences located this year in San Juan County. It is included in the California Gulch, Cinnamon Pass, Clear Lake, Crater Lake, Ice Lake Basin, Kite Lake, Molas Pass, South fork Mineral Creek and Spencer Basin PCAs.



Figure 37. *Eriophorum altaicum* var. *neogaeum*

***Hippochaete variegata* Variegated scouring rush G5 S1**

Variegated scouring rush is a member of the primitive horsetail family, *Equisetaceae*. The horsetails are one of the most ancient lineages of land plants, abundantly found in fossils from the Paleozoic era and relatively unchanged since then. Silica on the surface of the stems gives them their common name, and today, as in Colonial times they are sometimes used for scouring out pots and pans (Weber and Wittman 2001). Similar to the common scouring rush (*Hippochaete hyemalis*), the variegated scouring rush is more slender, and has 5 to 12 angles or grooves in its stem, compared with 16 to 48 grooves in the more stout stems of its relatives.

The range of this species is circumpolar in the North Temperate Zone, extending into the Arctic. There are five records of the species in the CNHP database, in Gunnison, Archuleta, San Miguel and, as of 2002, San Juan counties. Seven additional counties are represented by specimens at the University of Colorado Herbarium. This species may be more common but overlooked. In San Juan County, it was found in a mossy hillside seep in the spruce-fir forest along West Lime Creek. It was accompanied by a rich assortment of other moisture-loving plants, including fringed grass of Parnassus (*Parnassia fimbriata*); star gentian (*Swertia perennis*); Rocky Mountain fringed gentian (*Gentianopsis thermalis*); Merten's rush (*Juncus mertensianus*); longstyle rush (*Juncus longistylis*); nodding bluegrass (*Poa reflexa*); and golden sedge (*Carex aurea*). It is represented in the West Lime Creek PCA.

***Machaeranthera coloradoensis* Colorado tansy-aster G2 S2 FS sensitive**

Colorado tansy-aster is a striking member of the sunflower family (*Asteraceae*). It has large rose-colored flowers and coarsely toothed leaves (Figure 38). It is reported from elevations between 9500 ft. to 12,600 ft. in both moist and dry sites, often on gravelly soils.

The species is restricted to the Rocky Mountains in south-central Wyoming and western Colorado. There are 25 known occurrences in Colorado, in Gunnison, Hinsdale, La Plata, Lake, Park, Pitkin, Rio Grande, Saguache and San Juan counties. In San Juan County, there are five documented locations, two of which were visited in 2002. Others are historical records or have very small numbers or imprecise locations. It was most abundant on the south slopes of Grand Turk Mountain. Another very small population (two individuals) was found on the side of Engineer Mountain. There are also historic records from Eldorado Lake and Twin Sisters. It is represented in the Grand Turk South PCA.



Figure 38. *Machaeranthera coloradoensis*

Parnassia kotzebuei

Kotzebue grass-of-Parnassus

G4 S2

Kotzebue grass of Parnassus is a small white-flowered plant with only basal leaves. It has recently been segregated from the Saxifrage family (*Saxifragaceae*), into a new family, the *Parnassiaceae* (Weber and Wittman 2001). This species is similar to the more common fringed grass of Parnassus (*Parnassia fimbriata*), but smaller and lacking the single small leaf on the stem that characterizes its relative. It is found on rocky ledges or on streamsides in the subalpine and alpine zones.



Figure 39. *Parnassia kotzebuei*

Its range extends from Canada and northwestern U. S. to Colorado and Nevada. There are 13 known occurrences in Colorado, two of which are in San Juan County. It is also known from Clear Creek, Garfield, Grand, Larimer, Park and Summit counties. A very small population was relocated in 2002 in Burns Gulch. There is also a historic record from Balsam Lake. It is included in the Burns Gulch PCA.

Penstemon harbourii

Harbour beardtongue

G3G4 S3S4

Harbour beardtongue is a beautiful low powder-blue penstemon that grows on talus slopes above treeline (Figure 37). The plant has long, flexible caudex branches that allow it to cope with the slow downhill movement of the scree slopes. Observation of this species in 2002 indicated that it has very specific habitat requirements, needing a certain amount of soil below the rocks of the talus field, and preferring rocks of a certain size. It often is found in areas that have been further eroded or packed by mining roads.



Figure 40. *Penstemon harbourii*

This species is a Colorado endemic, known from 14 counties. The species is watchlisted (S3S4), based on the number of specimens at herbaria, indicating that it is probably secure. Therefore records are not entered in the CNHP data system. In San Juan County, it was observed at five locations. The largest of these was at Clear Lake, where hundreds to thousands of plants grew on scree above the northeast side of the lake. There is much more potential habitat to the south of that location. The species is represented in the Maggie Gulch, Mineral Point, Clear Lake, Kendall Mountain, and Lake Como PCAs.

Stellaria irrigua**Altai chickweed****G4? S2**

This tiny plant grows in the most inhospitable habitat imaginable: barren scree slopes high in the mountains (Figure 41). Its flowers, only about a quarter of an inch in diameter, are exquisite when viewed closely (Figure 42). Each of its five petals is cleft to the base, and touches its neighboring petal segment at the tip, forming a five-pointed star. The stamens are opposite and nearly as long as the petals. The leaves are purplish green. The roots are long and elastic, allowing the plants to advance along with the downward creep of the rocks.

This plant is found in North America only in Colorado and New Mexico, but is also found in the Altai region of Siberia, where it is also rare. It is one of several plants that share this disjunct distribution, suggesting that the two areas were once connected by habitat suitable to those species. In Colorado, it is known from nine counties in the San Juans and Central Rockies.

In 1999, several new occurrences were found in San Miguel County, and one of these extended into San Juan County at Ophir Pass. Although it was expected in similar habitats in San Juan County in 2002, no new populations were found. It is suspected that this is a result of the drought that the area experienced in 2002, and further search may reveal more populations in San Juan County.



Figure 41. *Stellaria irrigua*

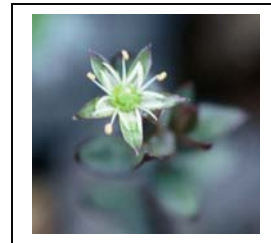


Figure 42. *Stellaria irrigua* close-up

Townsendia rothrockii**Rothrock townsendia****G2 S2**

Rothrock townsendia, or Easter daisy, is a perennial herb of the sunflower family (*Asteraceae*) that forms low tufts of thick leaves, 1-3.5 cm long. Large, showy flower heads with pale blue rays surround a yellow disk (Figure 43). The plants begin to bloom as the snow melts in early summer. They grow above timberline in areas that retain snow into the summer, as well as occasionally on high plateau ridgetops and in openings in ponderosa pine forests.



Figure 43. *Townsendia rothrockii*

The species is endemic to Colorado, although there have been reports from New Mexico that are apparently erroneous. There are collections at the University of Colorado from ten Colorado counties. Two new populations were found in San Juan County in 2002. Both sites were barren areas with little other vegetation, at 10,800 ft. and 12,600 ft. Rothrock townsendia is represented in the Molas Pass and Stony Pass PCAs.

Table 7. Non-vascular plants: Mosses, liverworts and lichens

Scientific Name	Common Name	Global Rank	State Rank	State/ Federal Status
<i>Sphagnum balticum</i>	Baltic peat moss	G2G4	S?	
<i>Sphagnum contortum</i>	Peat moss	G?	S?	
<i>Sphagnum girgensohnii</i>	Girgensohn's peat moss	G5	S?	
<i>Sphagnum platyphyllum</i>	Peat moss	G5	S?	
<i>Jungermannia rubra</i>	Liverwort	G2G4	S?	
<i>Cladina rangiferina</i>	Reindeer lichen	G5	S?	

Mosses

Sphagnum balticum

Baltic peat moss

G2G4 S?

The genus *Sphagnum* can be distinguished from other mosses by its fascicled branches, and microscopically by its alternation of small green cells with large transparent cells. *S. balticum* is similar to the more common *S. angustifolium*, but is often more reddish colored. It is aquatic, occupying shallow pools, and is distinguished in the field by its long side branches (Weber 2001). Until its discovery in Colorado, the known range of *Sphagnum balticum* in North America extended southward to approximately 51 degrees latitude in Alaska and British Columbia. *Sphagnum* tends to be uncommon in Colorado because most of our fens are not very acid, and we do not have wetlands that are dependent on rain water alone (Weber 2001). In Colorado, *Sphagnum balticum* is known only from one location, in Chattanooga Fen in San Juan County, where it is common. It is the primary moss in shallow pools of highly acidic water, growing with the common water sedge (*Carex aquatilis*) and beaked sedge (*Carex utriculata*). Only two species of *Sphagnum* are common in Colorado: *S. robustum* and *S. fuscum* (Weber 2001). *Sphagnum balticum* grows very slowly (fens accumulate sphagnum peat at the rate of 8" per 1,000 years in cold climates) and does not recover rapidly after disturbance.



Figure 44. *Sphagnum balticum*. Photo by Alan Hale, Mosses and Liverworts in Wales.

<http://home.clara.net/adhale/bryos/index.htm>

Sphagnum contortum

Peat moss

G? S?



Figure 45. *Sphagnum contortum*. Photo by Alan Hale Mosses and Liverworts in Wales.

<http://home.clara.net/adhale/bryos/index.htm>

This species is found particularly in base-rich flushes in otherwise more acidic habitat, usually in the open. The plant (including the stem) is usually orange in color, and the branch leaves are approaching a five-ranked arrangement (Hale 2003). It has hanging branches that are distinctly different from and longer and more slender than its spreading branches. It was previously known in Colorado from only one location in Rocky Mountain National Park (Weber 2001). *Sphagnum contortum* is found in the Chattanooga Iron Fen PCA.

Sphagnum girgensohnii

Girgensohn's Peat Moss

G5 S?

Girgensohn's peat moss, also known as white-toothed peat moss, is a green, robust, mat-forming species. The heads are star shaped and flat topped. Its stem leaves have rough edges, described as looking like they were cut with pinking shears (Borealforest 2003). It is a circumpolar species, occurring in woodlands, bogs and fens in the boreal forest and in tundra farther north. It was previously known in Colorado from one location, an iron fen at Geneva Creek, where it occurred on the margins of ponds between tussocks of sedges. In San Juan County, *Sphagnum girgensohnii* is found in the Chattanooga Iron Fen PCA.



Figure 46. *Sphagnum girgensohnii*. Photo Borealforest.org 2003.

Sphagnum platyphyllum

Peat Moss

G5 S?

According to Weber (2001), "*Sphagnum platyphyllum* grows prostrate in shallow water, but becomes stranded as the summer progresses. The stems and branches have a tumid appearance, and there is no obvious capitulum. The terminal bud is large and the stem cortex 2-3 layered. The branches are 1-3 per fascicle and scarcely differentiated as to spreading and pendant types. The stem leaves are relatively large and ovate, much like branch leaves in size, shape, and structure. The hyaline cells of both stem and branch leaves have few to many commassural pores on the outer surface and few on the inner.

The species has a scattered distribution in eastern North America and also in the west, from Alaska and the Yukon to Arizona.” This species was previously collected in Colorado in the Holy Cross Wilderness and in Summit County above Boulder Lake. In San Juan County, it was found at the Chattanooga Iron Fen PCA.

Liverworts

***Jungermannia rubra* (Jungermanniaceae)**

G2G4 S?

There are four records of this species in Colorado, including the one from San Juan County at Chattanooga Fen, where it was documented at the springs and in the water tracks on exposed limonite. It is abundant at the site, and apparently not threatened. The species also occurs in California, Northwestern United States and Canada. It is evidently not known from other continents (Weber 2001). In Colorado peat mining, draining of fens and the increase in motorized vehicle use have decreased the quality and quantity of habitat for this species.

Lichens

Cladina rangiferina

Reindeer Lichen

G5 S?

This showy white to silver-gray fruticose lichen has a treelike branching pattern, giving it a lacy appearance. It covers the ground in areas with well-drained peat, shallow nitrogen-poor soils, or soil over rock, primarily in spruce-fir habitats with little competition from vascular plants. In the far north, it is important forage for reindeer and caribou. There are only two known locations for this species in Colorado, one in Gunnison County and the other in San Juan County, at Burro Bridge. Although widely distributed in the boreal forest, this is the southernmost extent of the species in the western U. S. The rarity of peatlands in Colorado, where they cover only 0.1% of the land area makes this species especially vulnerable. Threats include sheep grazing and wildfire. It takes 30 to 100 years for the species to recover after wildfire.



Figure 47. *Cladina rangiferina*.

Weeds (Non-native invasive plants) of San Juan County

As a part of the Biological Assessment of San Juan County conducted in 2002 by the Colorado Natural Heritage Program, records were kept of weed populations encountered in the backcountry. In general, San Juan County was found to be far less affected by non-native plants than most other counties in Colorado. Three primary non-native species inhabit this mountainous area: *Linaria vulgaris* (Yellow toadflax, Figure 1); *Leucanthemum vulgare* (Ox-eye daisy, Figure 2); and *Cirsium arvense* (Canada thistle, Figure 3).



Figure 48. (left): *Linaria vulgaris*
Figure 49. (above): *Leucanthemum vulgare*
Figure 50. (right): *Cirsium arvense*



Yellow toadflax, or “butter and eggs”, is a relative of the snapdragons. Oxeye daisy is an attractive white composite. Both were originally introduced as garden plants in the early mining days. They have escaped cultivation, and are colonizing disturbed areas, and gradually moving away from roads and trails. Both species are abundant in the town of Silverton, along state highways, and to a lesser extent along county roads where their profusion decreases with distance from Silverton. Control of these species may be problematic unless the seed source is reduced by a conscientious effort to remove them from private lands within the town of Silverton. Otherwise, a continual holding action will be required to keep them from spreading onto public lands and into wilderness areas. Public education, along with assistance in finding replacement species that are not invasive, is recommended.

Canada thistle also invades disturbed areas. Its seeds are distributed by wind as well as by attachment to vehicles, hikers, and horses. It was found along county roads and hiking trails. In addition to Canada thistle, and other potentially occurring non-native thistles, San Juan County is home to several native thistles that should not be

confused with the weeds. At lower elevations, the yellow-flowered *Cirsium parryi* (Parry thistle, Figure 51) is common in aspen forests and along roads. Above treeline, it is replaced by the very handsome purple-flowered *Cirsium hesperium* (Hesperus thistle, Figure 52). Although they may be locally abundant, the native thistles grow as individuals, and do not form extensive dense patches, as does Canada thistle.

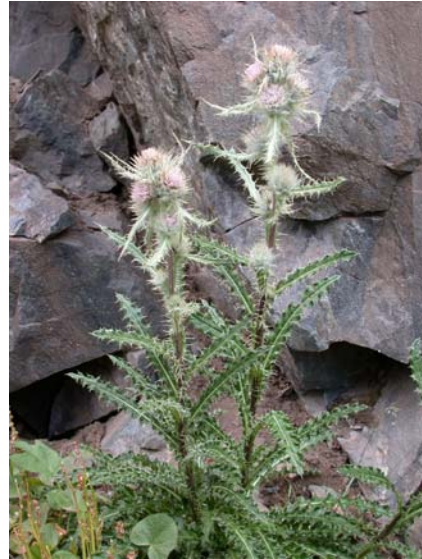


Figure 51 (left) and Figure 52 (right): Native thistles, *Cirsium parryi* and *Cirsium hesperium*, should be protected, and not confused with the non-native thistles.



One population of *Cynoglossum officinale* (Houndstongue, Figure 53) was found, and pulled. This location should be monitored, as it is unlikely that the plants were permanently eradicated.

Figure 53. *Cynoglossum officinale* (Houndstongue)

Although we did not encounter Dame's rocket (*Hesperis matronalis*), there are reports of it occurring in Silverton. It can be extremely invasive, and if found should be controlled. Several other plants that are listed on the San Juan County draft weed management plan were not encountered at all during this survey, and are probably not a

concern at the present time, although they should be watched for in the future. These include Dalmatian toadflax, Russian knapweed, Spotted knapweed, Bull thistle, Musk thistle and Scotch thistle. Quackgrass (*Elymus repens*) is known within the town of Silverton, but has not been found elsewhere. Other non-native species that are not mentioned in the draft weed plan, but could be considered for control, are yellow and white sweet clover (*Melilotus officinalis* and *M. alba*), and mullein (*Verbascum thapsus*). The sweet clovers are common along Highway 550, while mullein is often found in gravelly disturbed areas such as the flood plain of the Animas River and along train tracks.

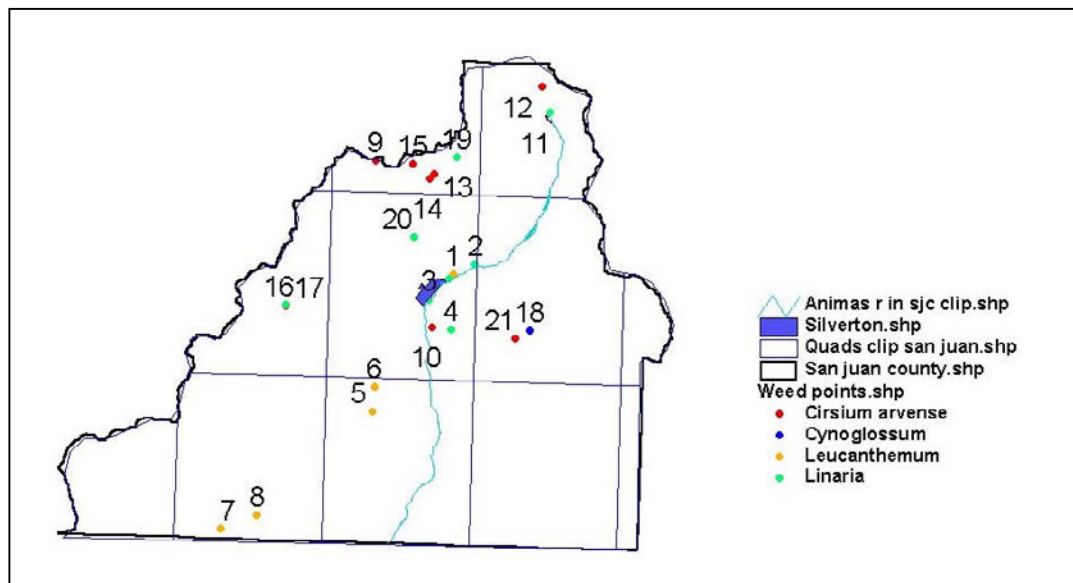


Figure 54. Locations of weeds noted in San Juan County, excluding those along major highways and the town of Silverton. Dot colors indicate species: green, *Linaria vulgaris*; yellow, *Leucanthemum vulgare*; red, *Cirsium arvense*; blue, *Cynoglossum officinale*. See GIS coverage for detail of location.

The following are locations of weeds observed during the Biological Assessment of San Juan County during the summer of 2002. These locations do not include the town of Silverton, Highway 550, and Highway 110, where the presence of all three major weed species is well known and obvious. Location numbers refer to the map above and the accompanying GIS coverage.

Location number: 1

Species: *Linaria vulgaris* and *Leucanthemum vulgare*

Location name: Cement Creek Road

Directions: West side of Cement Creek Road, for about a mile. *Linaria* at some distance from the road.

U.S.G.S. Quadrangle: Silverton

Township, Range, Section and/or UTM: T41N R7W Sec 16, 9

Population size class (Small, medium, large): Medium

Location number: 2
Species: *Linaria vulgaris*
Location name: Animas River, County Road 22
Directions: East of intersection with County Road 21, between road and river
U.S.G.S. Quadrangle: Silverton
Township, Range, Section and/or UTM: T41N R7W Sec. 10
Population size class (Small, medium, large): Medium

Location number: 3
Species: *Linaria vulgaris*
Location name: Kendall Mountain Road (County Road 33)
Directions: 0.2 miles from bottom of road
U.S.G.S. Quadrangle: Silverton
Township, Range, Section and/or UTM: T41N R7W Sec 29
Population size class (Small, medium, large): Small

Location number: 4
Species: *Linaria vulgaris*
Location name: Kendall Mountain Road switchback, County Road 33
Directions: both sides of road at switchback, 3 miles from bottom of road
U.S.G.S. Quadrangle: Silverton
Township, Range, Section and/or UTM: T41N R7W Sec. 29
Population size class (Small, medium, large): Medium

Location number: 5
Species: *Leucanthemum vulgare*
Location name: Andrews Lake
Directions: Central planter in parking lot, and around lake
U.S.G.S. Quadrangle: Snowdon Peak
Township, Range, Section and/or UTM: T40N R8W Sec. 23
Population size class (Small, medium, large): Medium

Location number: 6
Species: *Leucanthemum vulgare*
Location name: Little Molas Lake Road
Directions: scattered along road to Little Molas Lake
U.S.G.S. Quadrangle: Snowdon Peak
Township, Range, Section and/or UTM: T40N R8W Sec. 14
Population size class (Small, medium, large): Medium

Location number: 7
Species: *Leucanthemum vulgare*
Location name: Hermosa Creek
Directions: Forest Road 579. *Leucanthemum vulgare* along road and on adjacent closed road at 1.6 mi.
U.S.G.S. Quadrangle: engineer Mt.
Township, Range, Section and/or UTM: T38N R9W S14
Population size class (Small, medium, large): Medium

Location number: 8
Species: *Leucanthemum vulgare*
Location name: Lime Creek Road
Directions: Especially abundant around private land in Mill Creek area
U.S.G.S. Quadrangle: Engineer Mt.
Township, Range, Section and/or UTM: T38N R8W S7; UTM: (13) 256634 E; 4171158N; 9137 ft.
Population size class (Small, medium, large): large

Location number: 9
Species: *Cirsium arvense*
Location name: Red Mountain Pass
Directions: west side of highway 550 at pass, along irrigation ditch
U.S.G.S. Quadrangle: Ironton
Township, Range, Section and/or UTM: T43N R6W Sec. 30
Population size class (Small, medium, large): Small

Location number: 10
Species: *Cirsium arvense*
Location name: Kendall Mountain Road
Directions: County Road 33, about 2.2 miles from bottom, west side of road at switchback
U.S.G.S. Quadrangle: Silverton
Township, Range, Section and/or UTM: T41N R7W Sec. 29
Population size class (Small, medium, large): Medium

Location number: 11
Species: *Linaria vulgaris*
Location name: Engineer Pass Road
Directions: 0.1 miles past Cinnamon Pass intersection, on uphill side of road
U.S.G.S. Quadrangle: Handies Peak
Township, Range, Section and/or UTM: T43N R6W Sec. 25
Population size class (Small, medium, large): Small

Location number: 12
Species: *Cirsium arvense*
Location name: North Fork Animas River
Directions: About 0.1 miles past Denver Bridge
U.S.G.S. Quadrangle: Handies Peak
Township, Range, Section and/or UTM: T43N R6W Sec. 30
Population size class (Small, medium, large): Small

Location number: 13
Species: *Cirsium arvense*
Location name: County Road 35
Directions: 0.1 miles from Cement Creek Road, at turn
U.S.G.S. Quadrangle: Ironton
Township, Range, Section and/or UTM: T42N R7W Sec. 20
Population size class (Small, medium, large): Small

Location number: 14
Species: *Cirsium arvense*
Location name: County Road 35
Directions: 0.4 miles from Cement Creek Road
U.S.G.S. Quadrangle: Ironton
Township, Range, Section and/or UTM: T42N R7W Sec. 20
Population size class (Small, medium, large): Small

Location number: 15
Species: *Cirsium arvense*
Location name: County Road 35
Directions: Near end of road
U.S.G.S. Quadrangle: Ironton
Township, Range, Section and/or UTM: T42N R7W Sec 18; UTM: (13) 264187E; 4197317N; 11,149 ft.
Population size class (Small, medium, large): Large

Location number: 16
Species: *Linaria vulgaris*
Location name: South Mineral Creek
Directions: 0.6 miles west of South Mineral Campground, along north side of road
U.S.G.S. Quadrangle: Ophir
Township, Range, Section and/or UTM: T41N R8W Sec. 19
Population size class (Small, medium, large): Small

Location number: 17

Species: *Cirsium arvense*

Location name: South Mineral Creek

Directions: 0.6 miles west of South Mineral Campground, south side of road

U.S.G.S. Quadrangle: Ophir

Township, Range, Section and/or UTM: T41N R8W Sec. 19; UTM: (13) 254690E; 4186712N; 10,315 ft.

Population size class (Small, medium, large): small

Location number: 18

Species: *Cynoglossum officinale*

Location name: Highland Mary trailhead

Directions: From road to Highland Mary trailhead, turn right on road to mine.

Occurrence is about 100 yards up road.

U.S.G.S. Quadrangle: Howardsville

Township, Range, Section and/or UTM: T41N R6W Sec. 19

Population size class (Small, medium, large): Large (pulled)

Location number: 19

Species: *Linaria vulgaris*

Location name: Corkscrew Pass Road

Directions: County Road 11 north of Gladstone. *Linaria* is in bottom of drainage near mine. GPS point taken from road southwest of occurrence from which occurrence is visible.

U.S.G.S. Quadrangle: Ironton

Township, Range, Section and/or UTM: T42N R7W Sec. 16. UTM: (13) 267308E; 4197527N

Population size class (Small, medium, large): Large

Location number: 20

Species: *Linaria vulgaris*

Location name: Cement Creek Road

Directions: 0.6 miles north of 2 mile marker, south of new bridge construction. Toadflax is away from road.

U.S.G.S. Quadrangle: Silverton

Township, Range, Section and/or UTM: T41N R7W Sec. 6

Population size class (Small, medium, large): Medium

Location number: 21

Species: *Cirsium arvense*

Location name: Trail to Spencer Basin

Directions: Along trail above mine, about 0.2 miles past mine

U.S.G.S. Quadrangle: Howardsville

Township, Range, Section and/or UTM: T41N R7W Sec. 25. UTM: (13) 271802E; 4184284N

Population size class (Small, medium, large): Medium

Rare and imperiled Animals of San Juan County

Table 8. Animal Species tracked by CNHP found in San Juan County. See p. 5 for explanations of Global and State Ranks.

Scientific Name	Common Name	Global Rank	State Rank	State/ Federal Status
<i>Boloria improba acronema</i>	Uncompahgre fritillary	G5T1	S1	LE
<i>Cypseloides niger</i>	Black Swift	G4	S3B	
<i>Aegolius funereus</i>	Boreal owl	G5	S2	
<i>Oncorhynchus clarki pleuriticus</i>	Colorado River cutthroat trout	G4T3	S3	BLM sensitive Colorado State Species of Special Concern
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat trout	G4T3	S3	BLM sensitive Colorado State Species of Special Concern
<i>Lynx canadensis</i>	Lynx	G5	S1	(PS:LT)

Uncompahgre Fritillary *Boloria improba acrocnema* G5T1 S1 LE

The Uncompahgre fritillary butterfly (Figure 55) is a glacial relict species endemic only to high elevations in the San Juan Mountains of southwest Colorado. It is a very small and not particularly flashy little butterfly. The dorsal sides of the wings have a faded black pattern on a dusky golden brown background. The ventral side of the wings is similar, but slightly more ochre. The total wing span is 3 cm. They are poor fliers, hovering close to the ground as they travel. They are believed to have once been widely distributed during the Wisconsin glaciation period. However, it appears that loss of glacial habitats throughout the Rocky Mountain cordillera has lead to this species isolation and differentiation from its sister species, *Boloria improba*, the Dingy Fritillary, found in the northern Rockies (Britten and Brussard 1992). Emergence is usually in late June, and their reproductive period tends to be complete by mid-July.

In 1982, researchers were finding this species in sufficiently small numbers that it was proposed as a candidate for listing under the Endangered Species Act and in 1991, it was listed as endangered. The populations appear to fluctuate widely, the causes of which remain unknown. Potential threats may include collecting pressure by butterfly fanciers, intensive grazing and trampling by sheep, and periods of prolonged drought conditions. Future mining and recreational activities may have impacts on this species and its habitat.

The butterfly's habitat is comprised of mesic alpine areas higher than 12,000 ft. It is heavily dependent on the presence of its host plant *Salix reticulata* ssp. *nivalis*, the snow willow. This plant typically grows best in dense, prostrate mats on slopes with some terracing and north to northeastern aspect. Contiguous patches of greater than 10 meters in width individually, and greater than 1/3 acre in extent collectively, are required by *B. acrocnema* for breeding success (Ellingson, pers. comm. 2002). Benches on these aspects tend to accumulate and retain winter snow-pack longer, thus providing the late season moisture required by *B. acrocnema*. Slopes below peaks over 13,000 ft. high are preferred (Ellingson, pers. comm. 2002).

At the time of this writing, no colonies are known to exist in San Juan County. A small colony of five individuals at Cinnamon Mountain that was observed in 1995 has not been verified in recent years and may be extirpated.

Sheep grazing can pose a threat to the butterflies, as sheep tend to break up patches of mat-forming species like snow willow. They may also reduce the diversity of flowering plants that provide nectar for adults (Ellingson, personal communication).

During the summer of 2002, CNHP staff surveyed twelve high elevation sites for potential Uncompahgre fritillary habitat. These were: Mineral Basin, Ophir Pass/Crystal Lake, Burns Gulch, Fuller Lake, Kendall Mountain, Kite Lake, Maggie Gulch, Minnie Gulch, Picayune Gulch, South Fork Cement Creek, Spencer Basin, Stony Pass, and Mount Emory. Although marginal habitat was present in several of these sites, none was ideal, and no butterflies were observed either by CNHP staff or by members of the Colorado Cooperative Wildlife Research Unit (Colorado State University) (Ellingson, pers. comm. 2002).



Figure 56. Snow willow (*Salix reticulata* ssp. *nivalis*, the host plant of the Uncompahgre fritillary.

Black Swift

Cypseloides niger

G4 S3B

Black Swifts (Figure 57) are medium sized birds, blackish overall, with a long, slightly forked tail. Young birds have a small white patch on the face between the eyes and the nares.

Black Swifts are difficult to accurately census and study because of their eccentric habit of nesting on rock faces in the coldest, dampest spots they can find adjacent to waterfalls. The initial discovery of the Black Swift was made in 1881 from a specimen collected east of the town of Silverton (Knorr 1961). For the next several years, it was believed that this species was limited entirely to San Juan County, Colorado, but breeding status was unknown. In 1949, breeding birds were located in Cataract Gulch on the South Mineral drainage. Subsequent investigations have found colonies in other locations in Colorado and along the Pacific coast as well. Much remains unknown about their distribution, habits and winter range (Stiles and Negret 1994).

Black Swifts are colonial birds that nest behind or next to waterfalls and wet cliffs (Michael 1927, Knorr 1961, Foerster and Collins 1990). Nests are built in dark sites getting usually no more than 1 hour of sunlight each day. A flight path unobstructed by trees is necessary (Knorr and Knorr 1990). Nest site fidelity is virtually absolute, with birds returning year after year and old nest occupancy being very high (Knorr and Knorr 1990) (Schultz, pers comm.). Whether or not the birds utilizing these nests are always the same individuals is unknown, since banding and tracking of these birds is extremely difficult. The nest itself is a cup-like structure of mud, mosses and algae, and in Colorado all nests are located on sheer cliff faces with waterfalls pouring down close to the nesting colony (Boyle 1998). Colony size tends to average approximately 5 nests/pairs. Only one offspring is produced in a given year and hatchlings are fed all summer long, fledging in September.

Globally, this bird is widespread, occupying more than 1,000,000 sq. miles of the Americas. Winter range is poorly known; however, northern populations like those in Colorado may winter in South America (Stiles and Negret 1994). Although calculation of population size is difficult because of colony inaccessibility, it is estimated that over 200 nesting pairs occur in Colorado representing between 10% and 20% of the total nesting population of this species (Boyle 1998). This makes Colorado's population an important component of this bird's total population. Black Swifts are tolerant of human disturbance, as demonstrated by the group at Bridal Veil Falls power plant near Telluride. However, flowing falls, (including low flows) are a necessity for nesting swifts. Therefore, potential threats to this species include diversion or blockage of stream flows, which could result in abandonment of breeding sites.

CNHP staff collaborated with the U. S. Forest Service during the 2002 survey. Areas examined by CNHP as potential Black Swift habitat included Burns Gulch, Little Green Falls,

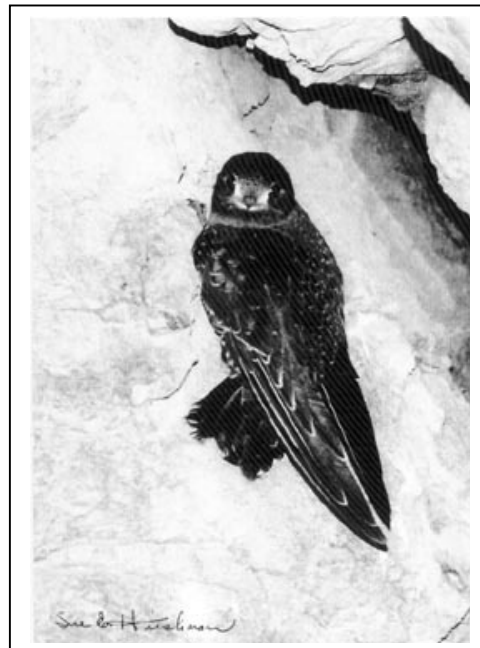


Figure 57. Black Swift, juvenile. Photo courtesy of Sue F. Hirshman.

South Mineral Creek falls, Mill Creek, Crater Creek, Three Lakes Creek, Lime Creek, and Maggie Gulch. Only two of these sites turned out to be occupied: known colonies in the South Mineral Creek area were re-confirmed, and a new site, Maggie Gulch, had nests at two waterfalls. Chris Schulz, a U. S. Forest Service researcher, has identified 17 occurrences in San Juan County (Chris Schultz, pers. comm. 2002). Mr. Schultz feels that recent surveys for the last few years compare favorably with populations tracked by other researchers in the 1950's. He is optimistic that this indicates a reasonably stable population, despite a lack of knowledge about its South American wintering grounds. The Black Swift is found in association with waterfalls in the following three PCA's in San Juan County: South Mineral Creek, Maggie Gulch and Middleton.

Boreal Owl

Aegolius funereus

G5 S2

Boreal Owls have a black facial border, with chocolate streaking of their underparts, and a pale bill (Figure 58). The quiet of the Colorado high country is often punctuated by the call of this bird. The owls' clear, six to eight syllable calls can be heard in subalpine forests above 9,000 feet.

Boreal Owls are moderately widespread with a spotty distribution (10,000-1,000,000 sq. miles) to widespread (greater than 1,000,000 sq. miles) in North America. Their wide range and apparently large numbers seem to make this species secure. Boreal Owls have been ranked the tenth most abundant owl in Colorado (Bridges 1992). There are 31 records of nesting Boreal Owls in Colorado (Ryder 1998). The USFS has located occurrences of nesting owls in the Uncompahgre National Forest within San Juan County. In Colorado these year-



Figure 58. Boreal Owl. Photo courtesy of Chris Schultz

round residents prefer dense coniferous forests of Engelmann spruce and subalpine fir above 9000 feet, most commonly in proximity to open grassy situations (AOU 1983), streams, and bogs. Lodgepole pine and aspen can also be occupied. These owls roost in dense cover by day, in cool microsites in summer, and frequently change roosting sites.

Major threats are the direct and indirect effects of forest harvesting practices. Harvesting may reduce primary prey populations, remove forest structure used for foraging, and eliminate nesting cavities (Hayward and Hayward 1993). Boreal Owls, however, are not very threatened range-wide and seem to have little difficulty with non-destructive intrusion. Large home ranges and low population densities require that preserves exceed 1000 sq. km of suitable habitat (Hayward and Hayward 1993). Management of forests for both maintenance of snags and maintenance of aspen groves with large diameter trees would benefit the owls. Uneven-age timber management may be compatible, but clear-cuts are not considered suitable habitat for foraging (Hayward and Hayward 1993). Stewardship needs include furnishing nesting cavities and forest structure necessary for foraging in the long-term.

Colorado River Cutthroat Trout *Oncorhynchus clarki pleuriticus* G4T3 S3
Status: Colorado State Species of Special Concern

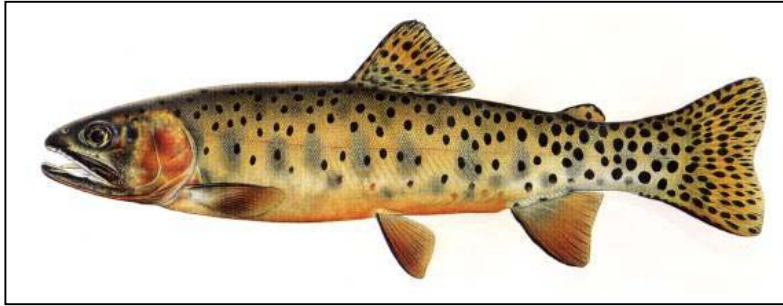


Figure 59. Colorado River cutthroat trout

Colorado River cutthroat trout (Figure 59) is one of 14 species of cutthroat trout found in the western U. S. It can be identified by the bright red stripe on each side of the lower jaw. During the breeding season the trout also displays bright shades of orange and yellow on a brassy background color. This subspecies is the only trout native to the upper Colorado River basin. Although historical records show that these fish were commonly as large as 20 lbs. (Benke 1979), most adult fish today are under 5 lbs. due to reduced habitat quality, among other factors.

Its native range extends southward to the Escalante River on the west and the San Juan drainage on the east sides of the basin, including the Green, Yampa, Gunnison, Dolores, and San Juan rivers, and their tributaries (CDOW 1986, Proebstel 1994, Young *et al.* 1996). It now occupies only 5 percent of its former range. Its current distribution includes remnant populations in Colorado, Wyoming, and Utah. The historical habitat included most clear water streams and rivers of western Colorado (Behnke 1992). Currently, all populations of *O.c. pleuriticus* are restricted to smaller order streams and a few high elevation lakes of the mountainous country over 7000 feet in elevation (Binns 1977). They prefer a 6% or less stream gradient, oxygen rich and cold stream waters. They also require a minimum stream flow to survive. The stream must include riffles and pool systems and clean gravel beds for spawning. Over-hanging vegetation in the riparian zone is necessary for water temperature regulation and cover. However, waters can also be too cold for the trout. Eggs laid in the spring will incubate until water temperatures rise to the point where fry can emerge. Delayed emergence from too chilly waters results in insufficient growth and inability to survive the winter. For this reason, stocking of very high alpine waters has often been unsuccessful.

Only 39 populations of Colorado River Cutthroat Trout are indigenous, genetically pure and secure from non-native trout and other threats. Most of these populations consist of less than 200 breeding individuals.

Threats include hybridization, competition from non-native trout and other introduced fishes, habitat alteration/fragmentation, overgrazing, logging, mining effluents, water diversion for irrigation, over-fishing and Whirling Disease. The primary reasons for conservation concern at the global and state levels are long-term trend prognoses and threats. Populations continue to decline in many streams (Young *et al.* 1996); hybridization between this subspecies and non-native trout species poses the greatest threat to the elimination of pure populations. Due to hybridization only 26% of the remaining populations of this trout are considered genetically pure (Young *et al.* 1996). Other concerns include interference with recolonization by established populations of

non-native salmonids (Spahr *et al.* 1991, Behnke 1992, Young 1995). For these reasons the Colorado River Cutthroat Trout is currently under petition for consideration as a Threatened or Endangered Species.

Management strategies include construction of fish barriers to prevent interbreeding with other trout, rehabilitation of both streambanks and water quality, elimination of non-native trout through chemical treatment, and transplanting genetically pure cutthroat into rehabilitated habitat (Spahr *et al.* 1991). Colorado has instituted restrictive angling regulations (Young 1995). Although the Animas River in San Juan County is too acidic and metal laden to support trout at this time, remediation efforts underway may make it a viable site in the future. Currently, there are no Colorado River cutthroat trout known in San Juan County. However, the headwaters of the East Fork Hermosa Creek in San Juan County are essential to the continuation of a population found downstream in La Plata County, and are included in the East Fork Hermosa Creek PCA.

Rio Grande Cutthroat Trout *Oncorhynchus clarki virginalis* G4T3 S3

Status: Colorado State Species of Special Concern



Figure 60. Rio Grande cutthroat trout

This subspecies of cutthroat trout is restricted to a small range in the Rio Grande River drainage of Colorado and New Mexico. There are approximately 200 extant populations (USFWS 1998). The actual abundance of the trout is unknown. It currently occupies 480 miles of stream and 1,120 acres of lake habitats in Colorado, and 260 miles of stream habitat in New Mexico (USFWS 1998). The historic range of the subspecies is not definitely known, but probably encompassed all "trout waters" in the Rio Grande drainage, including the Chama, Jemez, and Rio San Jose drainages, along with those of the Pecos and Canadian drainages (Sublette *et al.* 1990, Behnke 1992). The trout has declined greatly over the long term; it now occupies as little as 5-7% of the historical range (see Rinne 1995). However, populations are now thought to be relatively stable (USFWS 1998). Most populations are isolated in headwater habitats, and gene flow among populations is virtually nonexistent (Rinne 1995).

Threats to the fish include hybridization and competition from non-native fish, and habitat degradation. Like the Colorado River cutthroat, this subspecies readily hybridizes with other species of trout, including introduced rainbow, brook and brown trout. The New Mexico Department of Game and Fish and the Colorado Division of Wildlife both prohibit stocking of non-native fish within the range of this subspecies (USFWS 1998). The states of Colorado and New Mexico and the three occupied national forests are implementing programs of stream inventory, protection through removal of non-natives, and repatriation in historically occupied waters (USFWS 1998). In Colorado, 82 populations occupy streams that have been classified as either relatively pristine or exhibiting only a minor degree of impact (USFWS 1998).

Much habitat has been degraded by overgrazing by livestock or timber harvest which reduce streambank cover. The trout may also suffer from poor winter habitat,

stream intermittency, and deteriorating water quality resulting from drought (Rinne 1995) or wildfires. Whirling disease has recently been added as a new threat to the subspecies.

The Rio Grande cutthroat is represented in San Juan County in the Pole Creek PCA.

Lynx *Lynx canadensis* G5 S1 Status: Colorado endangered

The lynx (Figure 61) is a large carnivorous feline averaging 13 kilograms in weight, with distinctive facial hair tufts below its cheeks. The species is widespread in northern North America with a global Range extending throughout Alaska and Canada south through the Rocky Mountains, northern Great Lakes region, and northern New England. Declines have occurred in some populations, but apparently the lynx is still relatively abundant in most of historic range.

USFWS (Federal Register, 26 August 1994) found that federal listing of the North American population may be warranted and initiated a formal status review. In 1997, they determined that listing of the contiguous U.S. population is warranted, but precluded by other higher priority actions (Federal Register, 27 May 1997).

The lynx is considered globally secure (G5) but critically imperiled (S1) in Colorado, with fewer than 50 occurrences documented, most of which are historical. Most of the recent records were from Eagle County, suggesting that individuals may be extant in Colorado. However, studies indicate that existing records may represent sporadic populations based more upon wandering and dispersing individuals rather than viable, long-term populations (Ruggiero 1994). The Colorado Division of Wildlife lists the lynx as endangered in Colorado (CDOW draft 1997), and as of 1971, further hunting of lynx was not allowed in Colorado (CDOW draft 1997).

The Colorado Division of Wildlife embarked upon a lynx reintroduction project during the summer of 1999. A total of 41 lynx were released in 1999, of these, 24 remain alive, and three, all females, have established residence in the San Juan Mountains, with one frequenting the Lizard Head Peak area north of Telluride.

Threats to lynx include loss of habitat due to suppression of forest fires, intensive logging, and development; increased human access via logging roads; past trapping; and possible displacement by bobcat and coyote. Lynx must be protected from overharvest.

Protection of large, continuous blocks of public land, with minimal development or roads providing vehicular access, will be critical for survival of reintroduced lynx (Ruggiero 1994). Management of spruce-fir stands and snowshoe hare should also benefit lynx reintroduction (Ruggiero 1994). Although lynx were not included in any PCA, its potential presence here adds to the conservation significance of the high elevations of the San Juan Mountains.



Figure 61. *Lynx canadensis*

Potential Conservation Areas, San Juan County



B2 Very High
Biodiversity



B4 Moderate
Biodiversity



B3 High Biodiversity
Significance



B5 General
Biodiversity

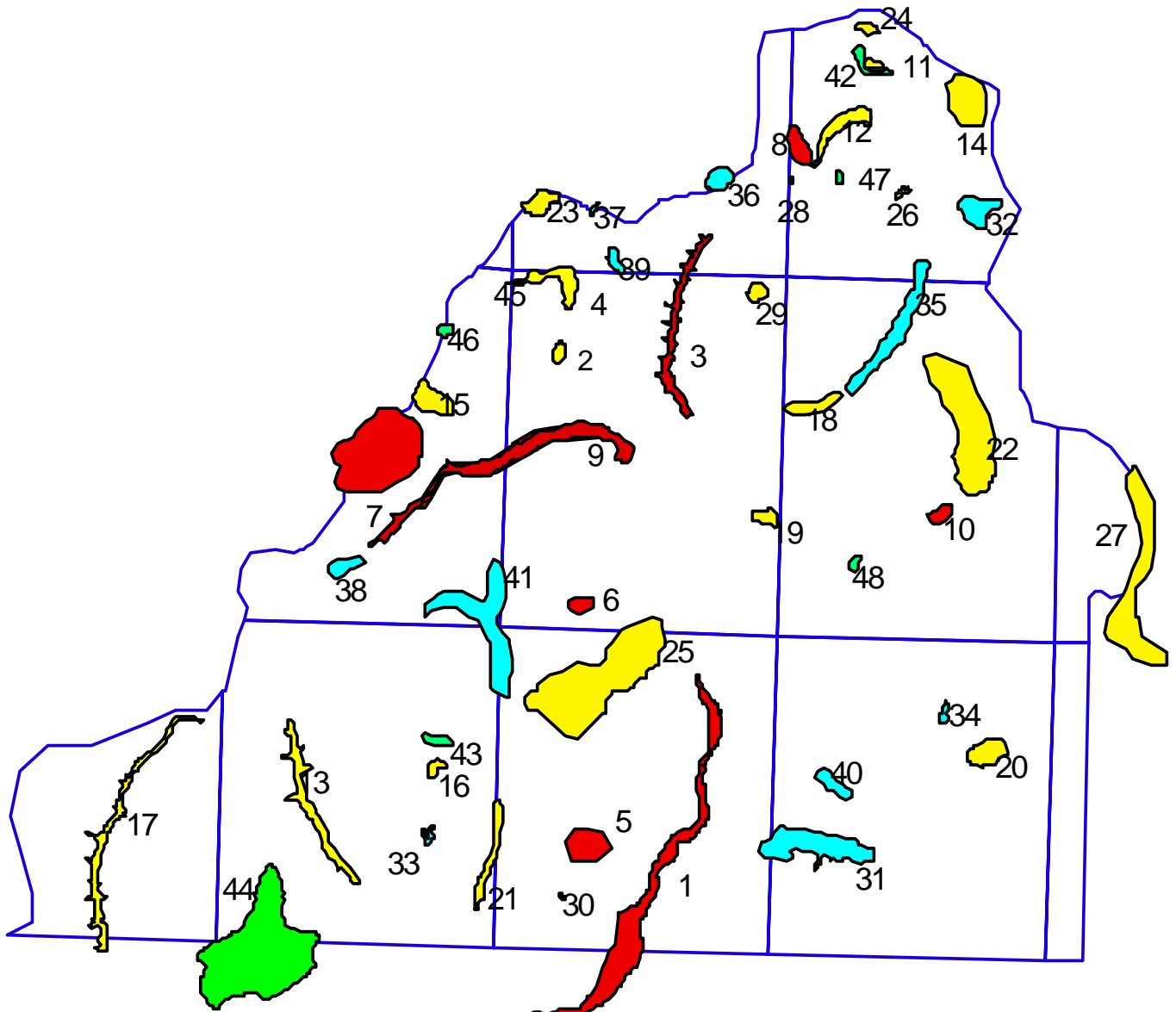


Table 9. Key to PCA Map

Map number	PCA Name	Biodiversity Rank
1	Animas River Canyon	B2
2	Burro Bridge Iron Fen	B2
3	Cement Creek Iron Fen	B2
4	Chattanooga Iron Fen	B2
5	Crater Lake	B2
6	Grand Turk South	B2
7	Ice Lake Basin	B2
8	Lake Como	
9	South Fork Mineral Creek	B2
10		B2
11	Burrows Creek Uplands	B3
12	California Gulch at Animas River	B3
13	Cascade Creek at Purgatory	B3
14	Cinnamon Pass	B3
15	Clear Lake	B3
16	Coal Bank Pass	B3
17	Hermosa Creek	B3
18	Howardsville	B3
19	Kendall Mountain	B3
20	Kite Lake	B3
21	Lime Creek	B3
22	Maggie Gulch	B3
23	Mineral Basin	
24	Mineral Point	B3
25		B3
26	Picayune Gulch	B3
27	Pole Creek	B3
28	Ross Basin	B3
	South Fork Cement Creek	B3
30	South Twilight Peak	
31	Balsam Lake	B4
32	Burns Gulch	B4
33	Coal Bank Hill	B4
34	Elk Creek Headwaters	B4
35	Middleton	B4
36	Red Mountain Number One (BLM and NF)	B4
37	Red Mountain Pass	B4
38	Rolling Mountain	B4
39		B4
40	Vestal Lake	B4
41	West Lime Creek	B4
42	Burrows Creek-Mineral Creek Headwaters	B5
43	Coal Creek at Highway 550	B5
44	East Fork Hermosa Creek	B5
45	Mill Creek at Chattanooga	B5
46	Ophir Pass	B5
47	Placer Gulch	B5
48	Spencer Basin	B5

Potential Conservation Areas

Forty-eight Potential Conservation Areas were identified in San Juan County (Figure 62). Each Potential Conservation Area is described in a standard site profile reflecting data fields in CNHP's Biological and Conservation Data System (BCD). The sections of this report and the contents are outlined and explained below.

Biodiversity Rank (B-rank): The overall significance of the site in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. For rank definitions, please see the **Natural Heritage Ranking System** section of this report.

Protection Urgency Rank (P-rank): An estimate of the urgency of conservation protection. This rank generally refers to the need for a major change of protective status (i.e., ownership or designation as a natural area). For rank definitions, please see the **Natural Heritage Ranking System** section of this report (Appendix II).

Management Urgency Rank (M-rank): An estimate of the time frame in which conservation management must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (legal, political, or administrative measures). For rank definitions, please see the **Natural Heritage Ranking System** section of this report (Appendix II).

Location: County, general location, usually in approximate air miles from the nearest town, and USGS 7.5 minute topographic map name.

Legal Description: Township, range and section(s).

Elevation Range: Lowest and highest elevations in feet within the site boundaries, as drawn on U.S.G.S. topographic maps.

Size: Number of acres within the site boundary, as determined from GIS mapping (ArcView).

General Description: A brief narrative of the topography, vegetation, and current use of the potential conservation area. Common names are used in the text. Scientific names are given in Appendix III.

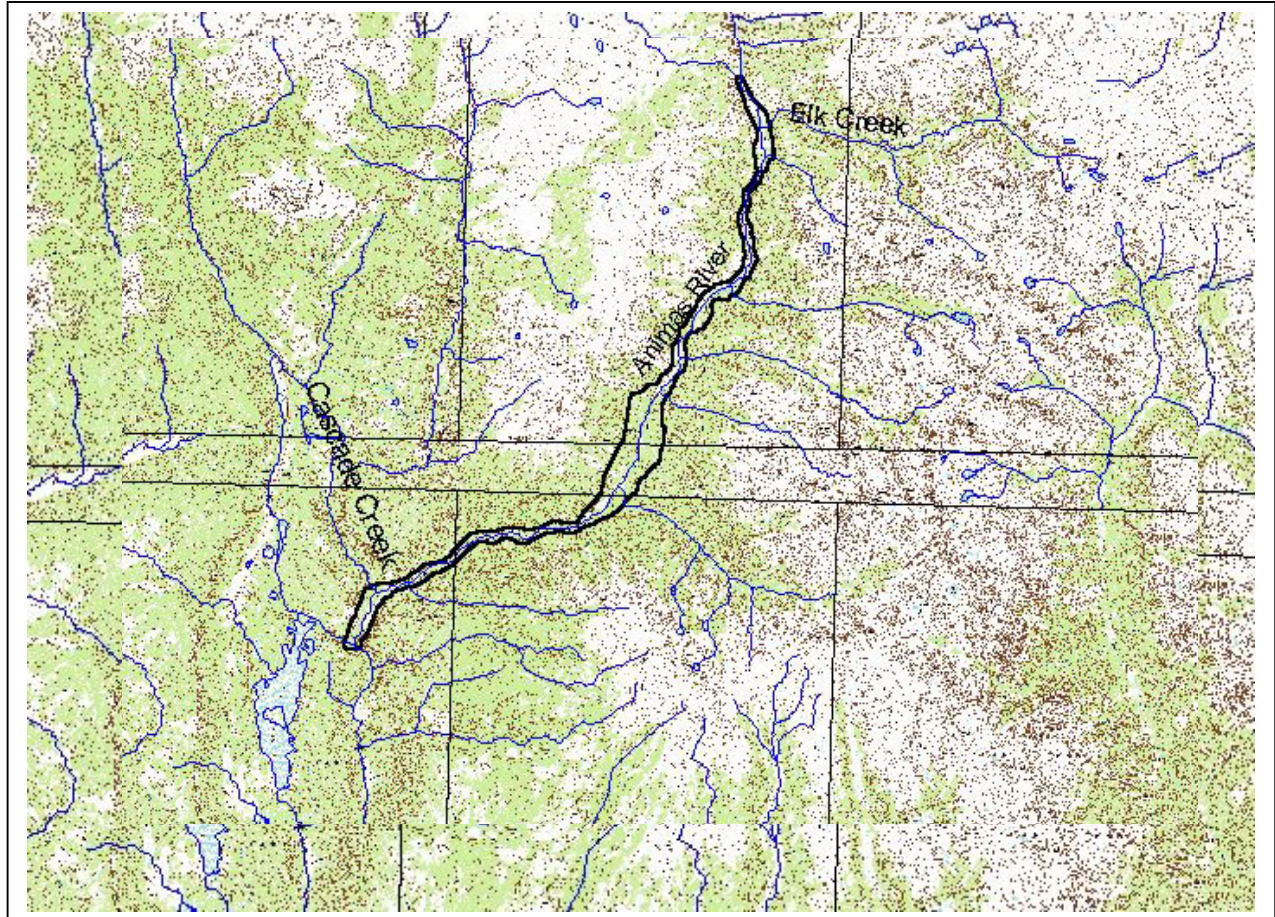
Biodiversity Rank Justification: A synopsis of the significant elements occurring in the site. A table within the site profile lists the element occurrences found within the site, their rarity ranks, the occurrence ranks and federal and state agency special designations. The species or communities that are the primary element of concern are printed in bold type within the table. When several entries are in bold type, any one of the occurrences would be sufficient to justify the site rank. See Table 1, Appendix II, for explanations of ranks, and Table 2, Appendix II, for legal designations.

Boundary Justification: Justification for the location of the potential conservation site planning boundary delineated in this report, including all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.

Protection rank comments: Any additional pertinent information regarding the need for protection of the site.

Management rank comments: Any additional pertinent information regarding the need for management actions at the site.

Animas River Canyon Potential Conservation Area



Location in San Juan County

Animas River Canyon Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance. Nearly irreplaceable.

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. Most of the site is within the San Juan National Forest, and surrounded by the Weminuche Wilderness.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan and La Plata counties. From about 4.5 miles south of Silverton, to about 19 miles north of Durango.

Legal Description:

U.S.G.S. 7.5 minute quadrangles: Snowdon Peak, Mountain View Crest, Electra Lake. T38N R8W S5, 6; T39N R8W S13, 24-28, 31-33; T39N R7W S5-7, 18, 19; T40N R7W S17, 21, 22, 28, 29, 32

Size: 2,665 acres

Elevation: 7600 ft. to 9000 ft.

General Description: The Animas River, between the confluence of Molas Creek and Little Cascade Creek, forms a spectacular 13.5 mile long canyon. The river cuts through the granitic gneiss visible on the Needle and West Needle Mountains, and then through even older metamorphic rock of the Uncompahgre Formation, over 1.7 billion years old. It follows the course of the Animas Glacier, one of the longest glaciers of the Pleistocene, that ran 40 miles from Silverton to Durango. The canyonsides were formed from the lateral moraines of the glacier. Soils are mapped as deep to very deep, well drained cobbly, gravelly or sandy loams of alluvial fans and river terraces, formed from alluvium derived primarily from volcanic rocks (USDA 2003).

The PCA contains a mosaic of high quality riparian communities, including the globally imperiled montane riparian forest dominated by white fir (*Abies concolor*), Colorado blue spruce (*Picea pungens*), narrowleaf cottonwood (*Populus angustifolia*) and Rocky Mountain maple (*Acer glabrum*). The natural periodic flooding regime that is critical for regeneration of cottonwoods and willows appears to be intact. The area has a high diversity of plant species and associations, with few exotic species. Other important plant species that characterize this stretch include subalpine fir (*Abies lasiocarpa*), Douglas fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), New Mexican white pine (*Pinus strobiformis*), thinleaf alder (*Alnus incana*), red-osier dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana* var. *melanocarpa*) and several willows (*Salix* spp.). Farther downstream in La Plata County, beginning at about Rockwood, the

spruce-fir forest gives way to ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (*Juniperus scopulorum*) and Gambel oak (*Quercus gambelii*). Riparian species such as box elder (*Acer negundo*) and river birch (*Betula occidentalis*) replace the higher elevation alder and willows. The Durango-Silverton railroad parallels the river through the site, bringing thousands of visitors each year through this scenic area. Stops are made at Elk Park, at the northern end of the PCA, and at Needleton, near the middle of the PCA, where passengers may disembark for hiking or sightseeing and be picked up by a later train. The canyon can be accessed by foot or horseback from Molas Pass, via the Molas Creek trail, or from Kite Lake, via the Elk Creek trail.

Natural Heritage element occurrences at the Animas River PCA

Scientific name	Common name	Global rank	State rank	State/federal status	Element occurrence rank
<i>Abies concolor</i> - <i>Picea pungens</i> - <i>Populus angustifolia</i> / <i>Acer glabrum</i> forest	White fir-Blue spruce-narrowleaf cottonwood/Rocky Mountain maple - Montane riparian forests	G2	S2		A
<i>Picea pungens</i> / <i>Alnus incana</i> woodland	Blue spruce/thinleaf alder- Montane riparian forests	G3	S3		A
<i>Populus angustifolia</i> - <i>Pseudotsuga menziesii</i> forest	Narrowleaf cottonwood-Douglas fir - Montane riparian forest	G3	S2		A
<i>Populus angustifolia</i> / <i>Salix exigua</i> forest	Narrowleaf cottonwood/coyote willow riparian forests	G4	S4		B
<i>Populus angustifolia</i> - <i>Picea pungens</i> / <i>Alnus incana</i> forest	Narrowleaf cottonwood-Blue spruce/thinleaf alder- Montane riparian forests	G4	S4		A
<i>Alnus incana</i> / <i>Salix drummondiana</i>	Thinleaf alder/Drummond's willow- Montane riparian shrubland	G3	S3		B
<i>Populus angustifolia</i> / <i>Alnus incana</i>	Narrowleaf cottonwood/Thinleaf alder riparian forest	G3	S3		B

Biodiversity comments: The Animas Canyon PCA supports an excellent (A ranked) occurrence of a globally imperiled plant community. At least five other good (B ranked) and excellent (A ranked) riparian communities occur in the canyon as well. See the section on plant communities (p. 25) for more information on each of these.

Boundary Justification: The boundary is drawn to include the entire length of the imperiled montane riparian woodland plant community. It includes the canyon and flood plain of the Animas River in this 13.5 mile stretch. The PCA also coincidentally encompasses a mosaic of several other riparian communities. A buffer of approximately 200 ft. upslope from the riparian zone was added, to account for the effects of runoff from this area on stream flows and water quality. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the riparian communities.

Protection Rank Comments: Except for a few small private inholdings, the entire site is within the San Juan National Forest. It is surrounded by the Weminuche Wilderness, although the canyon itself is excluded from the wilderness.

Management Rank Comments: Most of the canyon is not easily accessible. There is probably some effect on vegetation from the train's smoke. A few areas, such as Elk Park and Needleton receive fairly heavy recreational use from hikers and horse packers. Some Kentucky bluegrass (*Poa pratensis*) and common dandelion (*Taraxacum officinale*) were observed at Needleton. Continued monitoring will help to protect the area from invasive non-native plants that may be introduced by the railroad or recreational users.

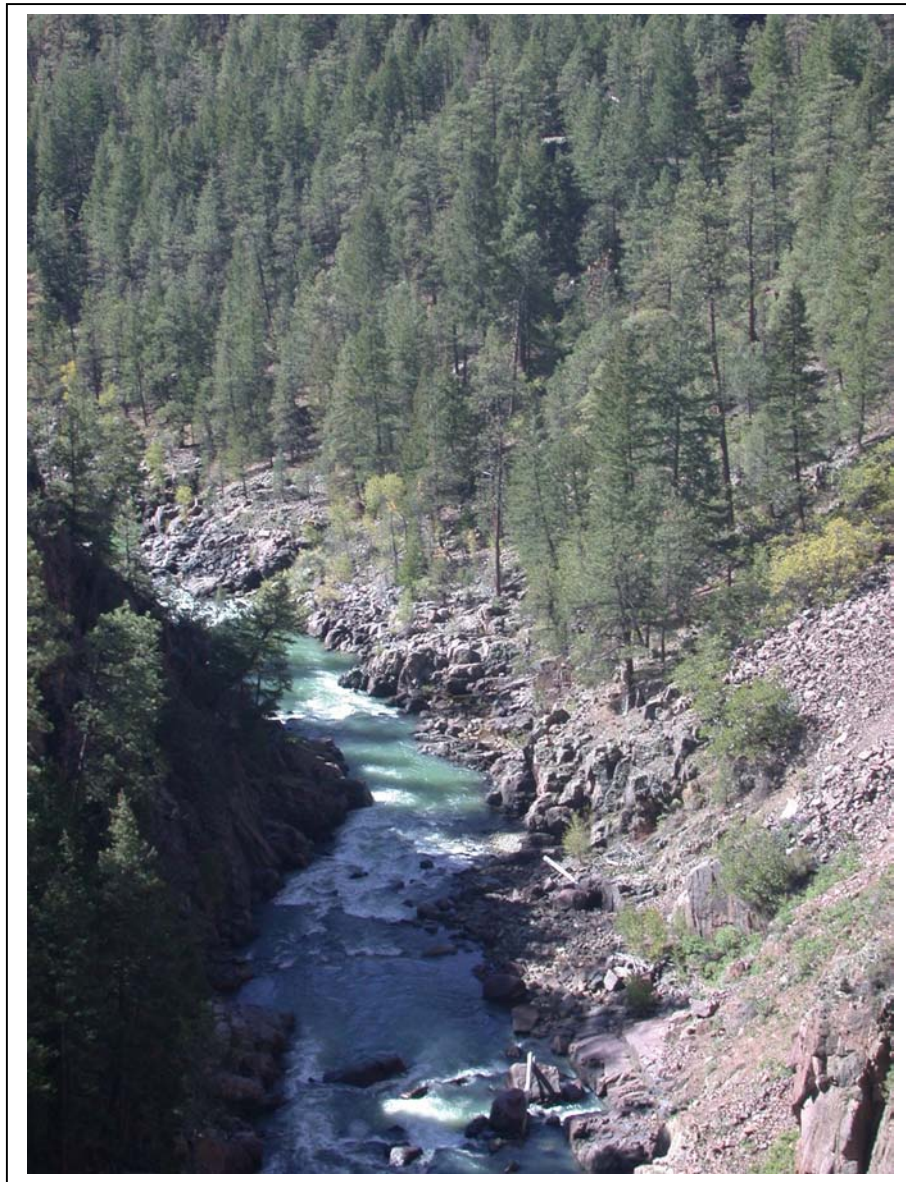
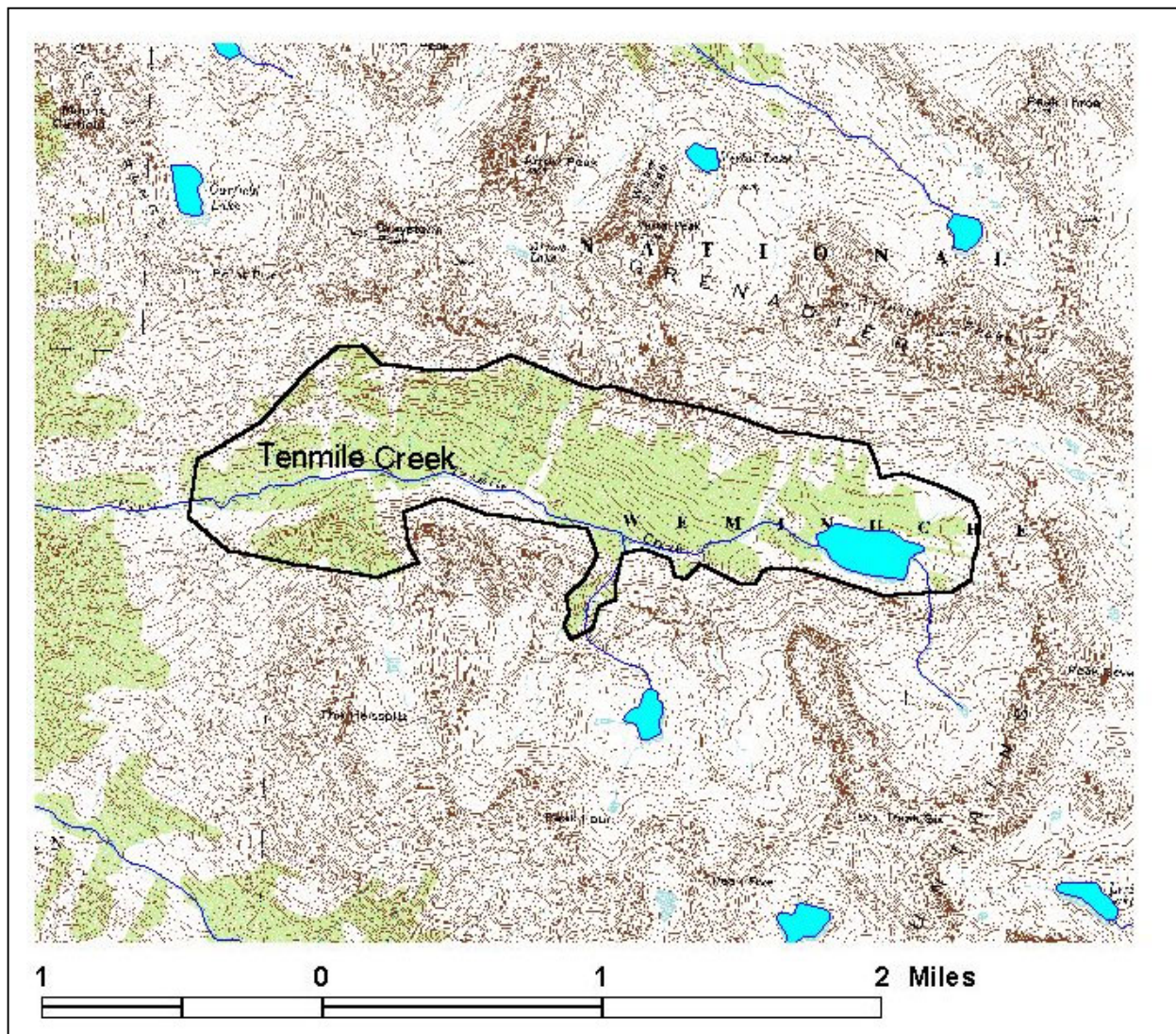


Figure 63. Animas River Canyon from Durango-Silverton train.

Balsam Lake Potential Conservation Area



Trautvetteria carolinensis



Location in San Juan County

Balsam Lake Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is within the Weminuche Wilderness of the San Juan National Forest.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, San Juan National Forest, Weminuche Wilderness, about 8.5 air miles south-southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Storm King Peak. T39N R7W S 1, 2, 11, 12; T39N R6W S 6; T40 N R7W S 35, 36

Size: 494 acres

Elevation: 10,500 ft. to 11, 800 ft.

General Description: This forested area around Balsam Lake and along Tenmile Creek supports an unusual plant community of subalpine fir (*Abies lasiocarpa*) and Carolina tasselrue (*Trautvetteria caroliniensis*), within a matrix of the characteristic subalpine fir forest. Geological formations in the area are Precambrian granite in the north, and Pennsylvanian Rico and Hermosa formations in the south. Soils in the PCA are mapped as Henson very gravelly loam and Frisco-Horsethief complex, both deep and well drained, derived from metamorphic, volcanic or sedimentary rocks. According to Hogan (Michener-Foote and Hogan 1997), the site was “marked by pit and mound topography upon a mix of alluvial and colluvial materials.” Areas where Carolina tasselrue dominated the understory appeared to be subject to heavier snow accumulation than surrounding areas. Data was recorded from a plot on a south facing slope, where Engelmann spruce (*Picea engelmannii*) attained a diameter of up to 25 inches, and where snags and rotting deadfall were also present. Although only small patches of the subalpine fir/Carolina tasselrue community were documented at this site, it is expected to occur in larger areas. It has been noted in extensive stands of several hundred acres in Archuleta County

Natural Heritage element occurrences at the Balsam Lake PCA

<i>Scientific Name</i>	Common name	Global rank	State rank	State/ Federal status	Element occurrence rank
<i>Abies lasiocarpa/Trautvetteria carolinensis</i>	Subalpine Fir/Carolina tasselrue	G3	S2?		C
<i>Abies lasiocarpa/Vaccinium myrtillus</i>	Subalpine Forests	G5	S5		B

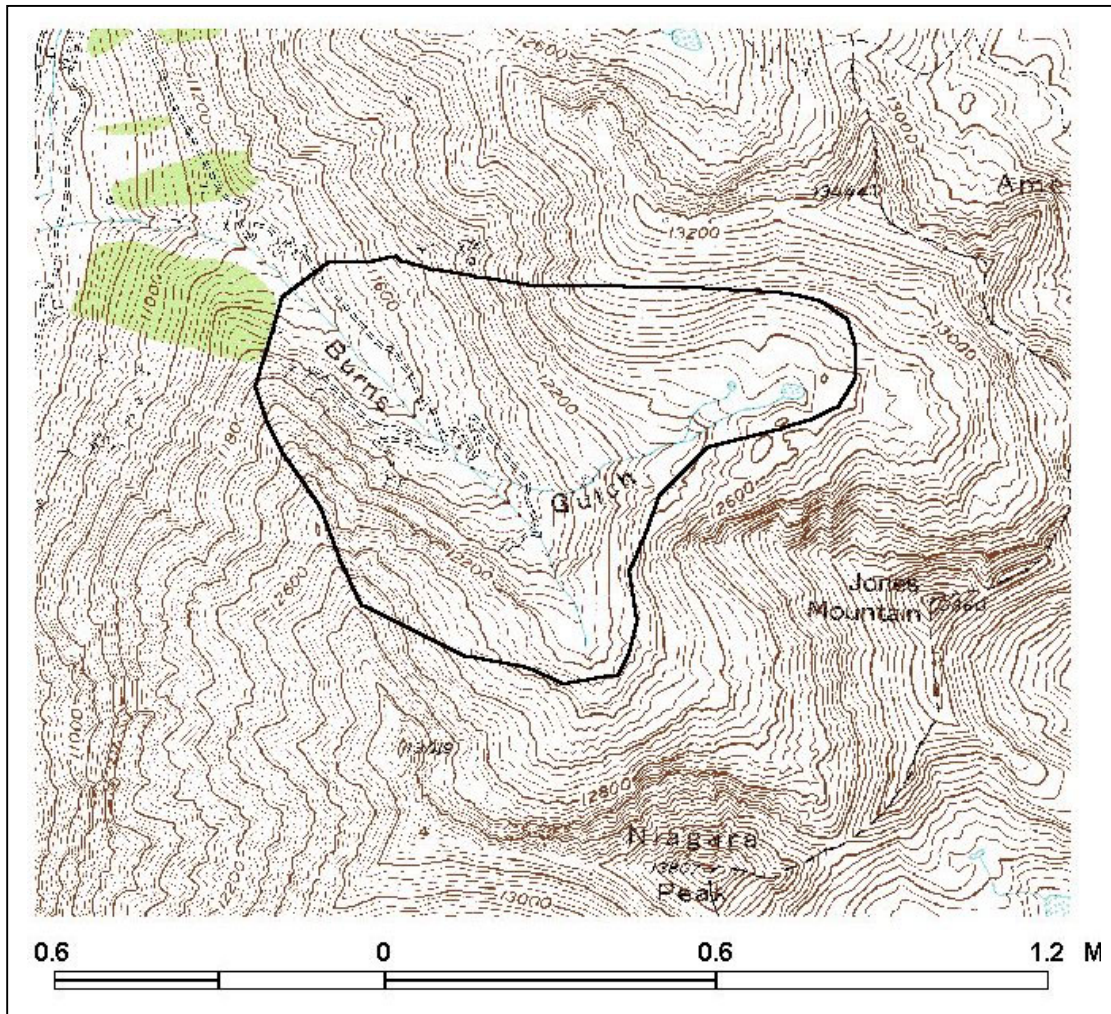
Biodiversity comments: The PCA supports a fair (C ranked) occurrence of subalpine fir/Carolina tasselrue, a plant community that is globally vulnerable (G3) and believed to be rare (S2?) in Colorado. This community occurs in small patches within a matrix of a good (B ranked) occurrence of the more common (G5) subalpine forest of subalpine fir, Engelmann spruce and whortleberry (*Vaccinium myrtillus*).

Boundary Justification: The boundary is drawn to encompass the forested area around Tenmile Creek and Balsam Lake. It is surrounded by rocky alpine tundra that does not support tree growth. The boundaries enclose an area that is large enough to support natural processes such as fire.

Protection Rank Comments: The site is within the Weminuche Wilderness.

Management Rank Comments: The area receives minimal threats from humans due to difficulty of access. Effects of sheep grazing are not known.

Burns Gulch Potential Conservation Area



View northeast toward Animas Forks from Burns Gulch



Location in San Juan County

Burns Gulch Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance.

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.**

Location: San Juan County, Alpine Loop, San Juan County Road 1B, about 8 air miles northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T42N R6W Sections 16 and 17

Size: 242 acres

Elevation: 11,000 ft to 12,600 ft.

General Description: Burns Gulch runs from the Continental Divide west to the Animas River. It is bordered by American Basin to the east across the divide, Jones Peak on the northeast and Niagara Peak on the southeast. The PCA is drawn to include the upper gulch above timberline with alpine vegetation. The gulch is geologically situated on San Juan volcanic lavas and ash flow tuff. Soils are mapped as Henson very gravelly loam, 30 to 60 percent slopes, a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite.

Vegetation in the site is a mixture of rocky alpine tundra and lush wet meadow areas. Alpine avens (*Geum rossii*) and snow willow (*Salix reticulata* ssp. *nivalis*) dominate large areas. Other common alpine species found in the site include blackhead fleabane (*Erigeron melanocephalus*), Parry's clover (*Trifolium parry* var. *salictorum*), Colorado columbine (*Aquilegia coerulea*), alpine sorrel (*Oxyria digyna*), mountain thistle (*Cirsium scopulorum*), *Smelowskia calycina*, alpine speedwell (*Veronica nutans*), willow (*Salix arctica*), and American bistort (*Bistorta bistortoides*). Rock outcrops with seeps on the north facing slope below Niagara Peak support a small population of Kotzebue's grass of Parnassus (*Parnassia kotzebuei*). The area was surveyed for potential Uncompahgre fritillary (*Boloria improba acrocneuma*) habitat, and although there was a significant amount of snow willow present, other characteristics led to the conclusion that it was not appropriate habitat. A county road extends to several mines at about 12,000 feet elevation.

Natural Heritage element occurrences at the Burns Gulch PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3		C
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		E
<i>Draba porsildii</i>	Porsild draba	G3G4	S1		E
<i>Parnassia kotzebuei</i>	Kotzebue grass-of-parnassus	G4	S2		D
<i>Draba fladnizensis</i>	Arctic draba	G4	S2S3		E

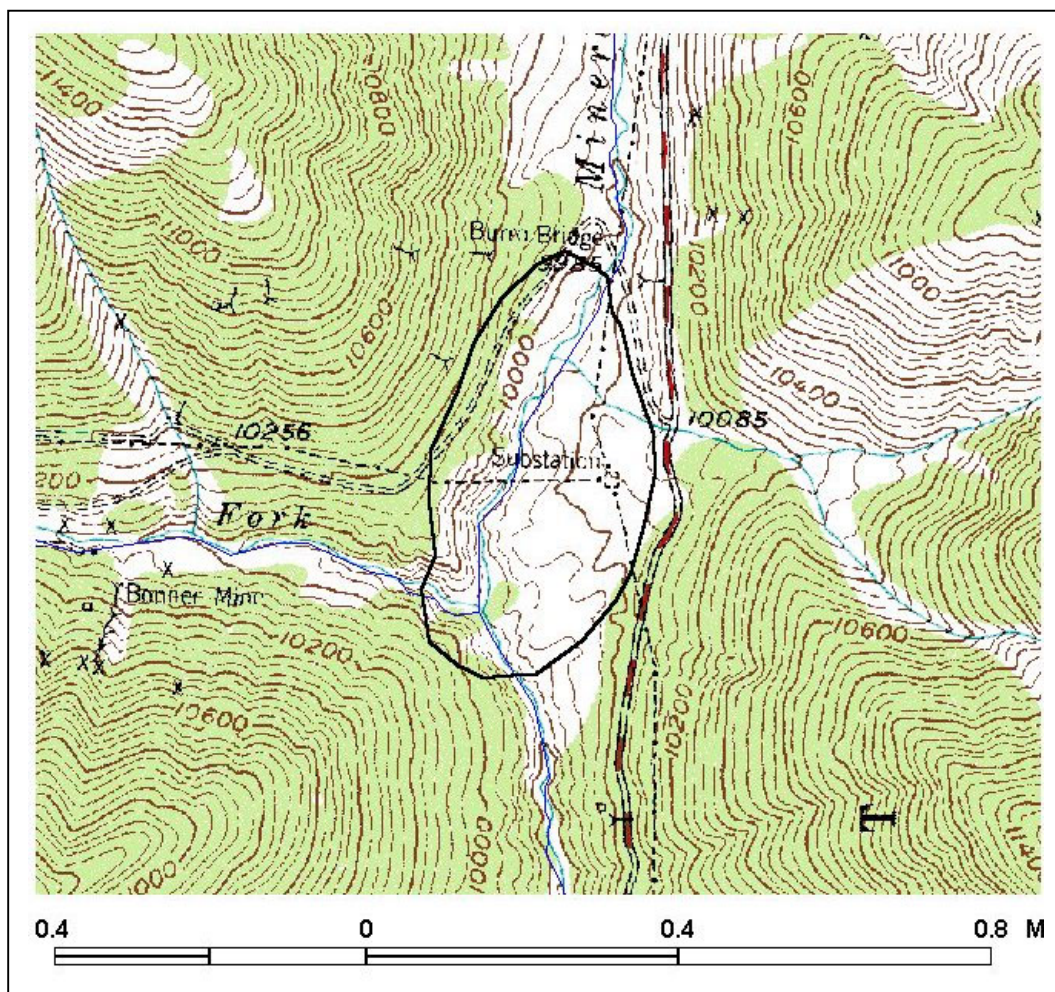
Biodiversity comments: The Burns Gulch PCA supports small populations of several rare plant species. A fair (C ranked) occurrence of thick-leaf whitlow-grass (*Draba crassa*), a globally vulnerable (G3) species, and a poor (D ranked) occurrence of Kotzebue's grass-of-Parnassus (*Parnassia kotzebuei*), a globally secure but state rare (G4 S2) plant, were located in 2002. Previously documented occurrences of Colorado Divide whitlow-grass (*Draba streptobrachia*), Porsild draba (*Draba porsildii*), and Arctic draba (*Draba fladnizensis*), based on specimens at the University of Colorado herbarium, were not ranked, and their size and quality are unknown. However, the collectors, Emily Hartman and Mary Lou Rottman, remember the populations as being small (personal communication). It is likely that all of these species suffered from the drought during 2002.

Boundary Justification: The boundary is drawn to encompass the occurrences of the four *Draba* species and Kotzebue's grass-of-Parnassus, and extends to the top of the ridge to the south, which provides the moisture from melting snow necessary for their survival. Some surrounding unoccupied area is included to provide space for the populations to expand in the future, and for support of pollinators.

Protection Rank Comments: Ownership of the PCA is approximately 50% private and 50% BLM. Although the PCA has been impacted by mining in the past, current uses do not threaten the plant populations. If the mines were to be re-opened, the rare plants could be affected.

Management Rank Comments: There is limited recreational use in the area by 4 wheel drive vehicles and ATVs. The location of the rare plants on steep hillsides precludes direct disturbance by humans; however, sheep grazing could affect the populations. No exotic species were found in the PCA, but continued monitoring is recommended.

Burro Bridge Iron Fen Potential Conservation Area



Plant community with bog birch, spruce and sphagnum at Burro Bridge Iron Fen



Location in San Juan County

Burro Bridge Iron Fen Potential Conservation Area

Biodiversity Rank: B2. Nearly irreplaceable. An excellent occurrence of an imperiled (G2) plant community and the only known occurrence in the state of a fruticose lichen.

Protection Urgency rank: P3 Although there is a definable threat to the area, it is unknown when it will affect the occurrence. Due the irreplaceability of the wetland it is suggested that special designation is warranted. There is currently no special protection for the area.

Management Urgency rank: M3. New management actions may be needed within 5 years to maintain the current quality of the occurrence. Main impacts are researchers destroying habitat. The area is located adjacent to Hwy 550 and the Ophir Pass 4WD road. However, the roads do not appear to currently pose a threat.

Location: San Juan County, at the confluence of Mineral Creek and the Middle Fork of Mineral Creek, 5 miles north of the Town of Silverton.

Legal Description: U.S.G.S. 7.5-min. quadrangle: Silverton. 41N R8W Section 3; T42N R8W Section 34

Elevation: 9,820 to 9,860 ft.

Size: Approximately 7 acres

General Description: The Burro Bridge Iron Fen is located at the confluence of Mineral Creek and the Middle Fork of Mineral Creek on the lower east wall of the canyon. Mineral Creek flows along a fault zone through quaternary glacial deposits at the west edge of the Silverton Caldera (Carsey 1999). To the north, Mineral Creek follows the trace of the caldera rim faults. The highly altered Henson and Burns Formations make up the valley wall east of the fault zone and lower third of the west valley wall. The upper two-thirds of the west valley wall are the San Juan Formation, derived from ancient volcanoes located northeast of Silverton, and a sequence of rhyolite ash flows, including the Ute, Blue Mesa, and Sapinaro Mesa Tuffs (Blair 1996). Soils are mapped as typic cryaquents-cryaquolls-cryofibrists complex, 0 to 5 percent slopes. They are described as deep, poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources. Mineral Creek at the Burro Bridge Iron Fen is composed of red rocks and large colluvial boulders in the creek bed. Springs emerge from a truncated alluvial fan at the first drainage south of Browns Gulch on the east side of Mineral Creek canyon. The drainage provides both substrate and iron-rich water that has created limonite ledges (Carsey 1999). The limonite ledges at Burro Bridge Iron Fen are the most extensive observed in San Juan County and in Colorado by CNHP.

Iron fens are hydrologically similar to other Colorado fens in that there is a discharge of ground water. However, the source water for iron fens flows through iron pyrite rich bedrock and talus. The oxidation of pyrite by flowing water results in the

formation of sulfuric acid and production of naturally acidic waters. As the pyrite oxidizes it will stain red, sometimes over large areas such as Red Mountain. The low pH is unique to Colorado wetlands, for a low pH is typically found in bogs in the eastern U.S. or Canada. Colorado's iron fens are also unique in that one would expect to find low ion concentrations in surface and pore waters such as documented in eastern and northern bogs. In contrast, iron fens have high ion concentrations because acids are produced on mountain slopes where ions can be leached from mineralized rock and dissolved in the flowing water. In particular Ca^{2+} and SO_4 concentrations can be high. In a preliminary study Dr. David Cooper found an average Ca^{2+} of 10-120 and SO_4 of 70-700 mg/kg (n = 8) (Cooper unpublished).

As is common with other iron fens, Burro Bridge is dominated by acid-tolerant shrubs with a thick ground cover of a variety of *Sphagnum* and other mosses. Engelmann spruce (*Picea engelmannii*) dominates the tree layer. Bog birch (*Betula glandulosa*) and whortleberry (*Vaccinium caespitosum*) dominate the shrub layer. Mosses, bluejoint (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*), and alpine spicy wintergreen (*Gaultheria humifusa*) form the lowest canopy layer.

Dr. David Cooper documented the fruticose lichen *Cladina rangiferina* at Burro Bridge Iron Fen (Cooper unpublished). The lichen is common on the margins of Burro Bridge Iron Fen in the Engelmann spruce forest. Although this species is common in the boreal forest region, the nearest location to Colorado is in northern Montana (Cooper unpublished).

Biodiversity Rank Justification: This site supports an excellent (A ranked) occurrence of a globally imperiled (G2) plant community and the only known occurrence of a northerly disjunct reindeer lichen. Currently there are only 13 iron fens known globally, four of which occur in San Juan County.

Natural Heritage element occurrences at the Burro Bridge PCA

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	Element occurrence Rank
(<i>Picea engelmannii</i>) <i>Betula glandulosa</i> / <i>Carex aquatilis</i> / <i>Sphagnum angustifolium</i>	Iron fen	G2	S2		A
<i>Cladina rangiferina</i>	Reindeer lichen	G5	S?		E

Boundary Justification: The boundary is drawn to include the Mineral Creek and Middle Fork of Mineral Creek floodplains and slopes below the steep cliffs that rise on both sides of the river. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain the wetland. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Since the elements are dependent on natural hydrological processes associated with Mineral Creek and its Middle Fork, any upstream activities such as water diversions, impoundments, and mining development could potentially be detrimental to the wetland. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by the USFS, San Juan National Forest. The area is closed year round to motorized vehicles, but is open in the winter to snowmobiles. Under the 1983 San Juan National Forest Plan the site is considered under Management Area 2B, which “emphasizes rural and roaded natural recreation...while enhancing or maintaining scenic qualities inherent in a forested environment. Forested land is suitable for timber production.”

Although this region was an important mining area during the early days of settlement, and several mines are still active, there are no mines on the site. A power substation occupies a site just upslope from the wetlands and power lines pass over the site. The road from Highway 550 to the power substation and the 4WD road to Ophir Pass continues downslope, above the fen.

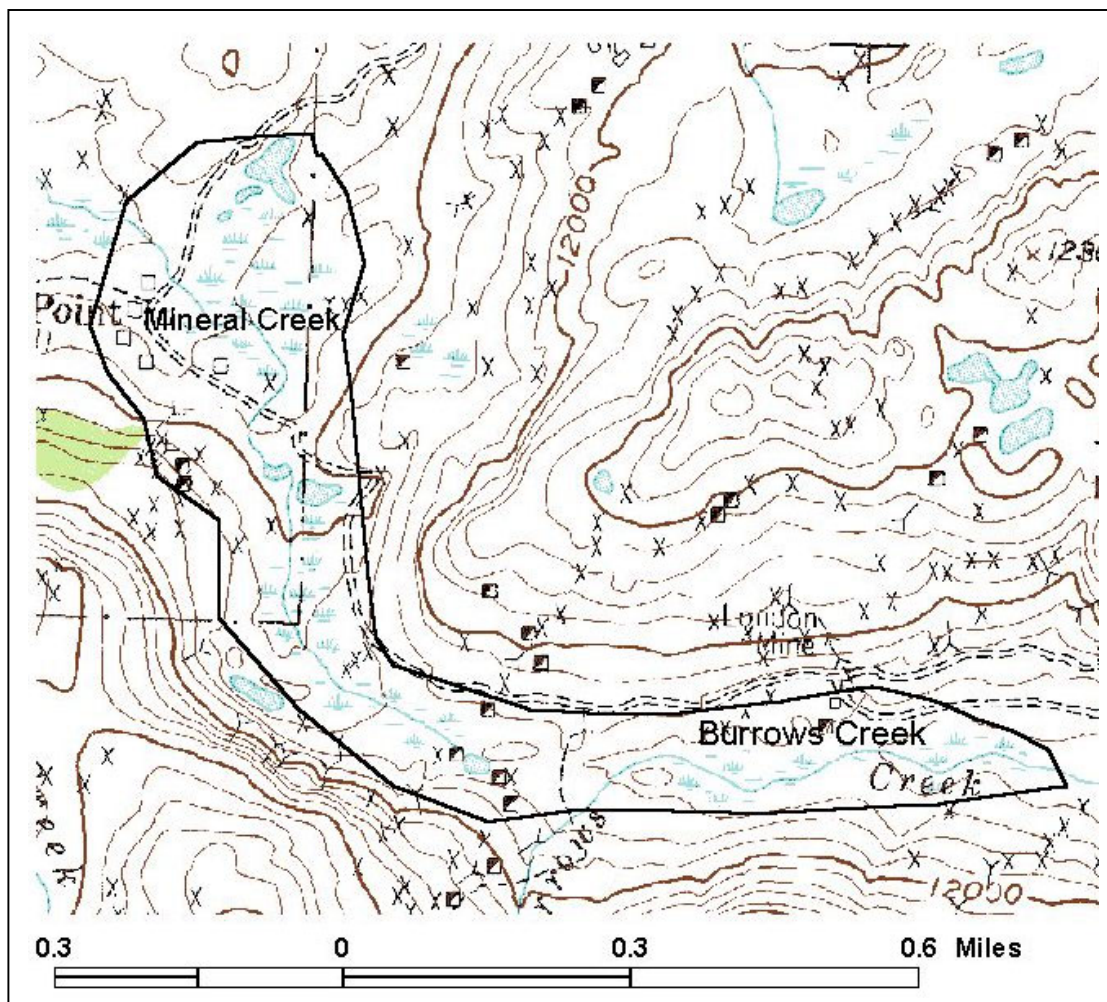
Management Comments: Due to recent interest in iron fens, Burro Bridge has received more attention from researchers. The impacts from increased foot traffic is unknown and should be monitored.

Wetland Soils Description: Soils have Histic epipedon with fibric to sapric peat up to 60 cm deep. Many areas of the wetlands were “quaking”. In areas where a mineral soil was reached with the shovel it was gleyed.

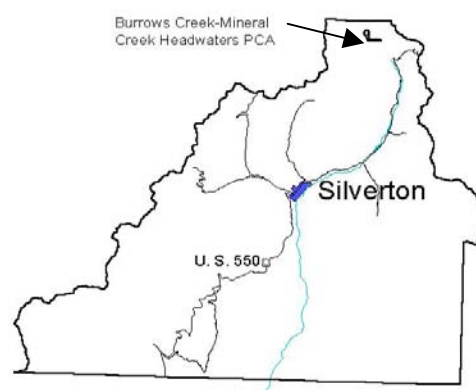
Wetland functional assessment for the slope wetland at the Burro Bridge Iron Fen.

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	N/A	The wetland is located above Mineral Creek
Sediment/Shoreline Stabilization	High	Iron fen is densely vegetated with shrubs and herbaceous species, fen is not located adjacent to moving stream, but is located to an active output from springs
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan therefore is naturally acidic, however due to current and past mining activities is likely more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	High	Wetland contains peaty soils, presence of permanently flooded areas, dense vegetation.
Biological Functions		
Habitat Diversity	Low	Wetland supports 1 Cowardin Class
General Wildlife Habitat	Low	None were observed
General Fish/Aquatic Habitat	Low	Wetland is too acidic to support fish.
Production Export/Food Chain Support	Moderate	Wetland does not support the best habitat for fish or wildlife
Uniqueness	Very High	There are 13 known occurrences of iron fens in the world.

Burrows Creek-Mineral Creek Headwaters Potential Conservation Area



Wetlands along Burrows Creek, habitat of *Carex limosa*.



Location in San Juan County

Burrows Creek-Mineral Creek Headwaters Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, County Road 18, about 9.8 air miles north-northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T43N R7W Sections 25, 26, and 36

Size: 126 acres

Elevation: 11,800 ft. to 12,000 ft.

General Description: The Burrows Creek-Mineral Creek Headwaters PCA encompasses a large wetland dominated by sedges, with a series of highly acidic ponds. Soils are comprised of typic cryaquents-cryaquolls-cryofibrists complex, 0 to 5 percent slopes. They are described as deep, poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources.

Wetlands are dominated by water sedge (*Carex aquatilis*), with smaller amounts of gray sedge (*Carex canescens*), small-tipped sedge (*C. microglochin*), sheep sedge (*C. illota*), boreal bog sedge (*C. magellanica*), marsh-marigold (*Caltha leptosepala*), rose crown (*Sedum rhodanthum*), and star gentian (*Swertia perennis*). Some very short planeleaf willows (*Salix planifolia* var. *planifolia*) are interspersed with the graminoids and forbs. Thick mosses grow between the plants, acting like a giant sponge to hold water. The occurrence of mud sedge (*Carex limosa*) was found near the London Mine. Although the wetland area upstream was surveyed, no mud sedge was found there.

Natural Heritage element occurrences at the Burrows Creek-Mineral Creek Headwaters PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Carex limosa</i>	Mud sedge	G5	S2		B

Biodiversity comments: This PCA supports a good (B ranked) occurrence of mud sedge (*Carex limosa*), a plant that is globally secure (G5) but rare in Colorado (S2).

Boundary Justification: The boundary is drawn to include the occurrence of mud sedge, as well as upstream wetlands that are critical for maintaining the hydrology upon which the mud sedge depends.

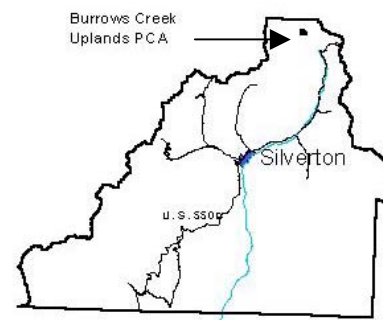
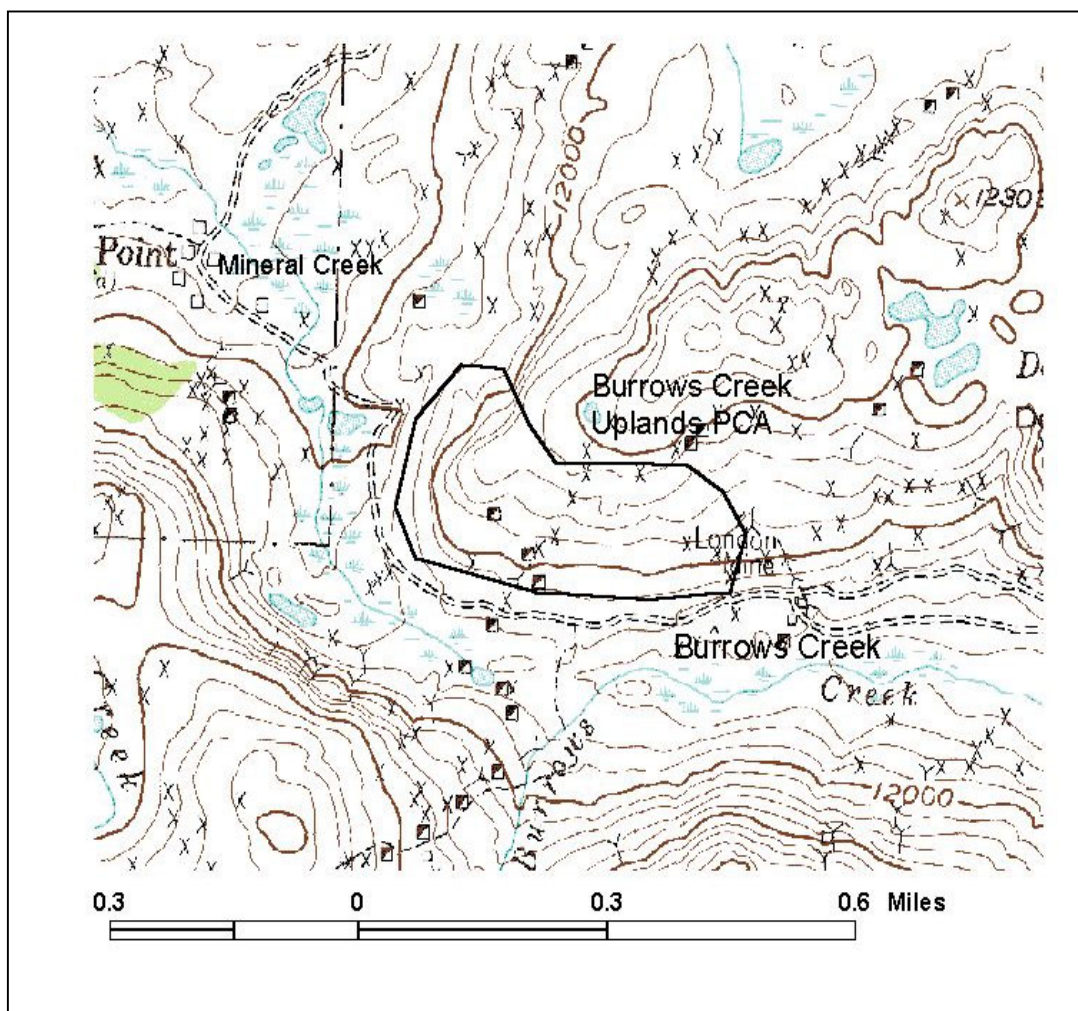
Protection Rank Comments: The PCA is a combination of BLM and private lands. There is no special protection in place.

Management Rank Comments: No exotic species were observed in the PCA. Present management appears to be adequate for maintaining the population.



Figure 64. Wetlands at divide between Burrows Creek and Mineral Creek, looking west.

Burrows Creek Uplands Potential Conservation Area



Location in San Juan County

Intermediate oatgrass community above divide
between Burrows Creek and Mineral Creek headwaters

Burrows Creek Uplands Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, County Road 18, about 9.8 air miles north-northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T43N R7W Section 25

Size: 42 acres

Elevation: 11,800 ft. to 12,200 ft.

General Description: This site is representative of a tundra grassland that is typical of drier areas above timberline in this part of San Juan County. The PCA is in the northern portion of the Silverton caldera, composed of andesitic lavas and ashflows from the Tertiary volcanic period. Soils are mapped as Whitecross-Rock outcrop complex, 45 to 75 percent slopes, a complex of shallow or very shallow, well drained soils formed in colluvium and slope alluvium derived from volcanic rocks.

The *Danthonia intermedia* grassland is located on south facing slopes just north of the extensive wetlands that are described below in the Burrows Creek-Mineral Creek Headwaters PCA. This community was observed several times in San Juan County, interspersed with more mesic or rocky areas. Intermediate or timber oatgrass (*Danthonia intermedia*) is a common and important native bunchgrass in the area, even when it is not the dominant species. Species commonly associated with the grass include alpine avens (*Geum rossii*), subalpine fleabane (*Erigeron peregrinus*), Drummond's rush (*Juncus drummondii*), arnica (*Arnica mollis* and *Arnica parryi*), nodding ragwort (*Ligularia bigelovii*), yarrow (*Achillea lanulosa*), and cinquefoil (*Potentilla sp.*).

Natural Heritage element occurrences at the Burrows Creek Uplands PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Danthonia intermedia</i>	Intermediate oatgrass grassland	G2G3	S2S3		B

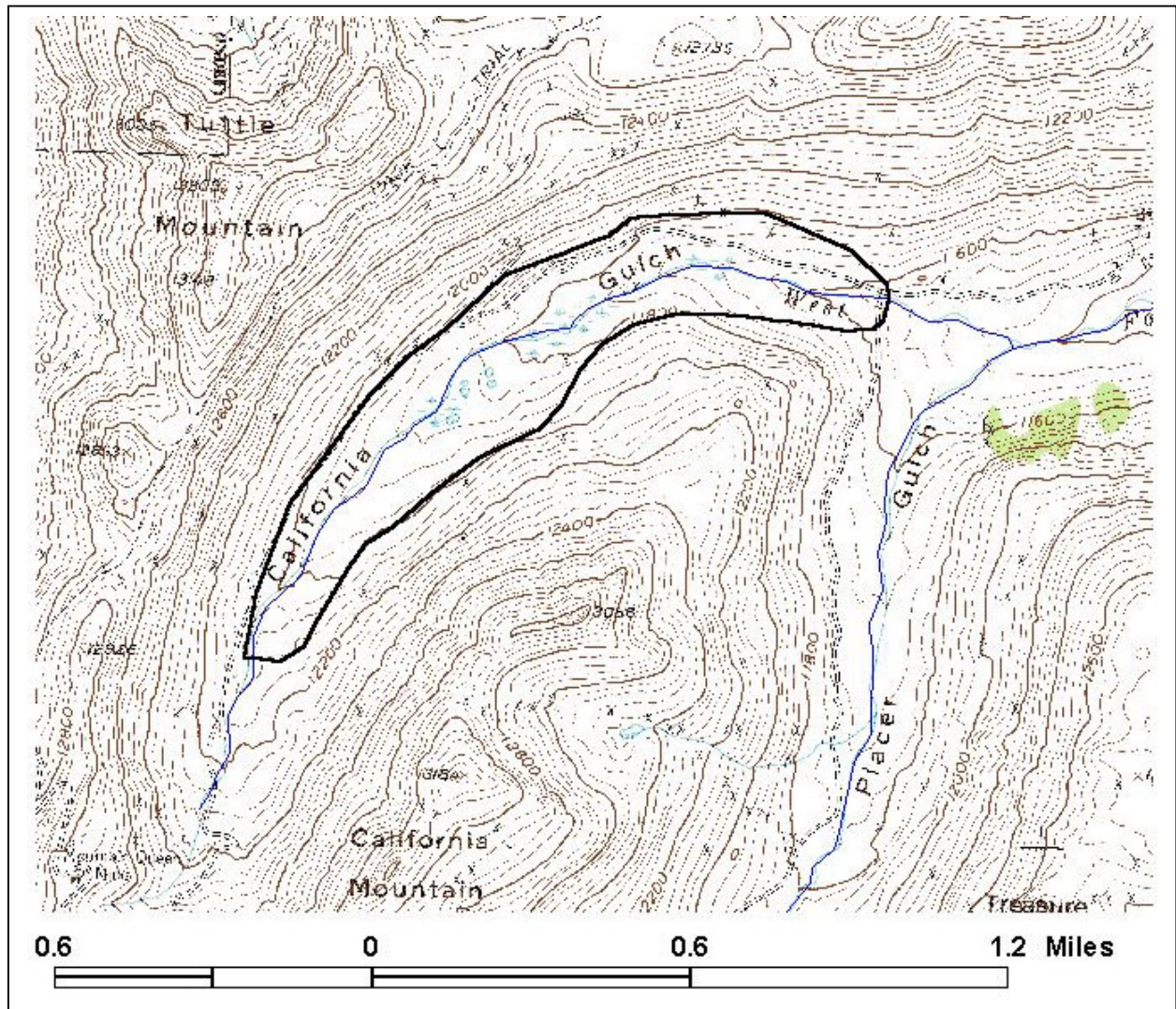
Biodiversity comments: This PCA supports a good (B ranked) occurrence of a plant community that is imperiled globally (G2G3).

Boundary Justification: The boundary is drawn to include the grassland that was observed from County Road 18, although this community may be more extensive and occupy other open areas at this elevation that were not surveyed. The PCA incorporates an area large enough to support natural processes such as fire, mass wasting, pollination and seed dispersal.

Protection Rank Comments: The PCA includes BLM land and unsurveyed mining claims that have no special protection.

Management Rank Comments: No exotic species were observed in the site. The county road receives considerable traffic, but off-road driving was not observed. Effects of sheep grazing are not known; however, they could have the effect of reducing the forb component of the plant community, and may encourage the dominance of timber oatgrass.

California Gulch at Animas River Potential Conservation Area



Sedges wetlands at California Gulch



Location in San Juan County

California Gulch at Animas River Potential Conservation Area

Biodiversity Rank: B3 High Diversity Significance. The site is drawn for a good occurrence of a globally vulnerable herbaceous wetland, an excellent occurrence of an apparently secure montane wet meadow, and a good occurrence of demonstrably secure Altai cottongrass.

Protection Urgency rank: P3. Protection actions may be needed, but probably not within the next 5 years. It is estimated that stresses may reduce the viability of the elements within the site if protection action is not taken. The Potential Conservation Area is located on USFS land, with private in-holdings. There is currently no special protection for the area. A special designation for this area is suggested to protect this unique wetland.

Management Urgency rank: M3. New management actions may be needed within five years to maintain the current quality of the wetland. Off road vehicle and mining activities have the potential to have deleterious effects on the wetland.

Location: San Juan County, along the West Fork of the Animas River, approximately 12 air miles northwest of Silverton, Colorado.

Legal Description: U.S.G.S. 7.5-min. quadrangle: Handies Peak. T43N R7W Sections 35, 36; T42N R7W Sections 1, 2, 10, 11

Elevation: 11,600 –12,800 ft.

Size: Approximately 31 acres

General Description: The California Gulch at Animas River site is a scenic subalpine wet meadow located west of Animas Forks. California Gulch is surrounded by several peaks over 13,000 feet: Houghton Mountain, California Mountain and Treasure Mountain. The California Gulch wetland extends for approximately 2 miles from the eastern base of Hurricane Peak to the confluence of the West Fork and Placer Gulch.

Soils in the wetland are mapped as typic cryaquents-cryaquolls-cryofibrist complex, 0 to 5 percent slopes, deep poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources.

The wetland supports several areas of “quaking” fens dominated by clustered sedge (*Carex praegracilis*) with water sedge (*Carex aquatilis*), and moss (*Sphagnum* spp.). There are several perched ponds where the groundwater has been forced up. These ponds are very shallow (> 0.5 meters) and support an extensive population of quillwort (*Isoetes bolanderi*). The wet meadows above the ponds are dominated by bluejoint (*Calamagrostis canadensis*) and tufted hairgrass (*Deschampsia cespitosa*), with planeleaf willow (*Salix planifolia*) and shortfruit willow (*Salix brachycarpa*).

Biodiversity Rank Justification: The site is drawn for a good (B-ranked) occurrence of a globally vulnerable (G3) herbaceous wetland, an excellent (A-ranked) occurrence, the best observed during the field season of 2002, of a demonstrably secure (G4) montane wet meadow, and a good (B-ranked) occurrence of an apparently secure (G4?T3) Altai cottongrass.

Natural Heritage element occurrences at the California Gulch at Animas River PCA

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	Element occurrence Rank
<i>Carex praegracilis</i>	Clustered sedge herbaceous wet meadow	G3G4	S2		B
<i>Calamagrostis canadensis</i>	Montane wet meadow	G4	S4		A
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	B

Boundary Justification: The boundary is drawn to include the West Fork of the Animas River floodplain from the base of Hurricane Mountain on the east side to the confluence of the West Fork with Placer Gulch. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the wetland. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Because the wetlands are dependent on natural hydrological processes associated with West Fork, any upstream activities such as water diversions, impoundments, and mining development could potentially be detrimental to the wetland. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by USFS, San Juan National Forest and private landowners. There is currently no special protection for the area. A special designation for this area is suggested to protect the unique wetland.

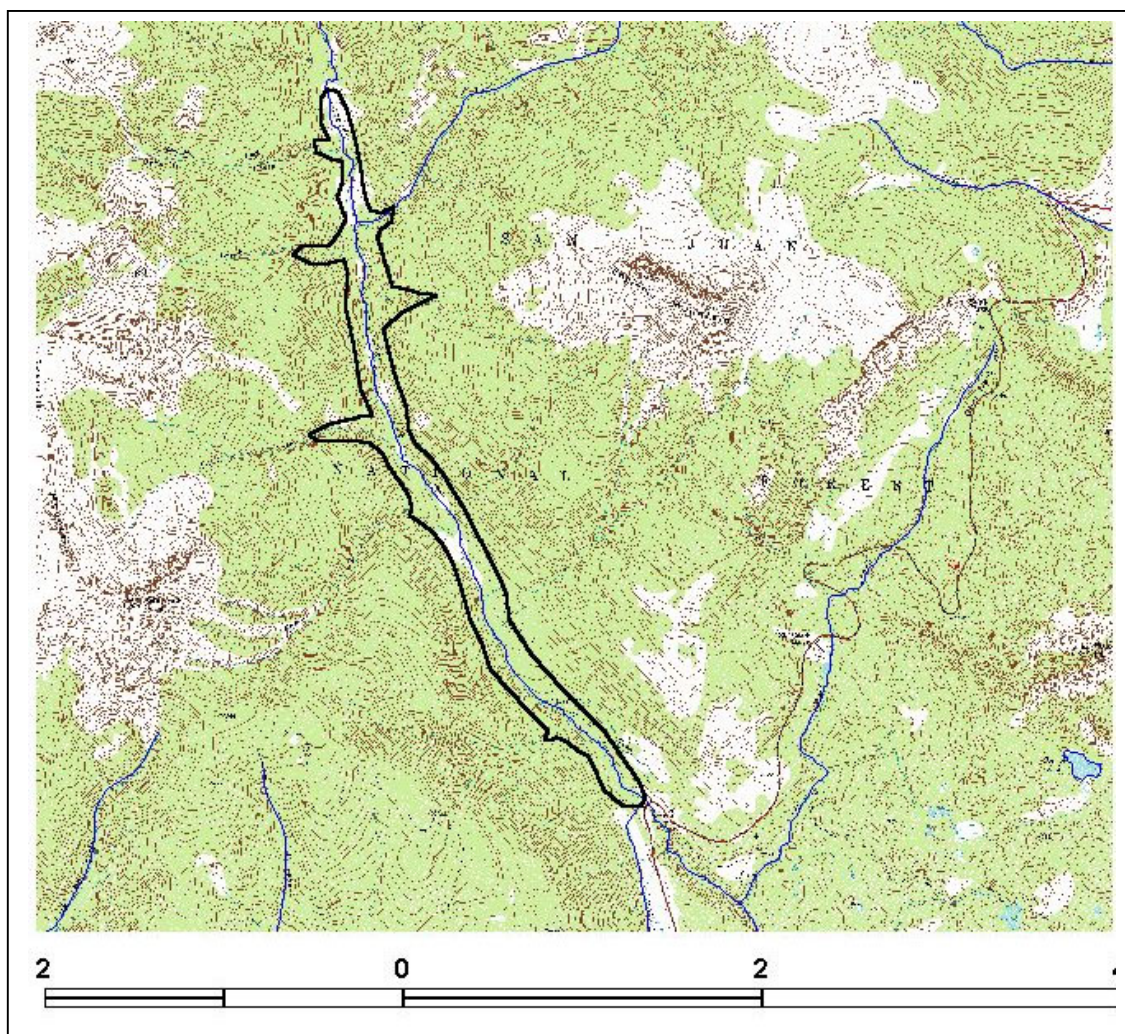
Management Comments: New management actions may be needed within five years to maintain the current quality of the wetland. Off road vehicle and mining activities have the potential to have deleterious effects on the wetland.

Wetland Soils Description of “quaking fen”: Soils are < 60 cm of sapric peat. Ground water level was not reached with a sharp-shooter shovel.

Wetland functional assessment for the riparian wetland at the California Gulch at Animas River PCA.

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	Low to Moderate	The wetland is located above the stream and does not receive seasonal flood waters; however in the event of a flood the wetland would be able to store flood waters
Sediment/Shoreline Stabilization	N/A	Wetland is not subjected to bank erosion
Groundwater Discharge/ Recharge	High	Several springs and pools observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan Mountains, and therefore is naturally acidic; however, due to current and past mining activities is likely more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	High	Wetland does contain peaty soils and is removing minerals inherent to the Mineral Belt of the San Juans.
Biological Functions		
Habitat Diversity	Low	Wetland supports a Cowardin Classes
General Wildlife Habitat	Low	None observed
General Fish/Aquatic Habitat	Low	No open water
Production Export/Food Chain Support	Low	Wetland is has a restricted outlet and low diversity of habitat types.
Uniqueness	Moderate	Wetland plant community types are common, but are the best observed in 2002.

Cascade Creek at Purgatory Potential Conservation Area



Location in San Juan County

Cascade Creek at Purgatory Potential Conservation Area

Biodiversity Rank: B3. High Biodiversity significance. The site is drawn for an excellent occurrence of a globally vulnerable montane riparian forest.

Protection Urgency rank: P3. Protection actions may be needed, but probably not within the next 5 years. It is estimated that stresses may reduce the viability of the elements within the site if protection action is not taken. Potential conservation area is located on both USFS, with private in-holdings. There is currently no special protection for the area.

Management Urgency rank: M3. New management actions may be needed within five years to maintain the current quality of the riparian wetland. In the lower 1 to 2 miles of the potential conservation area there are residential properties. Increased development could potentially have deleterious effects on the occurrence.

Location: This site occurs along Cascade Creek. The southeast end is located 2 miles north of the Purgatory Ski Area (Durango Mountain Resort).

Legal Description: U.S.G.S. 7.5-min. quadrangle: Engineer Mountain. T39N R9W Sections 2, 3, 11,12; T40N R9W Sections 22, 26, 27, 34, and 35.

Elevation: 8,796 ft. to 9,600 ft.

Size: Approximately 58 acres

General Description: The Cascade Creek at Purgatory site is a narrow riparian corridor located in southern San Juan County. Cascade Creek flows south between Engineer Mountain to the northeast and Graysill Mountain to the southwest. It cuts through the Rico and Hermosa geologic formations of Permian and Pennsylvanian sedimentary rock. Cascade Creek is fed by several tributaries that include Engineer Creek, Graysill Creek, EZ Creek, Pando Creek, and Camp Creek. Soils are mapped as Clayburn-Hourglass complex and Horsethief-Needleton complex, both described as very deep, well drained soils formed in alluvium derived from sandstone and shale, or rhyolite.

The riparian vegetation is dominated by blue spruce (*Picea pungens*) with thinleaf alder (*Alnus incana*), Drummond's willow (*Salix drummondiana*), and Rocky Mountain willow (*Salix monticola*). The drier slopes are dominated by Engelmann spruce (*Picea engelmannii*). .

Natural Heritage element occurrences at the Cascade Creek at Purgatory PCA

Scientific Name	Common Name	Global Rank	State Rank	Federal and State Status	Element Occurrence Rank
<i>Picea pungens</i> / <i>Alnus incana</i>	Montane riparian forest	G3	S3		A

Biodiversity Rank Justification: This site supports an excellent occurrence (A ranked) of a globally vulnerable (G3) montane riparian forest plant community. This is the highest quality occurrence of this plant association observed during the 2002 field survey.

Boundary Justification: The boundary is drawn to include the Cascade Creek floodplain from the confluence of Graysill and Engineer Creeks to Highway 550. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain a viable wetland. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Because the wetland is dependent on natural hydrological processes associated with Cascade Creek, any upstream activities such as water diversions, impoundments, and mining development could potentially be detrimental to the wetland. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by USFS, San Juan National Forest and private landowners. There is currently no special protection for the area.

Management Comments: New management actions may be needed within five years to maintain the current quality of the riparian wetland. In the lower 1 – 2 miles of the PCA, there are private residential properties located throughout the floodplain. Increased residential developments could potentially have deleterious effects on the occurrence.

Wetland Soils Description: Soils are rocky, derived from alluvial outwash. Texture is sandy with large gravel.

Wetland Functional Assessment for the Cascade Creek at Purgatory PCA

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	High	The wetland is large > 20 acres, vegetation is dense, presence of microtopography, presence of ponds, sloughs, and pools, low to moderate gradient
Sediment/Shoreline Stabilization	High	Cascade Creek is moderately vegetated with shrubs and herbaceous species, some evidence of bank erosion due to recreational and grazing activity
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan therefore is naturally acidic, however due to current and past mining activities is likely more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	Moderate	Wetland does not contain peaty soils, high flushing due to flooding.
Biological Functions		

Habitat Diversity	Moderate	Wetland supports 2 Cowardin Classes
General Wildlife Habitat	High	Deer and elk sign
General Fish/Aquatic Habitat	High	Native and non-native fish observed.
Production Export/Food Chain Support	High	Wetland receives flushing of organic material, nutrients, supports overhanging vegetation, outlet for flushing flows.
Uniqueness	Moderate	Wetland type is common, but the plant community is globally vulnerable.

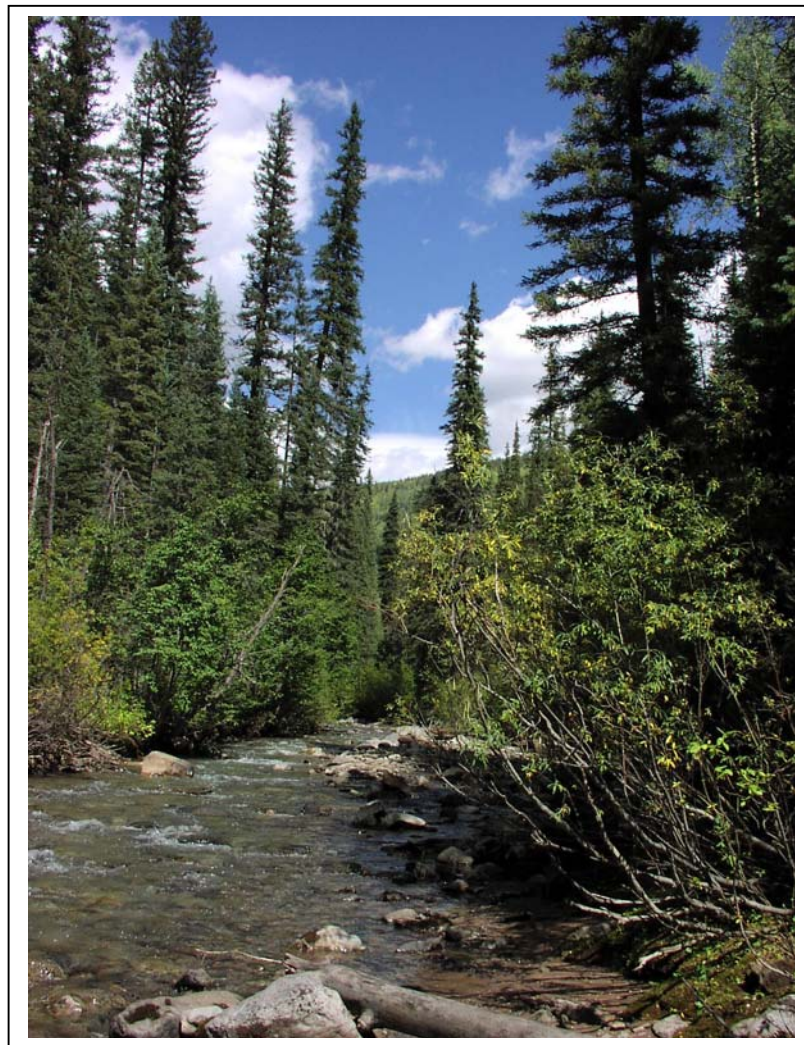
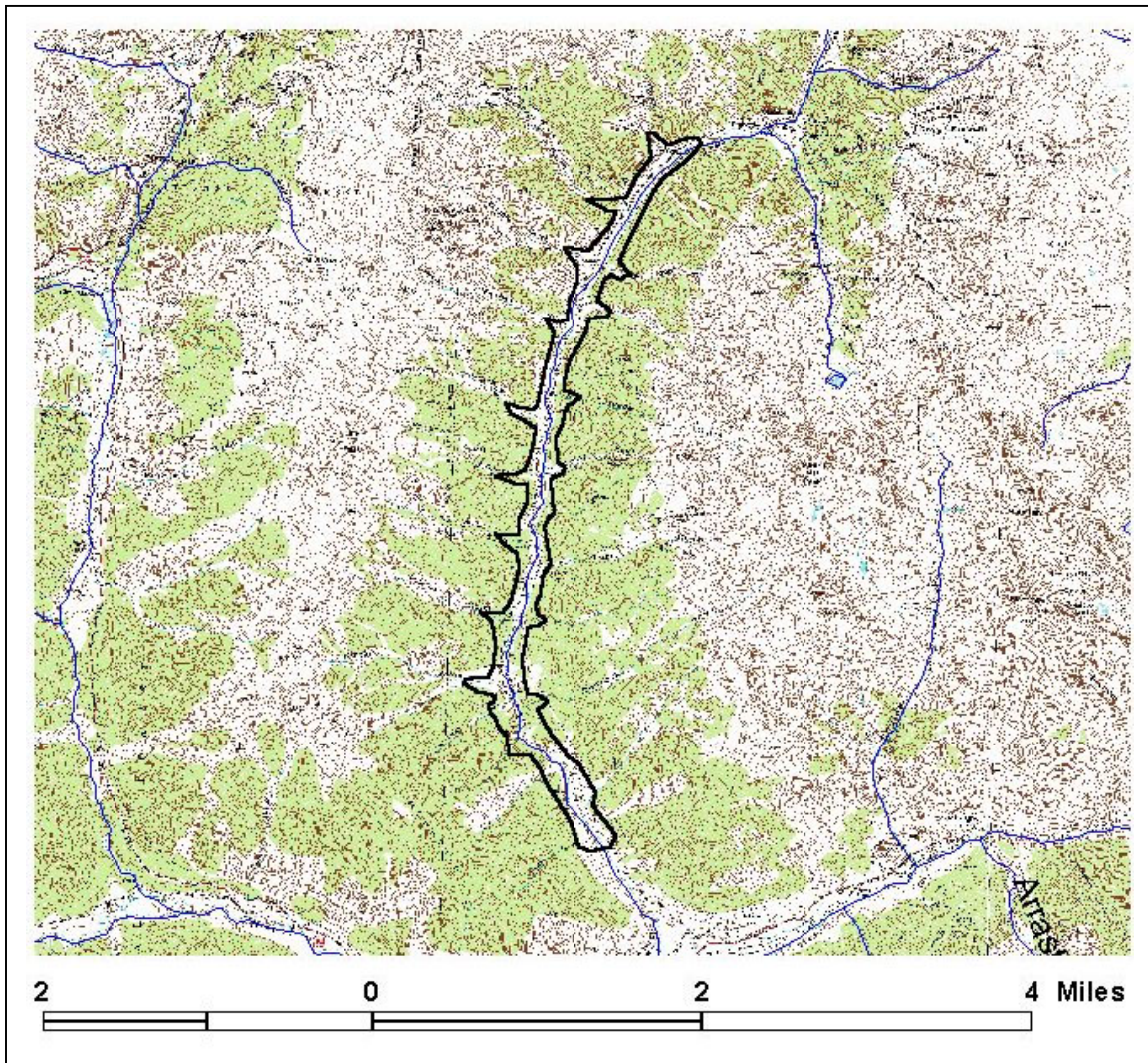


Figure 65. Blue spruce/thinleaf alder montane riparian forest at Cascade Creek.

Cement Creek Iron Fen Potential Conservation Area



Location in San Juan County

Cement Creek Iron Fen Potential Conservation Area

Biodiversity Rank: B2. Nearly irreplaceable. A good occurrence of a globally imperiled (G2) plant community.

Protection Urgency rank: P2. Protection actions may be needed within five years. It is estimated that stresses may reduce the viability of the elements within this approximate time frame. The Potential Conservation Area is located on both BLM and private lands. There is currently no special protection for the area.

Management Urgency rank: M2. New management actions may be needed within five years to prevent the loss of the element occurrences. The area is located adjacent to State Highway 110 and within the impact area of several active mining claims.

Location: San Juan County, State Highway 110, along Cement Creek, north of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Silverton and Ironton. T42N R7W Sections 19, 20, 29, 30, 31; T41N R7W Sections 6, 7, and 8.

Size: Approximately 56 acres

Elevation: 10,200 ft. to 11,300 ft.

Cement Creek is one of the three major tributaries of the upper Animas River, between the Mineral Creek and main stem of the Animas. It is located northwest of the Town of Silverton and south of the Town of Gladstone. Cement Creek flows along a steep, narrow valley, with peaks on both sides ascending to over 13,000 ft. The creek runs through the center of the Silverton Caldera, which is composed of Oligocene andesitic lavas. Iron fens and associated limonite ledges can be found along 4 miles of Cement Creek starting just south of the Town of Gladstone. The most prominent iron fens are located at Tiger Gulch and Topeka Gulch.

Iron fens are hydrologically similar to other Colorado fens in that there is discharge of ground water. However, the source water for iron fens flows through iron pyrite rich bedrock and talus. The oxidation of pyrite by flowing water results in the formation of sulfuric acid and production of naturally acidic waters. As the pyrite oxidizes it will stain red, sometimes over large areas such as at Red Mountain. The low pH is unique to Colorado wetlands; a low pH is typically found in bogs in the eastern U.S. or Canada. Colorado's iron fens are also unique in that one would expect to find low ion concentrations in surface and pore waters such as documented in eastern and northern bogs. In contrast, iron fens have high ion concentrations because acids are produced on mountain slopes where ions can be leached from mineralized rock and dissolved in the flowing water. In particular, Ca^{2+} and SO_4 concentrations can be high. Dr. David Cooper found in a preliminary study an average Ca^{2+} of 10-120 and SO_4 of 70-700 mg/kg (n = 8) (Cooper unpublished).

The Cement Creek Iron Fens are fed by groundwater seeping from eastern and western valley walls, as well as overflow from Cement Creek. A common feature of iron fens is limonite terraces or iron precipitates that have been deposited onto organic matter in layers. These terraces will perch the water table and form an extensive network of pools and ponds. The Cement Creek Iron Fens are good examples of this process.

Cement Creek Iron Fens are dominated by acid-tolerant shrubs with a thick ground cover of a variety of *Sphagnum* spp. and other mosses. Engelmann spruce (*Picea engelmannii*) dominates the tree layer. Bog birch (*Betula glandulosa*) and dwarf blueberry (*Vaccinium cespitosum*) dominate the shrub layer. Mosses, bluejoint (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*), and alpine spicy wintergreen (*Gaultheria humifusa*) make up the lowest canopy layer.

Natural Heritage element occurrences at the Cement Creek PCA

Scientific name	Common name	Global Rank	State Rank	State/Federal status	Element occurrence rank
(<i>Picea engelmannii</i>)/ <i>Betula glandulosa</i> / <i>Carex aquatilis</i> / <i>Sphagnum angustifolium</i>	Iron fen	G2	S2		B

Biodiversity comments: This site supports a good occurrence (B rank) of a globally imperiled (G2) iron fen plant community. Currently there are only 13 iron fens known globally, four of which occur in San Juan County.

Boundary Justification: The boundary is drawn to include the Cement Creek floodplain from Gladstone to just above the confluence of Cement Creek with the Animas River. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the wetland. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Since the wetlands are dependent on natural hydrological processes associated with Cement Creek, any upstream activities such as water diversions, impoundments, and mining development could potentially be detrimental to the wetland. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by BLM and private landowners. There is currently no special protection for the area.

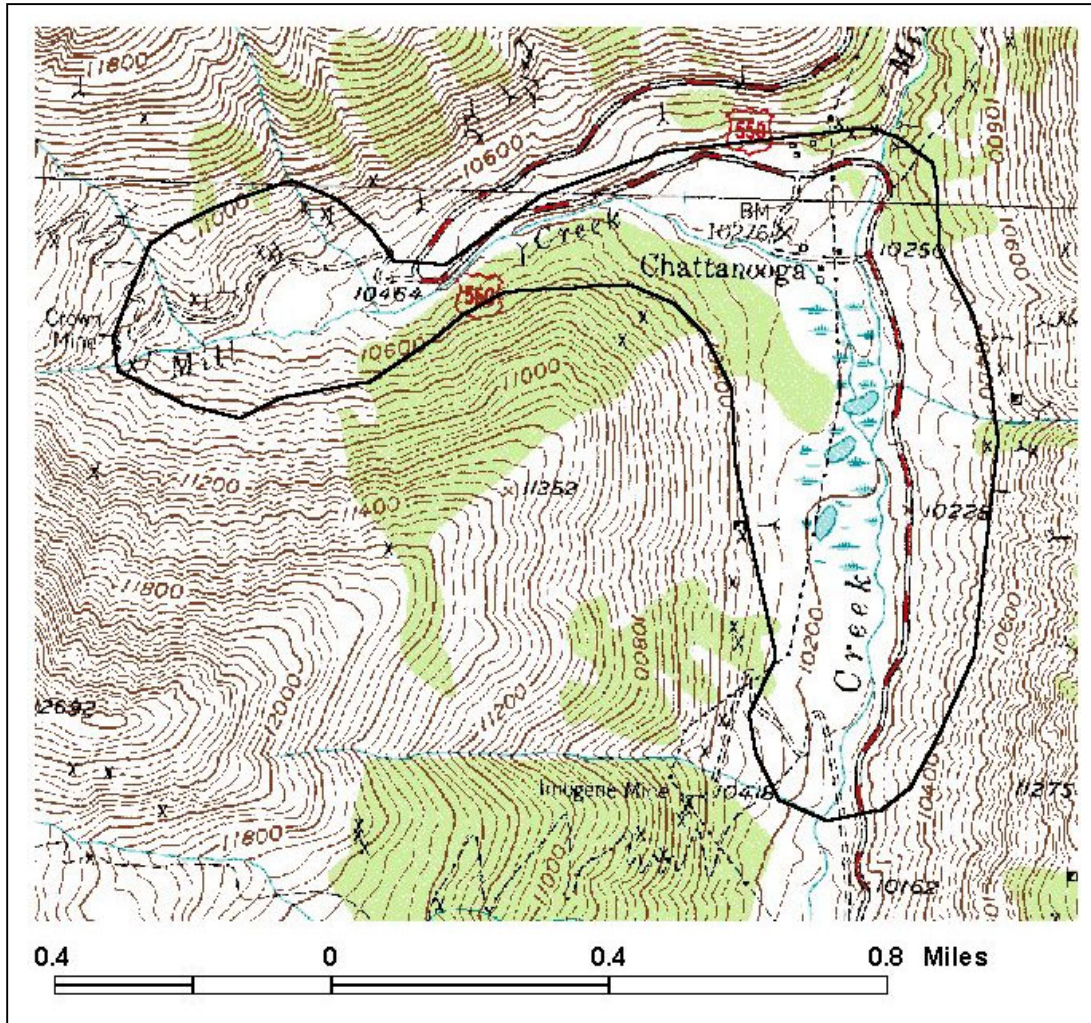
Management Comments: The iron fen is located adjacent to State Highway 110 and may be threatened by road maintenance and improvements. It is recommend that the County Road Department and Colorado Department of Transportation be notified of the importance and location of the fen to avoid impacts.

Wetland Soils Description: Soils have Histic epipedon with fibric to sapric peat up to 60 cm deep. Many areas of the wetlands were “quaking”. In areas where a mineral soil was reached with the shovel it was gleyed (Chart 1 6/10Y).

Wetland Functional Assessment for the Cement Creek Iron Fen at Tiger Gulch

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	High	The wetland is large > 20 acres, vegetation is dense, presence of microtopography, presence of ponds and pools, low gradient
Sediment/Shoreline Stabilization	High	Cement Creek is densely vegetated with shrubs and herbaceous species, some evidence of bank erosion due to mining activity
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan Mountains, and therefore is naturally acidic; however due to current and past mining activities it is likely more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	High	Wetland contains peaty soils, presence of permanently flooded areas, dense vegetation.
Biological Functions		
Habitat Diversity	Low	Wetland supports 1 Cowardin Class
General Wildlife Habitat	Low	None were observed
General Fish/Aquatic Habitat	Low	Wetland is too acidic to support fish.
Production Export/Food Chain Support	Moderate	Wetland does not support the best habitat for fish or wildlife
Uniqueness	Very High	There are 13 known occurrences of iron fens in the world and all of them occur in Colorado.

Chattanooga Iron Fen Potential Conservation Area



Bog birch community at Chattanooga Iron Fen



Location in San Juan County

Chattanooga Iron Fen Potential Conservation Area

Biodiversity Rank: B2 Nearly irreplaceable. A good occurrence of a globally imperiled (G2) plant community and several disjunct *Sphagnum* spp.

Protection Urgency Rank: P3 Protection actions may be needed but probably not within the next five years. The Potential Conservation Area is located on USFS and private lands. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within five years to maintain the current quality of the element occurrences. The area is located adjacent to Hwy 550 and within the impact area of several active mining claims.

Location: San Juan County, along U. S. Highway 550 and Mineral Creek, about five air miles northwest of Silverton.

Legal Description: U S.G.S. Quadrangles: Silverton and Ironton. T42N R8W Sections 26 and 27.

Size: approximately 30 acres

Elevation: 10,200 ft. to 11,300 ft.

General Description: Chattanooga Iron Fen lies in the Mineral Creek floodplain in the San Juan Mountains, 3 miles south of Red Mountain Pass and 5 miles northwest of the Town of Silverton. Ohio Peak and Anvil Mountain border the iron fen to the east and two unnamed peaks over 12,000 ft. border to the west. Mineral Creek flows along a fault zone through quaternary glacial deposits at the west edge of the Silverton Caldera. To the north, Mineral Creek follows the trace of the caldera rim faults. The highly altered Henson and Burns Formations make up the valley wall east of the fault zone and lower third of the west valley wall. The upper two-thirds of the west valley wall are the San Juan Formation, derived from ancient volcanoes located northeast of Silverton, and a sequence of rhyolite ash flows, including the Ute, Blue Mesa, and Sapinaro Mesa Tuffs.

The Chattanooga Iron Fen is fed by groundwater seeping from eastern valley walls under Highway 550 and overflow by Mineral Creek. Highly acidic groundwater from mineralized springs emerging from the lower west wall of the valley feeds the iron fen. A common feature of iron fens is limonite terraces or iron precipitates that have been deposited onto organic matter in layers. These terraces will perch the water table and form an extensive network of pools and ponds. Chattanooga Iron Fen is a good example of this process.

Soils of the wetland are mapped as typical cryaquents-cryaquolls-cryofibrist complex, 0 to 5 percent slopes, deep poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources.

The vegetation of Chattanooga Iron Fen is characterized by acid-tolerant shrubs with a thick ground cover of a variety of *Sphagnum* and other mosses. Engelmann spruce (*Picea engelmannii*) dominates the tree layer. Bog birch (*Betula glandulosa*) and whortleberry (*Vaccinium cespitosum*) dominate the shrub layer. Mosses, bluejoint (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*), and alpine spicy wintergreen (*Gaultheria humifusa*) form the herbaceous layer. Open water accounts for 25 to 30% of the surface.

Dr. David Cooper of Colorado State University documented several new bryophyte records for Colorado and the United States in Chattanooga Iron Fen. *Sphagnum balticum* is common in the fen. Until its discovery in Colorado, its known range in North America extended southward to approximately 51 degrees latitude in British Columbia. *S. balticum* is the primary moss in shallow pools with water sedge (*Carex aquatilis*) and beaked sedge (*Carex utriculata*). A rare liverwort, *Jungermannia rubra*, was documented at the springs and in the water tracks on the exposed limonite (Carsey 1999).

Common mosses collected at Chattanooga Fen were identified by Dr. William Weber as: *Aulacomnium palustre*, *Brachythecium oedipodium*, *Brachythecium oedipodium*, *Ceratodon purpureus*, *Gymnocolea inflata*, *Hypnum cupressiforme*, *Lophozia incisa*, *Palustriella falcata*, *Philonotis marchica*, *Pohlia nutans*, *Polytrichastrum alpinum*, *Polytrichum juniperinum*, *Racomitrium canescens*, *Scorpidium cossonii*, *Sphagnum angustifolium*, *Sphagnum fuscum*, *Sphagnum russowii*, *Tomentypnum nitens*, and *Warnstorfia exannulata*.

Natural Heritage element occurrences at the Chattanooga Fen PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
(<i>Picea engelmannii</i>)/ <i>Betula glandulosa</i> / <i>Carex aquatilis</i> / <i>Sphagnum angustifolium</i>	Iron fen	G2	S2		B
<i>Sphagnum balticum</i>	Arctic peat moss	G2G4	S?		E
<i>Jungermannia rubra</i>	Liverwort	G2G4	S?		E
<i>Sphagnum contortum</i>	Peat moss	G?	S?		E
<i>Sphagnum platyphyllum</i>	Peat moss	G5	S?		E
<i>Sphagnum girgensohnii</i>	Peat moss	G5	S?		E

Biodiversity comments: This site supports a good (B ranked) example of a globally imperiled (G2) plant community and multiple occurrences of disjunct *Sphagnum* species known to occur in acidic wetlands at more northerly latitudes. Currently there are only 13 iron fens known globally, four of which occur in San Juan County.

Boundary Justification: The boundary is drawn to include the Mineral Creek floodplain and slopes below the cliffs, which rise on both sides of the river at the base of Red Mountain Pass. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain a viable wetland. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Impoundments, and mining development or cleanup could potentially be detrimental to the wetland. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by USFS, San Juan National Forest and private landowners. There is currently no special protection for the area. Slopes above the wetland were used historically for mining. A dirt road along the south end and upper slopes of the site and several abandoned mine adits on the road remain from past mine activities. The extremely limited range of these species makes protection of their habitat crucial. Efforts should be made to educate and work with the private landowners for the protection of this unique wetland type.

Management Comments: The area has been mined in the past and it is not readily apparent if mining is currently going on. Highway 550 bisects the upper end of the PCA, and continues along the eastern side of the wetland. The impact of road maintenance, e.g., chemicals, sediments or road widening activities, is unknown. A monitoring study for both the vegetation and hydrology is recommended to document impacts of the highway and past and current mining activities, including mine cleanup that may take place upstream.

Wetland Soils Description: Soils have Histic epipedon with fibric to sapric peat up to 60 cm deep. Many areas of the wetlands were “quaking”. In areas where a mineral soil was reached with the shovel it was gleyed.

Wetland functional assessment for the slope wetland at the Chattanooga Iron Fen.

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	High	The wetland is large > 20 acres, vegetation is dense, presence of microtopography, presence of ponds and pools, low gradient
Sediment/Shoreline Stabilization	High	Mineral Creek is densely vegetated with shrubs and herbaceous species, some evidence of bank erosion due to mining activity
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan therefore is naturally acidic, however due to current and past mining activities is more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	High	Wetland contains peaty soils, presence of permanently flooded areas, dense vegetation.
Biological Functions		
Habitat Diversity	Low	Wetland supports 1 Cowardin Class
General Wildlife Habitat	Low	None were observed
General Fish/Aquatic Habitat	Low	Wetland is too acidic to support fish
Production Export/Food Chain Support	Moderate	Wetland does not support the best habitat for fish or wildlife
Uniqueness	Very High	There are 13 known occurrences of iron fens in the world and all of them occur in Colorado.

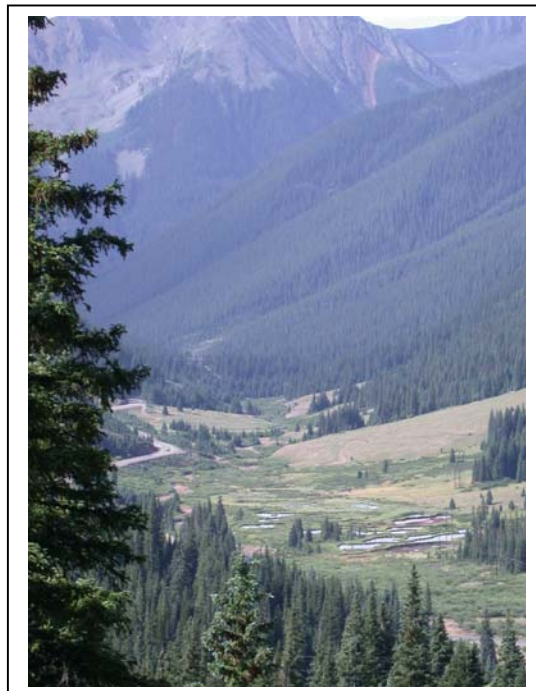
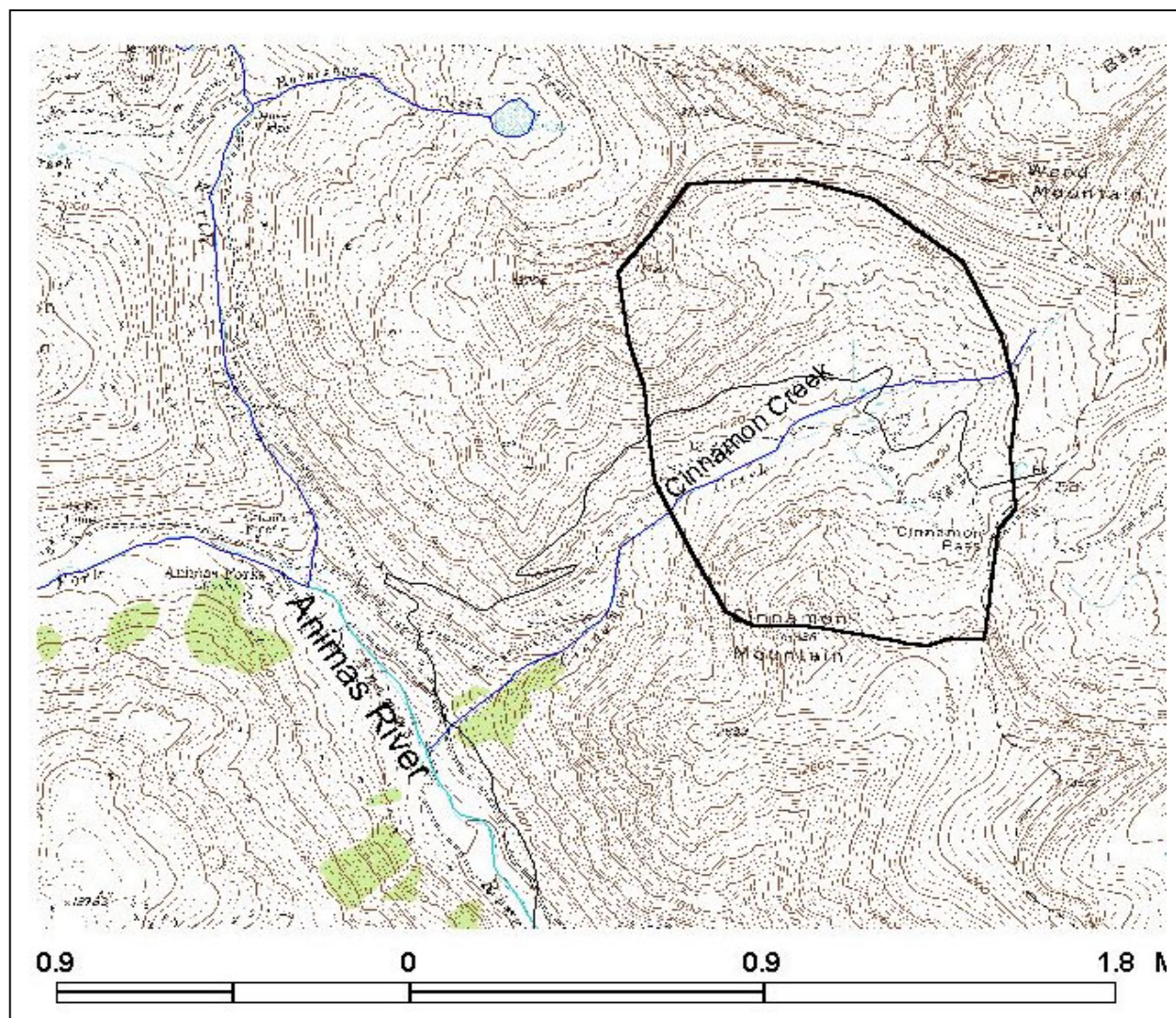


Figure 66. Chattanooga Iron Fen from Red Mountain Pass

Cinnamon Pass Potential Conservation Area



Wetland communities at Cinnamon Pass



Location in San Juan County

Cinnamon Pass Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.\

Location: San Juan County, Alpine Loop, San Juan County Road 5, about ten air miles northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T42N R6W Sections 4, 5; T43N R6W Sections 32, 33

Size: 630 acres

Elevation: 12,000 ft. to 13,328 ft.

General Description: This site contains most of the northeast-facing bowl below Cinnamon Mountain. It is bisected by a jeep road that connects Animas Forks and Lake City. Geologically, it is situated on the San Juan volcanic ash flow tuff. High ridges define the site, forming a tight horseshoe-shaped alpine bowl, with Cinnamon Mountain (13,328 ft.) as the high point, on the south side of the site. The terrain is variable, with three or four obvious terraced benches distributed throughout the upper portions of the site. Talus fields and semi-permanent snow fields dominate the steep slopes that form the upper-most reaches of the site. Soil moisture is variable, with low-lying areas remaining moist to saturated from snow-melt and elevated areas being moist only in early summer.

Soils in the wetland areas of the PCA are mapped as typic cryaquents-cryaquolls-cryofibrist complex, 0 to 5 percent slopes, (deep poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources). The soils of the hillsides are identified as Moran very gravelly loam, 30 to 65 percent slopes, (a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite).

The headwaters of Cinnamon Creek contain some excellent quality wetlands. Drier upper slopes support typical alpine tundra with rock outcrops. The highest areas are dominated by snow willow (*Salix reticulata* ssp. *nivalis*), the host plant of the extremely rare Uncompahgre fritillary butterfly (*Boloria improba acrocneuma*). More mesic slopes are dominated by alpine avens (*Geum rossii*). Other common species in the site include Holm's ragwort (*Senecio amplexans* var. *holmi*), false strawberry (*Sibbaldia procumbens*), moss campion (*Silene acaulis*) and fleabane (*Erigeron vagus*). Thick-leaf whitlow-grass (*Draba crassa*) was found in rock crevices and in shallow soils surrounding rock outcrops on north facing slopes. The wetlands have small areas of

standing water and permanently saturated peat soils that support a variety of grasses and sedges, including tufted hairgrass (*Deschampsia cespitosa*), globe sedge (*Carex perglobosa*), black sedge (*Carex nova*), smallwing sedge (*Carex microptera*), and native sedge (*Carex vernacula*), along with Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*).

Natural Heritage element occurrences at the Cinnamon Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3		B
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	A
<i>Boloria improba acrocynema</i>	Uncompahgre fritillary	G5T1	S1	LE	F
<i>Carex vernacula</i>	Alpine wetlands	GU	SU		A

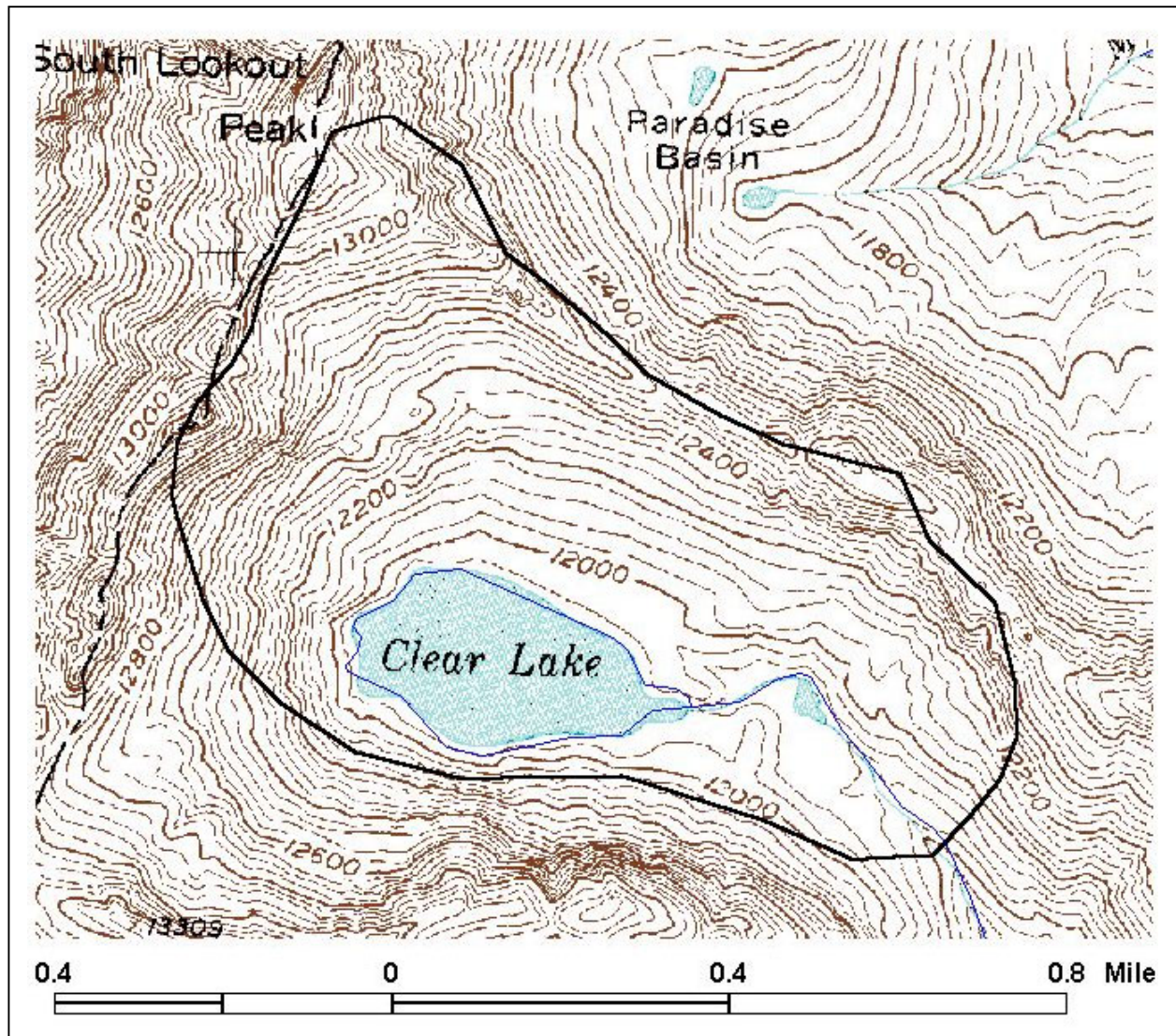
Biodiversity comments: The Cinnamon Pass PCA supports a good (B ranked) occurrence of thick-leaf whitlow-grass, a plant that is vulnerable (G3) globally. There is also an excellent (A ranked) occurrence of alpine wetlands dominated by *Carex vernacula*, (*Carex vernacula*), a plant community for which more information is needed before a rank can be assigned. The community has been documented only five times, all in Colorado. However, more research may prove it to be more common and widespread than is now known. The wetland areas contain excellent quality (A ranked) patches of Altai cottongrass, a subspecies that is listed as sensitive by the U.S. Forest Service. Although the Uncompahgre fritillary, a critically imperiled subspecies (T1) is known from this site, it has not been observed recently. A total of five individuals were documented on August 8, 1995 (L.D. Beutler pers. comm.). The colony has not been confirmed since, and may be extirpated.

Boundary Justification: The boundary is drawn to encompass the occurrences of the alpine wetland community and areas upslope that provide moisture from snow melt that support the wetland. This area also includes the habitat of the Altai cottongrass and thick-leaf whitlow-grass. The boundary is not intended to include all of the area that would be required to sustain a population of the Uncompahgre fritillary. It does, however, contain appropriate habitat, including the snow willow upon which the butterflies depend.

Protection Rank Comments: The area is primarily BLM land, with a few private mining claims. There is no special protection in place.

Management Rank Comments: No exotic species were observed in the site. Some erosion resulting from sheep trailing was observed. The site has been subject to past mining activity and relatively intense domestic sheep grazing. Sheep grazing may have already had negative effects on the Uncompahgre fritillary by reducing floral diversity for nectar sources and possible trampling of larvae and snow willow (Ellingson, pers. comm.).

Clear Lake Potential Conservation Area



Location in San Juan County

Clear Lake Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No threat is known for the foreseeable future. The PCA is entirely within the San Juan National Forest.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, South Mineral Creek watershed, County Road 12, about five air miles west of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ophir. T41N R8W Sections 6, 7 and 8

Size: 2,080 acres

Elevation: 11,800 ft. to 13,200 ft.

General Description: Clear Lake is a beautiful glacial tarn located above timberline north of South Mineral Creek. It is geologically situated at the western side of the Silverton caldera, in Tertiary volcanics predating the large ashflows.

Soils of the PCA are a mosaic of deep and shallow well drained soils derived from volcanics and rock outcrops. They are mapped as Moran very gravelly loam, 30 to 65 percent slopes, Whitecross-Rock outcrop complex, 45 to 75 percent slopes, and Telluride-Rock outcrop complex, 15 to 45 percent slopes (USDA 2003).

Surrounding areas display a great deal of heterogeneity of habitats. The steep hillsides on the east side of the lake are covered with grasses and forbs, including the San Juan endemic kittentails (*Besseya ritteriana*), which is co-dominant with alpine avens (*Geum rossii*) and western paintbrush (*Castilleja occidentalis*). Associated species include another species of paintbrush (*Castilleja rhexifolia*), orange sneezeweed (*Dugaldia hoopsii*), Whipple's penstemon (*Penstemon whippleanus*) and American bistort (*Bistorta bistortoides*). Drier areas on the east side support snow willow (*Salix reticulata* ssp. *nivalis*), alpine avens (*Geum rossii*), false strawberry (*Sibbaldia procumbens*), alpine sage (*Artemisia scopulorum*), and dwarf bilberry (*Vaccinium cespitosum*). Interspersed with the meadows are talus slopes where Harbour beard-tongue (*Penstemon harbourii*) was found. The long elastic roots of this penstemon allow it to adjust to the constantly shifting rocks. Other species found in the talus are Colorado columbine (*Aquilegia coerulea*) and Colorado ragwort (*Senecio soldanella*). Extensive talus areas farther south have not been surveyed, but appear to contain much additional suitable habitat for the *Penstemon*. On the west side of the lake, the slopes are barren and rocky, almost devoid of vegetation. The outlet stream supports a riparian area with high floral diversity, and includes the rare Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*). Associated species along the stream include tufted hairgrass (*Deschampsia*

cespitosa), bittercress (*Cardamine cordifolia*) and paintbrush (*Castilleja rhexifolia*). A county road provides access to the site, and it is a popular destination for 4-wheel drive enthusiasts.

Natural Heritage element occurrences at the Clear Lake PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		A
<i>Penstemon harbourii</i>	Harbour beard-tongue	G3G4	S3S4		A
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	E

Biodiversity comments: The Clear Lake PCA includes excellent (A ranked) occurrences of a globally (G3) vulnerable plant, kittentails (*Besseyia ritteriana*). The site also supports and excellent occurrence of Harbour beard-tongue (*Penstemon harbourii*), a watchlisted.Colorado endemic plant, and an unranked (E) occurrence of Altai cottongrass, a subspecies that is listed as sensitive by the U.S. Forest Service.

Boundary Justification: The boundary is drawn to include the occurrence of kittentails and Harbour beard-tongue, as well as the slopes above them which provide the moisture from snow- melt that is necessary for their survival. The PCA encloses an area that is large enough to support natural processes such as pollination and seed dispersal.

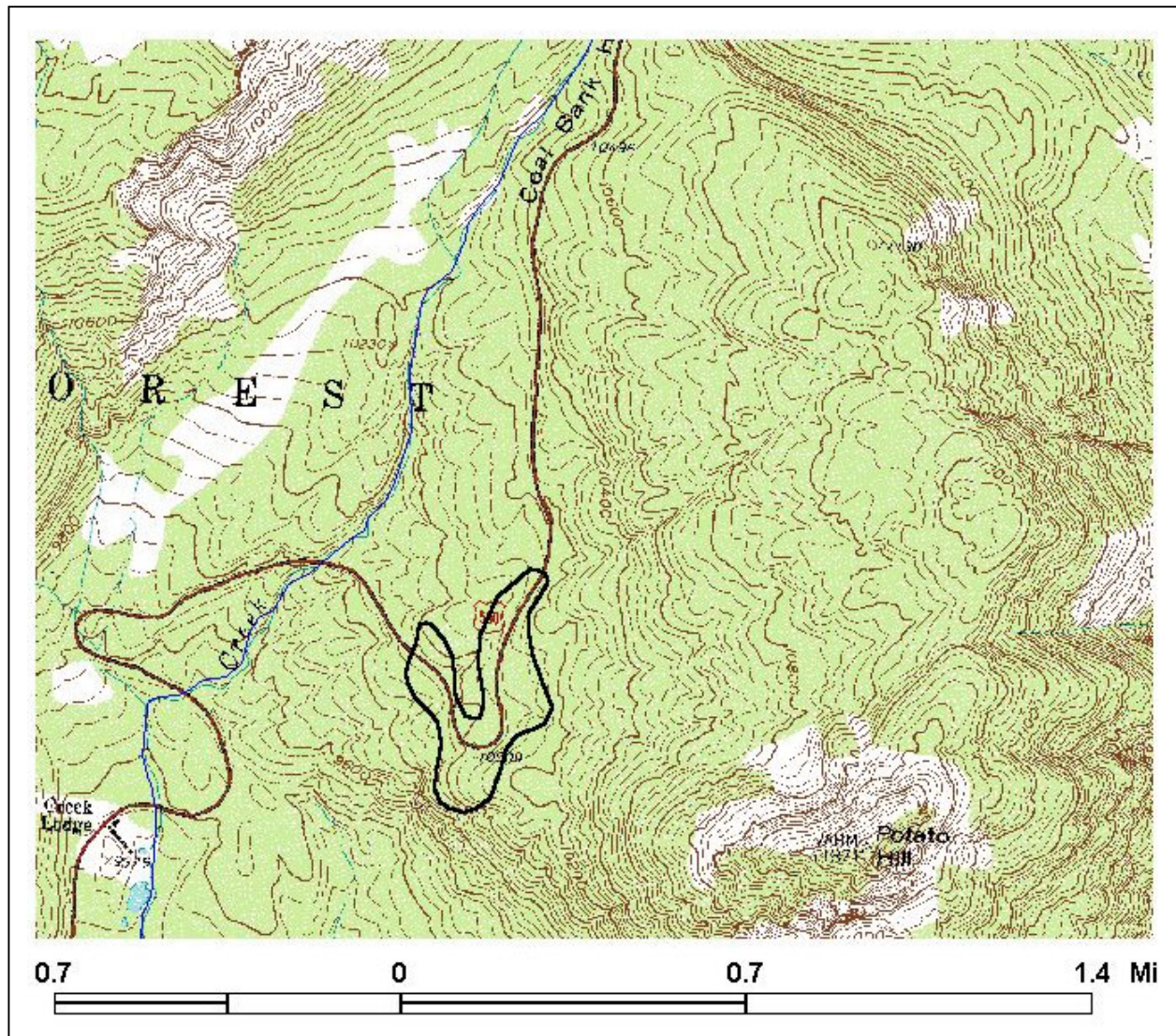
Protection Rank Comments: The site is entirely within the San Juan National Forest. It has no special designation.

Management Rank Comments: Although the site is a popular 4-wheel drive and ATV destination, vehicles have impacted only a small area around the lake. An old two-track leads uphill from the east side of the lake, and becomes an unmarked hiking trail, which continues partway up the hill, and then fades out. This trail has caused some erosion where it goes steeply uphill. If use is found to be heavy, providing a trail with switchbacks could prevent further erosion.



Figure 67. South end of Clear Lake and Clear Creek drainage. Alpine meadow in foreground is habitat of *Besseyia ritteriana*

Coal Bank Hill Potential Conservation Area



Location in San Juan County

Reflected moonwort (*Botrychium echo*)
found at Coal Bank Hill PCA

Coal Bank Hill Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance.

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, U. S. Highway 550, 2 miles south of Coal Bank Pass, about 10.7 air miles southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain. T39N R8W Sections 5 and 6

Size: 44 acres

Elevation: 9,800 ft. to 10,200 ft.

General Description: This PCA is located in a rocky, forested area near the roadside of Highway 550. Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta* var. *latifolia*) dominate the site, with patches of aspen (*Populus tremuloides*), and a shady understory with whortleberry (*Vaccinium myrtillus*) and strawberry (*Fragaria virginiana*). Soils in the PCA are well drained, formed in residuum from a variety of rock types including rhyolite, sandstone, limestone, granite and schist (USDA 2003).

Three species of moonworts (*Botrychium*), including two that are rare, were found in a small dry drainage channel in 1987. Although the site was visited in 2002, the moonworts were not found. However, it is common for them not to appear above ground every year, even though their underground parts are viable. Few moonworts were found anywhere in San Juan County during the extreme drought in 2002.

Natural Heritage element occurrences at the Coal Bank Hill PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Botrychium echo</i>	Reflected moonwort	G3	S3	S-FS	E
<i>Botrychium pinnatum</i>	Northern moonwort	G4?	S1		E

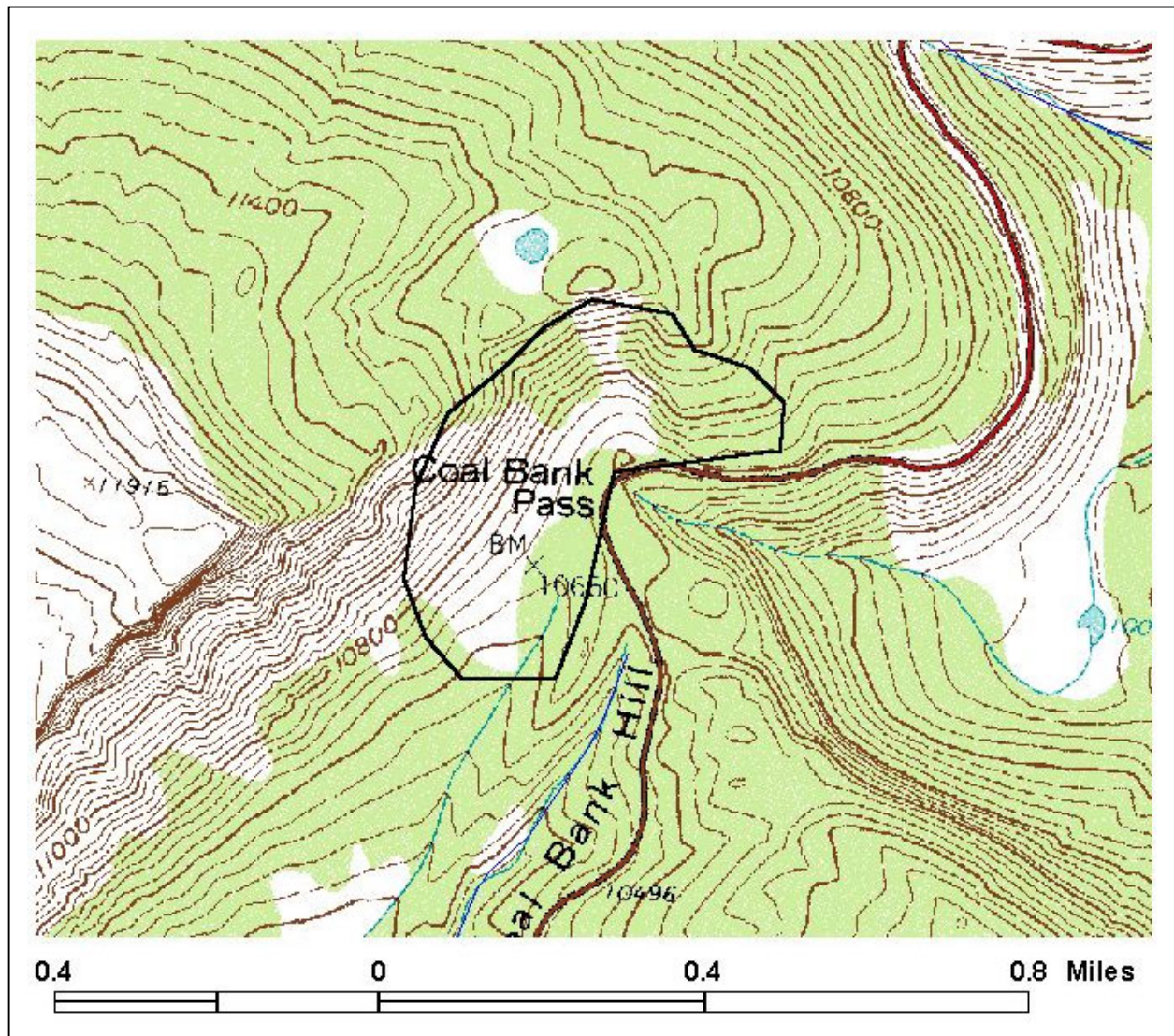
Biodiversity comments: This PCA supports an unranked (E) occurrence of reflected moonwort, a globally vulnerable (G3) species. It occurred together with northern moonwort, considered to be extremely rare (S1) in Colorado. Moonwort (*Botrychium*) populations generally are not ranked unless they are observed for several years, due to their habit of remaining viable underground while often failing to produce above ground parts.

Boundary Justification: The boundary was drawn to include the occurrences of the moonworts with a small buffer zone.

Protection Rank Comments: The site is within the San Juan National Forest.

Management Rank Comments: The site is close to Highway 550. The San Juan National Forest has indicated that it will work with the Colorado Department of Transportation to protect the occurrence from road maintenance activities.

Coal Bank Pass Potential Conservation Area



Wet meadow with kittentails and showy whitlow-grass



Location in San Juan County

Coal Bank Pass Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance.

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest. There is no special designation.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Highway 550 at Coal Bank Pass, about 9 air miles southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain. T40N R8W Sections 29, 30, 31, 32

Size: 74 acres

Elevation: 10,600 ft. to 11,400 ft.

General Description: The Coal Bank Pass PCA occupies a moist hillside west of highway 550, at the Engineer Mountain trailhead. This area is near a deposition of the Pennsylvanian sediments containing black shale that is easily mistaken for coal, which accounts for the site's name. The hillside is treeless, apparently the site of a former avalanche.

Soils are deep to shallow, well drained, formed from rhyolite, limestone, sandstone and shale. They are mapped as Needleton-Snowdon complex, 30 to 80 percent slopes and Runlett-Needleton-Sessions complex, 15 to 45 percent slopes (USDA 2003).

The lush vegetation is dominated by corn husk lily (*Veratrum tenuipetalum*), and has a rich diversity of forbs, including the largest known populations of two rare species, showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) and kittentails (*Besseya ritteriana*). Other members of this community are osha (*Ligusticum porteri*), meadowrue (*Thalictrum fendleri*), Richardson's geranium (*Geranium richardsonii*), sickletop lousewort (*Pedicularis racemosa*), cow parsnip (*Heracleum lanatum*), alpine groundsel (*Ligularia amplexans*), sky pilot (*Polemonium pulcherrimum*), arrowleaf ragwort (*Senecio triangularis*), nodding brome (*Bromus anomalus*), cowbane (*Oxypolis fendleri*) and orange sneezeweed (*Dugaldia hoopsii*). The surrounding vegetation is spruce-aspen forest (*Picea* spp. – *Populus tremuloides*), with serviceberry (*Amelanchier alnifolia*) and lodgepole pine (*Pinus contorta* var. *latifolia*) that was planted after the Lime Creek burn in 1879.

Natural Heritage element occurrences at the Coal Bank Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		A
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		A

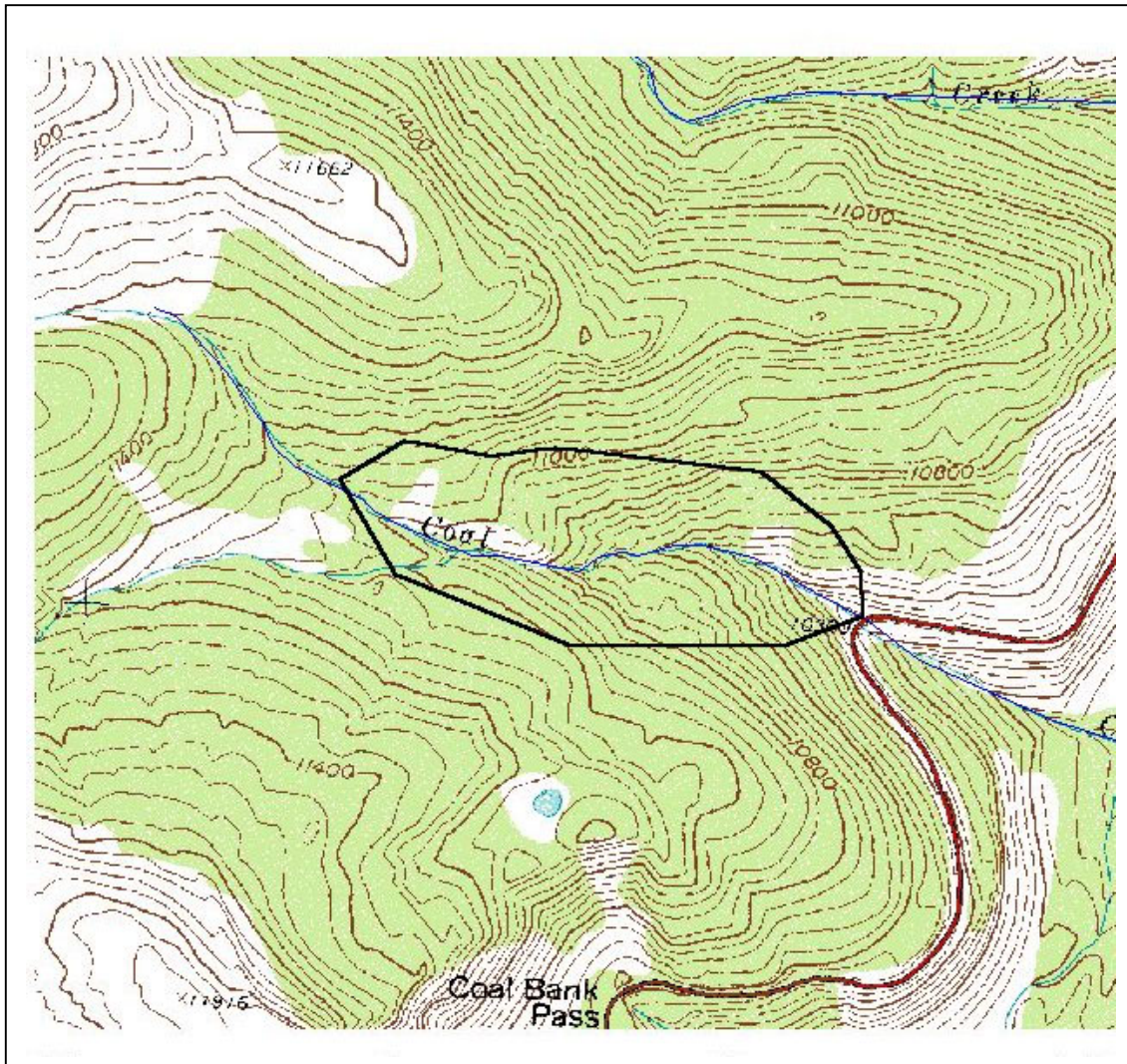
Biodiversity comments: This PCA contains excellent (A ranked) occurrences of two plants, showy whitlow-grass (*Draba spectabilis* var. *oxyloba*), a globally vulnerable (T3Q) variety, and kittentails (*Besseyia ritteriana*), a globally vulnerable (G3) species. This is one of the largest and best known occurrences of both species.

Boundary Justification: The boundary is drawn to include the hillside that supports the two rare plants, and some upslope area that provides the moisture to support this mesic community. The PCA provides sufficient area to support natural processes such as pollination and seed dispersal.

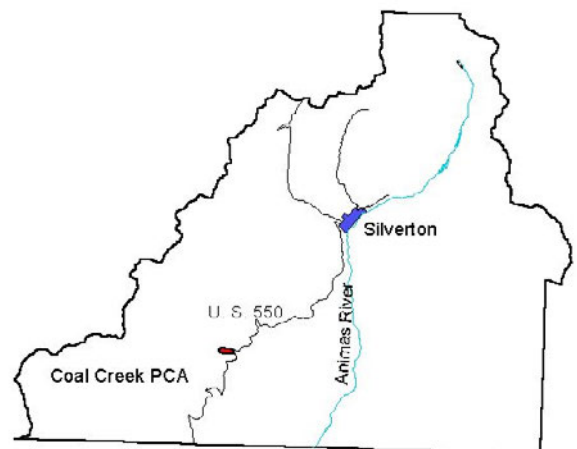
Protection Rank Comments: The site is entirely within the San Juan National Forest. There is no special designation.

Management Rank Comments: This site receives heavy foot traffic, as the Engineer Mountain trail runs through it. However, most hikers stay on the trail, and there is little impact to the plant community. Weed invasion is a potential threat. Some common dandelion (*Taraxacum officinale*) was found in the site in 2002. Weeds from the roadside such as Canada thistle (*Cirsium arvense*), oxeye daisy (*Leucanthemum vulgare*) and yellow toadflax (*Linaria vulgaris*) are potential invaders.

Coal Creek at Highway 550 Potential Conservation Area



Slender rock-brake at Coal Creek



Location in San Juan County

Coal Creek at Highway 550 Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is within the San Juan National Forest.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, just west of Highway 550, about 0.5 miles north of Coal Bank Pass, about 8.5 air miles southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain
T40N R8W Section 29

Size: approximately 114 acres

Elevation: 10,400 feet

General Description: Mossy, shaded cliffs of Pennsylvanian sandstone form the sides of a narrow canyon at the Coal Creek PCA. Seeps keep the cliff faces permanently moist with water slowly oozing out through horizontal crevices, saturating mosses and algae. Spray from waterfalls adds to the humidity of the site. Even in a drought year like 2002, the area was moist. A delicate fern, slender rockbrake, grows out from the rock crevices, along with the more common brittle fern (*Cystopteris fragilis*). The site is accessible just a short walk from Highway 550, at a sharp turn in the road. There may be more habitat for the fern upstream, in areas that were not surveyed.

Natural Heritage element occurrences at the Coal Creek at Highway 550 PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Cryptogramma stelleri</i>	Slender rock-brake	G5	S2		B

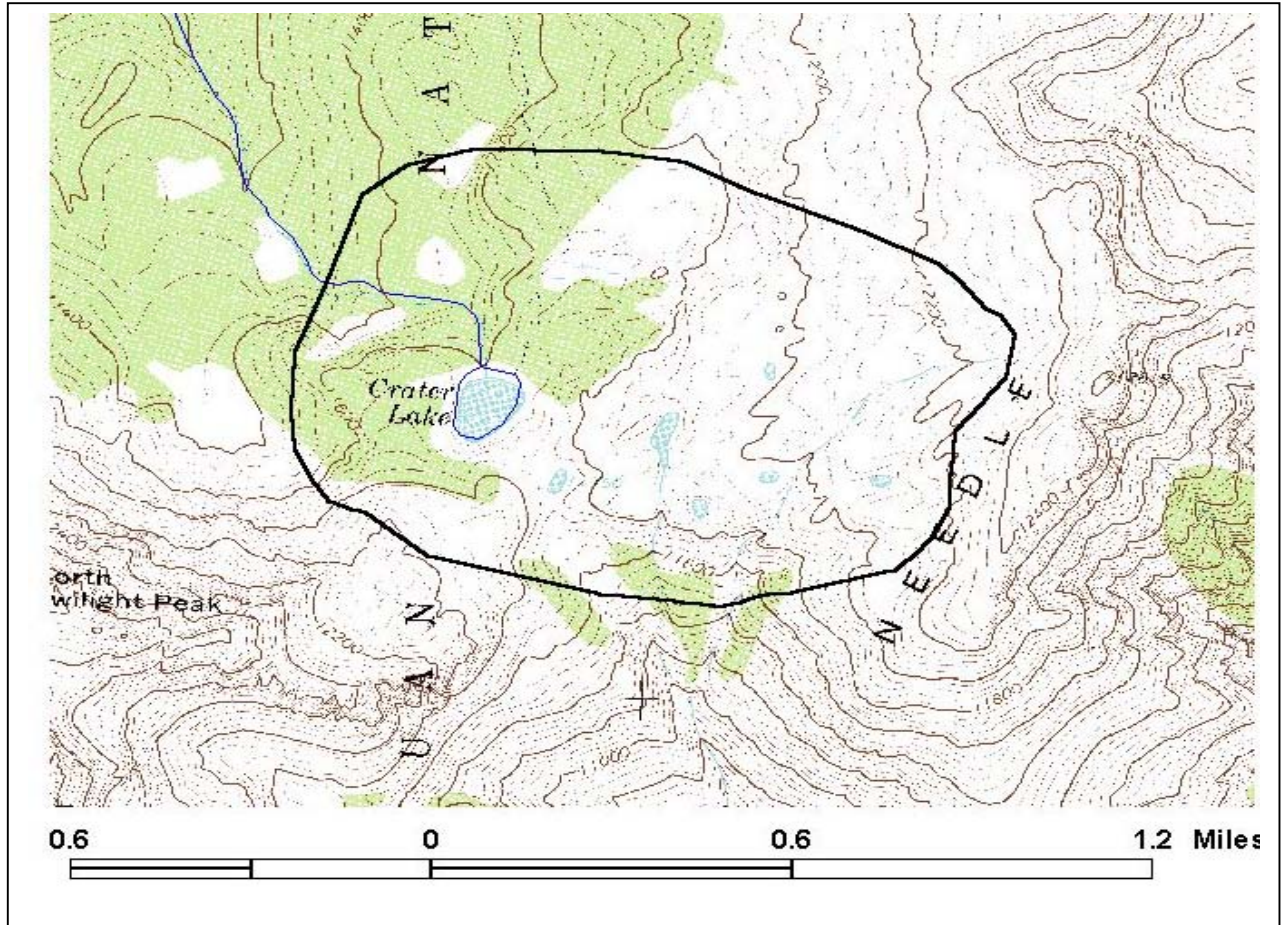
Biodiversity comments: The PCA supports a good (B ranked) occurrence of slender rock-brake, a plant that is globally common but rare (S2) in Colorado.

Boundary Justification: The boundary includes the occurrence and additional habitat upstream that may be occupied, but in any case is essential to the continuation of the current hydrology that supports the fern.

Protection Rank Comments: The site is within the San Juan National Forest, and probably requires no further protection

Management Rank Comments: No management needs were noted. There were no exotic species, and in spite of its proximity to a major highway, the site does not appear to receive much human visitation. However, any changes upstream that affect the hydrology of the site, such as logging or fire, could be detrimental to the fern.

Crater Lake Potential Conservation Area



Lake northeast of Crater Lake, with buckbean and sedge meadow



Location in San Juan County

Crater Lake Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance.

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The PCA is within the Weminuche Wilderness.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Needle Mountains, Weminuche Wilderness, about 8.5 air miles south-southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Snowdon Peak. T39N R8W Sections 2, 11, 12; T40N R8W Section 36

Size: 810 acres

Elevation: 11,600 ft. to 12,200 ft.

General Description: This site includes Crater Lake, a beautiful natural lake, and several smaller lakes. It sits in an old geologic exposure of metamorphic, volcanic rock characterized by interlayered biotite gneisses. Soils on the hillsides are well drained, derived from volcanic rocks and sandstone. They are mapped as Needleton stony loam, 15 to 30 percent slopes, and Telluride-Rock outcrop complex, 15 to 45 percent slopes. Low lying areas are mapped as typic cryaquents-cryaquolls-cryofibril complex, 0 to 5 percent slopes (deep poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources). (USDA 2003).

The lake is surrounded by spruce-fir (*Picea* spp. – *Abies* spp.) forest and high peaks with tundra vegetation. Rock outcrops on the south side of Crater Lake, below north facing cliffs that provide shade and retain snow late in the year, are home to San Juan whitlow grass (*Draba graminea*). Associated species include fringed grass-of-Parnassus (*Parnassia fimbriata*), snow willow (*Salix reticulata* ssp. *nivalis*), spotted saxifrage (*Cilinia austromontana*), brittlefern (*Cystopteris fragilis*), moss campion (*Silene acaulis*), alpine sandwort (*Lidia obtusiloba*), woodrush (*Luzula spicata*), alpine avens (*Geum rossii*), alpine spring beauty (*Claytonia megarhiza*), and alpine sage (*Artemisia scopulorum*).

A small un-named lake north of Crater Lake supports a wetland community of buckbean (*Menyanthes trifoliata*), and is rimmed by mud sedge (*Carex limosa*). Other species in this wetland are water sedge (*Carex aquatilis*), elephant head (*Pedicularis groenlandica*), and spikerush (*Eleocharis* sp.). Extensive wetlands to the east of Crater Lake are the site of Altai cottongrass (*Eriophorum altaicum*).

Natural Heritage element occurrences at the Crater Lake PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		B
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	A
<i>Carex limosa</i>	Mud sedge	G5	S2		B

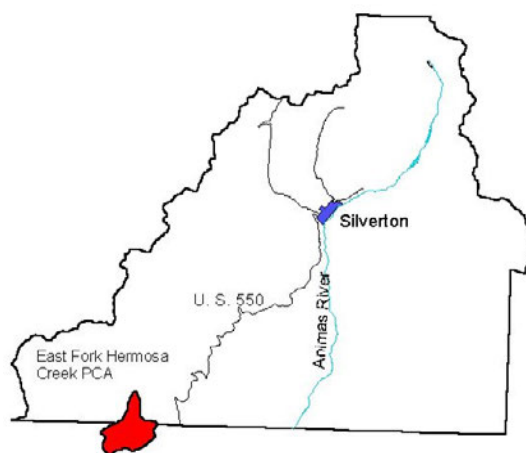
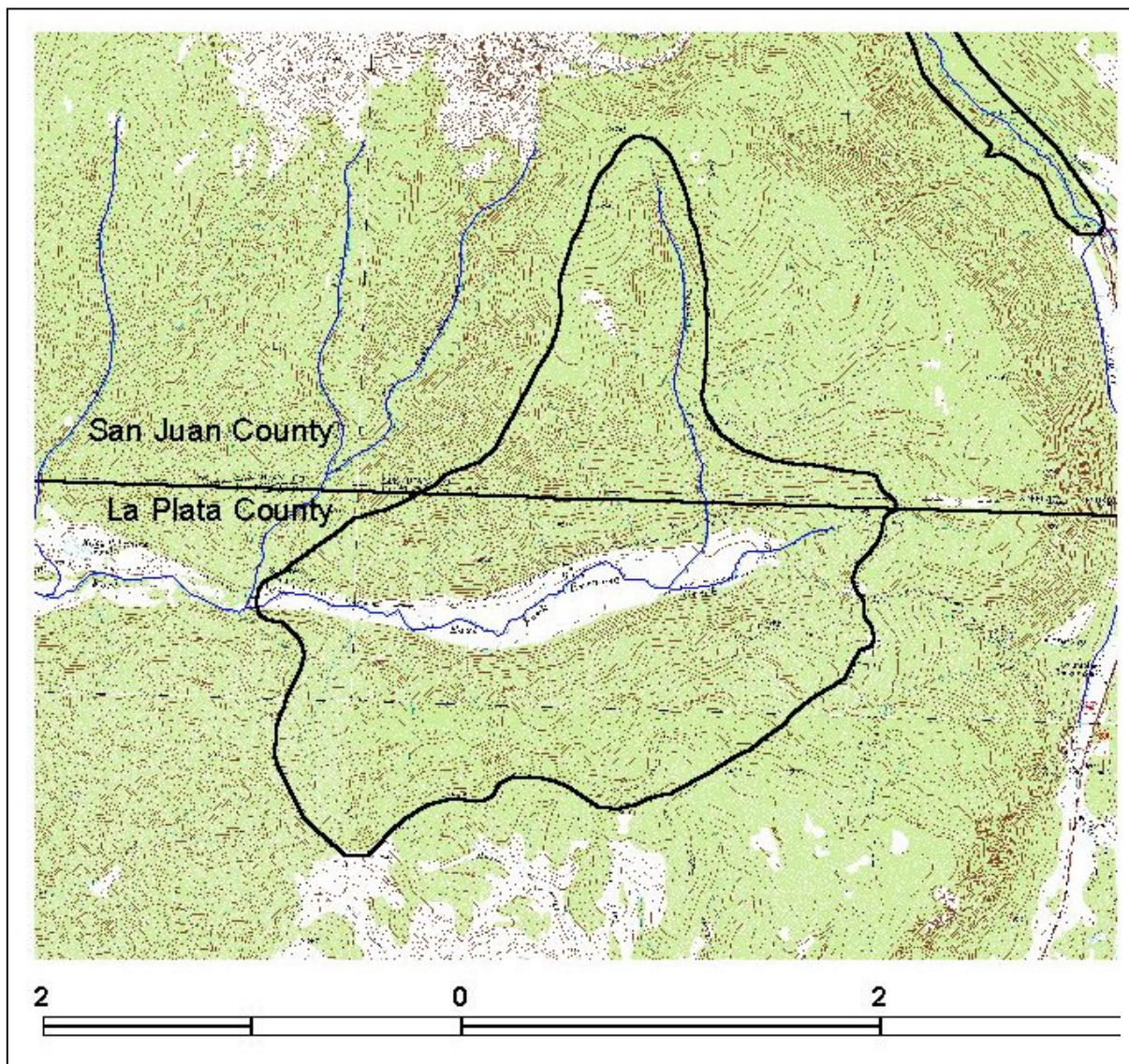
Biodiversity comments: The Crater Lake PCA contains a good (B ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) plant. It also supports an excellent (A ranked) occurrence of Altai cottongrass, a subspecies that is listed as sensitive by the U.S. Forest Service, and a good (B ranked) occurrence of mud sedge, a species that is globally secure (G5) but rare in Colorado (S2).

Boundary Justification: The boundary is drawn to include the three rare plant occurrences in the area and some surrounding area that provides the source of the groundwater that supports the wetland species. The area provides space to allow for natural processes such as pollination and seed dispersal that are essential to the long term viability of the plant populations.

Protection Rank Comments: The site is entirely within the San Juan National Forest, in the Weminuche Wilderness.

Management Rank Comments: Although there is heavy foot and horse traffic to Crater Lake, impacts were not excessive. No exotic species were noted.

East Fork Hermosa Creek Potential Conservation Area



Location in San Juan County

East Fork Hermosa Creek Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest. There is no special designation.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan and La Plata Counties. Forest Road 578 west from highway 550, along East Fork of Hermosa Creek

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain. Also includes Electra Lake, Hermosa Peak and Elk Creek in La Plata County. San Juan County: T39N R9W Sections 10, 14, 15, 16, 20-23, 27-29

Size: 924 acres

Elevation: 9,340 to 9,600 ft.

General Description: This PCA straddles the border of San Juan and La Plata counties. It includes the East Fork of Hermosa Creek from its headwaters near Durango Mountain Resort, to the confluence of Sig Creek. It also includes a major tributary, Pasture Creek that is primarily in San Juan County.

The cutthroat trout (*Onchorhynchus clarki pleuriticus*) population in this stream was introduced, and is genetically pure, according to biologists from the San Juan National Forest. The San Juan County portion of the PCA does not support trout because the stream is intermittent in the upper reaches. However, this upper portion of the watershed is critical for maintaining the habitat for the fish downstream.

Natural Heritage element occurrences at the East Fork Hermosa Creek PCA (La Plata County only)

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Onchorhynchus clarki pleuriticus</i>	Colorado river cutthroat trout	G4T3	S3	BLM SENS.	E

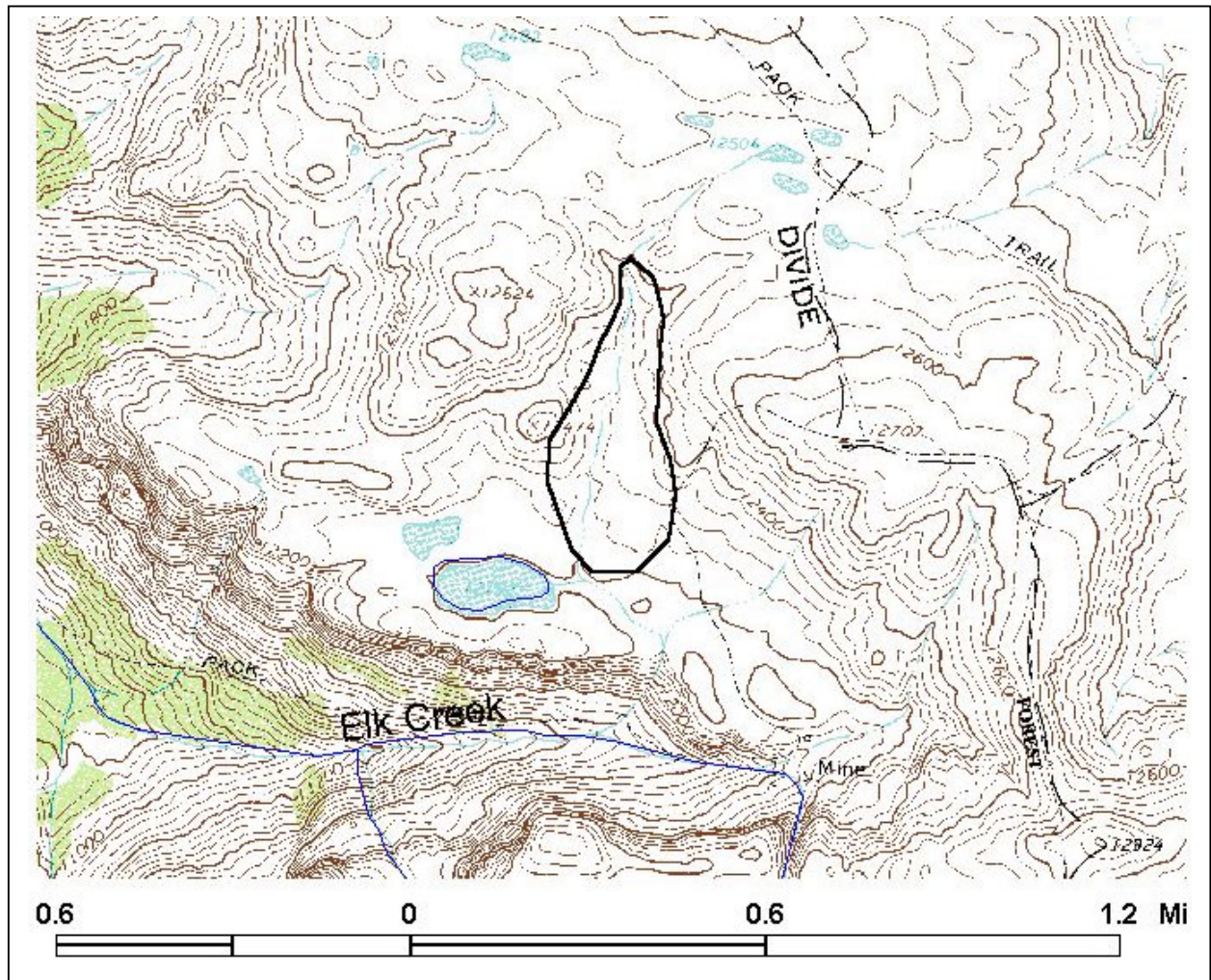
Biodiversity comments: The East Fork Hermosa Creek PCA (in La Plata County) supports an unranked (E) population of Colorado River cutthroat trout, a subspecies that is globally vulnerable (G4T3).

Boundary Justification: The planning boundary includes the entire stretch of stream and all of its major tributaries above a waterfall that protects the trout from competition and hybridization with non-native trout. A 1000 foot buffer and waters upstream are incorporated in the PCA because of their potential to alter the hydrology of the stream.

Protection Rank Comments: The site is entirely on U.S. Forest Service land.

Management Rank Comments: Management may be needed within 5 years to maintain the current quality of the element occurrence. Recreational use is light and cattle grazing is excluded from the area. Road building and camping are causing minor siltation. Hydrological processes originating outside of the planning boundary, including water quality, quantity, timing and flow must be managed to maintain the viability of this site.

Elk Creek Headwaters Potential Conservation Area



Carex vernacula



Location in San Juan County

Elk Creek Headwaters Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is entirely within the San Juan National Forest. There is no special designation.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Weminuche Wilderness, about 8.5 air miles southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Storm King Peak. T40N R6W Sections 17 and 20

Size: 45 acres

Elevation: 12,200 ft. to 12,400 ft.

General Description: This PCA is located near the Continental Divide, and is accessible by foot or horseback from the Elk Creek trail. It includes a cluster of ponds in an area of rolling tundra and rock outcrops. The site sits on the hard, basement gneisses characteristic of the sharp jagged Precambrian uplifts, with volcanic tuff adjacent. The stream that becomes Elk Creek flows through a small valley with patches of willows (*Salix* spp.) and krumholtz (bent and flagged conifers stunted by the harsh conditions at tree line). Soils in the wetland are mapped as typic cryaquents-cryaquolls-cryofibril complex, 0 to 5 percent slopes, described as deep, poorly drained soils on flood plains, valley bottoms and depressions, formed in alluvium derived from mixed sources (USDA 2003).

Natural Heritage element occurrences at the Elk Creek Headwaters PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Carex vernacula</i>	Alpine wetlands	GU	SU		B

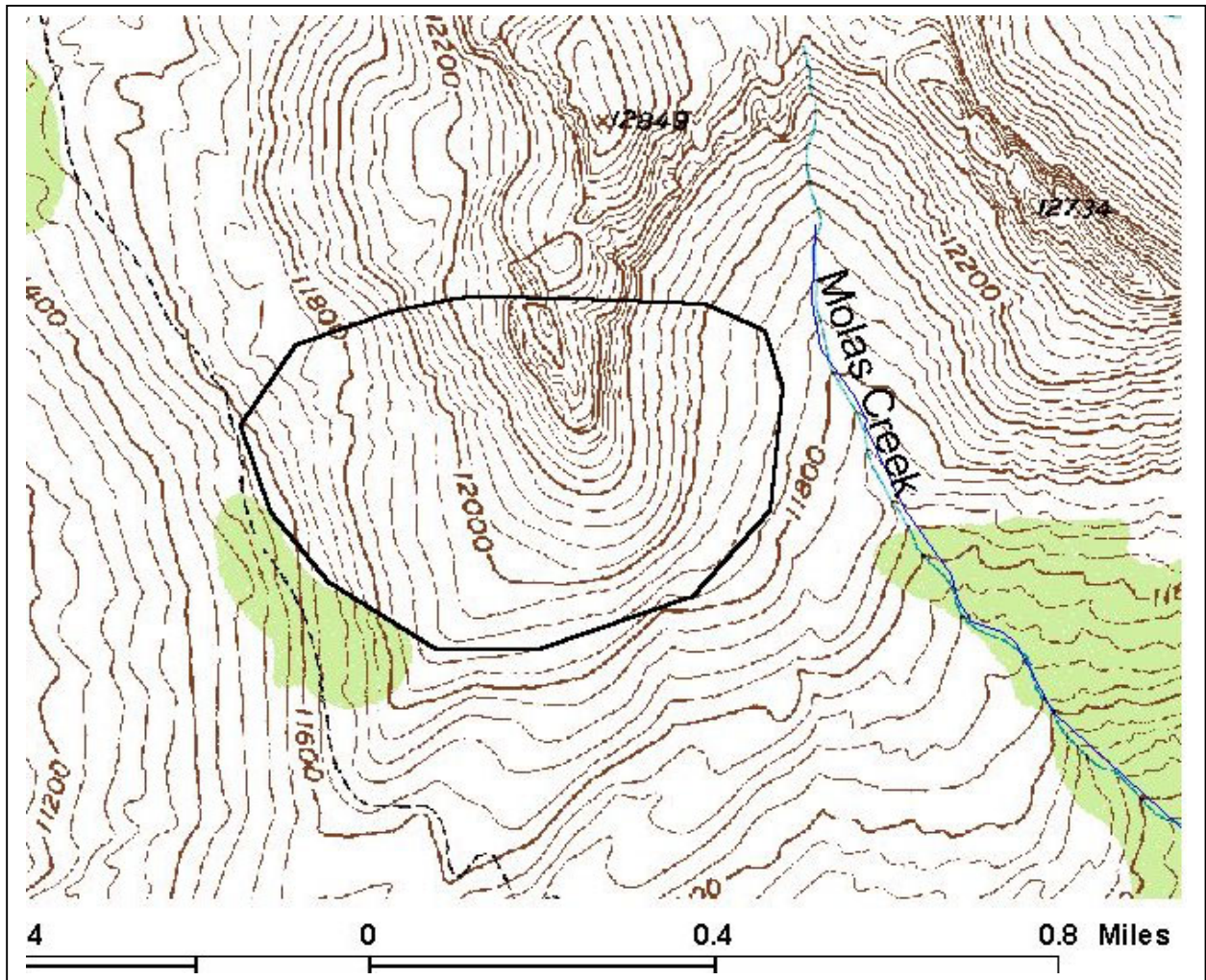
Biodiversity comments: This PCA supports a good (B ranked) occurrence of alpine wetlands (*Carex vernacula*), a plant community for which more information is needed before a rank can be assigned. The community has been documented only five times, all in Colorado. However, more research may prove it to be more common and widespread than is now known.

Boundary Justification: The boundary is drawn to include the occurrence of *Carex vernacula* alpine wetlands, and a small buffer upslope and upstream that includes areas that provide the moisture to sustain this community.

Protection Rank Comments: The site is entirely within the Weminuche Wilderness of the San Juan National Forest.

Management Rank Comments: No management needs are known. Effects of domestic sheep grazing and recreational uses may require monitoring.

Grand Turk South Potential Conservation Area



South slopes of Grand Turk, with limestone ledges, seen from Molas Pass



Location in San Juan County

Grand Turk South Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance

Protection Urgency Rank: P4 No threat is known for the foreseeable future. The site is entirely within the San Juan National Forest. There is no special designation.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, west of Molas Pass, about four air miles southwest of Silverton

Legal Description: U.S.G.S. 7.5 minute quadrangle: Silverton. T40N R8W Sections 2 and 11; T41N R8W Section 35.

Size: 128 acres

Elevation: 11,600 ft. to 12,600 ft.

General Description: This PCA is located on the south slopes of Grand Turk Mountain, one of the San Juan mountains characterized by rock talus fields and rock glaciers. The mountains in this area are mostly carved from a thick volcanic pile or tuff – a brittle metamorphic rock composed of volcanic ash and debris. Grand Turk is capped by the San Juan Formation, sitting atop the Telluride Peneplain and the red Permian Cutler formation near the base – indicators that the mountain was part of the uplifted San Juan Dome, covered in volcanic pile, and then carved by erosion in late Cretaceous and early Tertiary time (Blair 1996). Outcrops of conglomerate rocks (Figure 69) characterize the site of the rare plants in the PCA.

Soils in steeper areas of the PCA are mapped as Whitecross-Rock outcrop complex, 45 to 75 percent slopes. These are a complex of shallow or very shallow, well drained soils and rock outcrop on alpine valley floors, mountain slopes and ridges. They are formed in colluvium and slope alluvium derived from rhyolite, tuff and other volcanic rocks, and in some places from granite, quartzite and similar rocks. More gentle slopes are mapped as Moran very gravelly loam, 10 to 30 percent slopes, a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite (USDA 2003).

The site is characterized by alpine tundra vegetation below the barren rock cliffs that form the top of the mountain. Near the top of this area, the largest known population of Colorado tansy-aster (*Machaeranthera coloradoensis*) in San Juan County grows at the edges of isolated rock outcrops, while Colorado Divide whitlow-grass (*Draba streptobrachia*) was found in crevices of these rocks. Parry's clover (*Trifolium parryi*) dominates the upper slopes. Lower on the same slope, kittentails (*Besseyia ritteriana*) is

abundant on the south facing hillsides with other alpine species such as alpine avens (*Geum rossii*), alpine timothy (*Phleum commutatum*), arctic bluegrass (*Poa arctica*), false strawberry (*Sibbaldia procumbens*), strawberry (*Fragaria virginiana*) and orange sneezeweed (*Dugaldia hoopsii*). There are also several large patches of grassland dominated by blackroot sedge (*Carex elynoides*).

Natural Heritage element occurrences at the Grand Turk South PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Machaeranthera coloradoensis</i>	Colorado tansy-aster	G2	S2	S-FS	B
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		A
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		D

Biodiversity comments: The PCA is drawn to include two rare plants, a good (B ranked) population of Colorado tansy-aster, a globally imperiled (G2) species; and an excellent (A ranked) occurrence of kittentails, a globally vulnerable (G3) plant. It also includes a poor (D ranked) population of Colorado Divide whitlow-grass, a globally vulnerable (G3) plant found in the rock outcrops along with the Colorado tansy-aster.

Boundary Justification: The boundary is drawn to include the occurrences of Colorado tansy-aster and kittentails, two plants that share the ecological requirements of moisture and sun. It encompasses an area that will allow for natural processes such as pollination and seed dispersal that are essential to the long term viability of the plant populations.

Protection Rank Comments: This site is within the San Juan National Forest.

Management Rank Comments: The PCA is away from the usually traveled hiking trails, so does not receive much human impact. Sheep grazing may affect the vegetation composition.

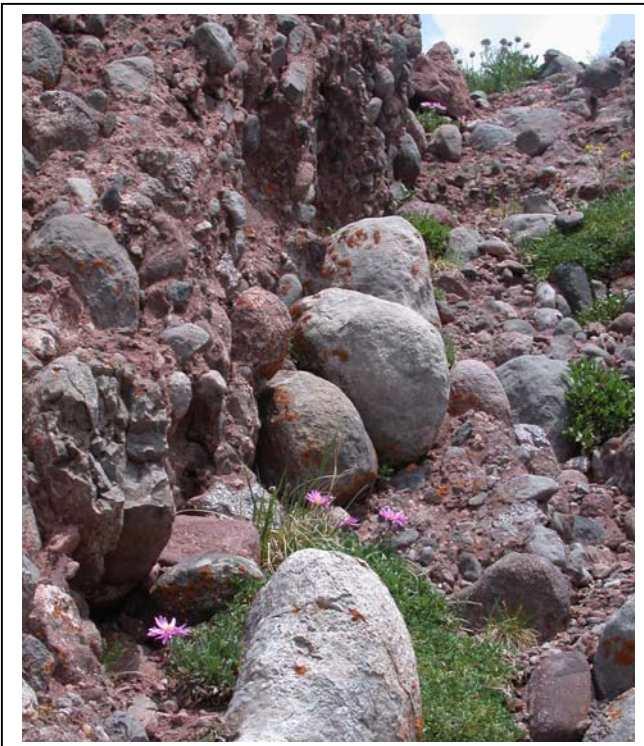
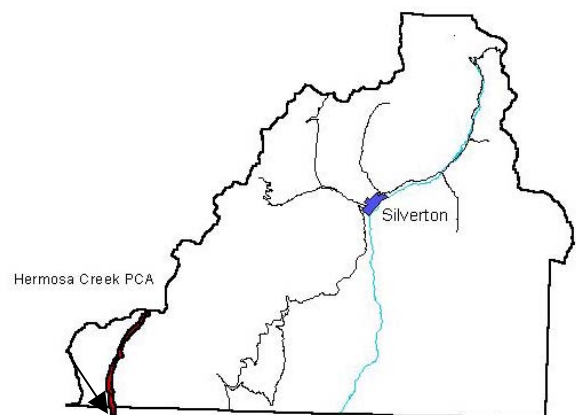
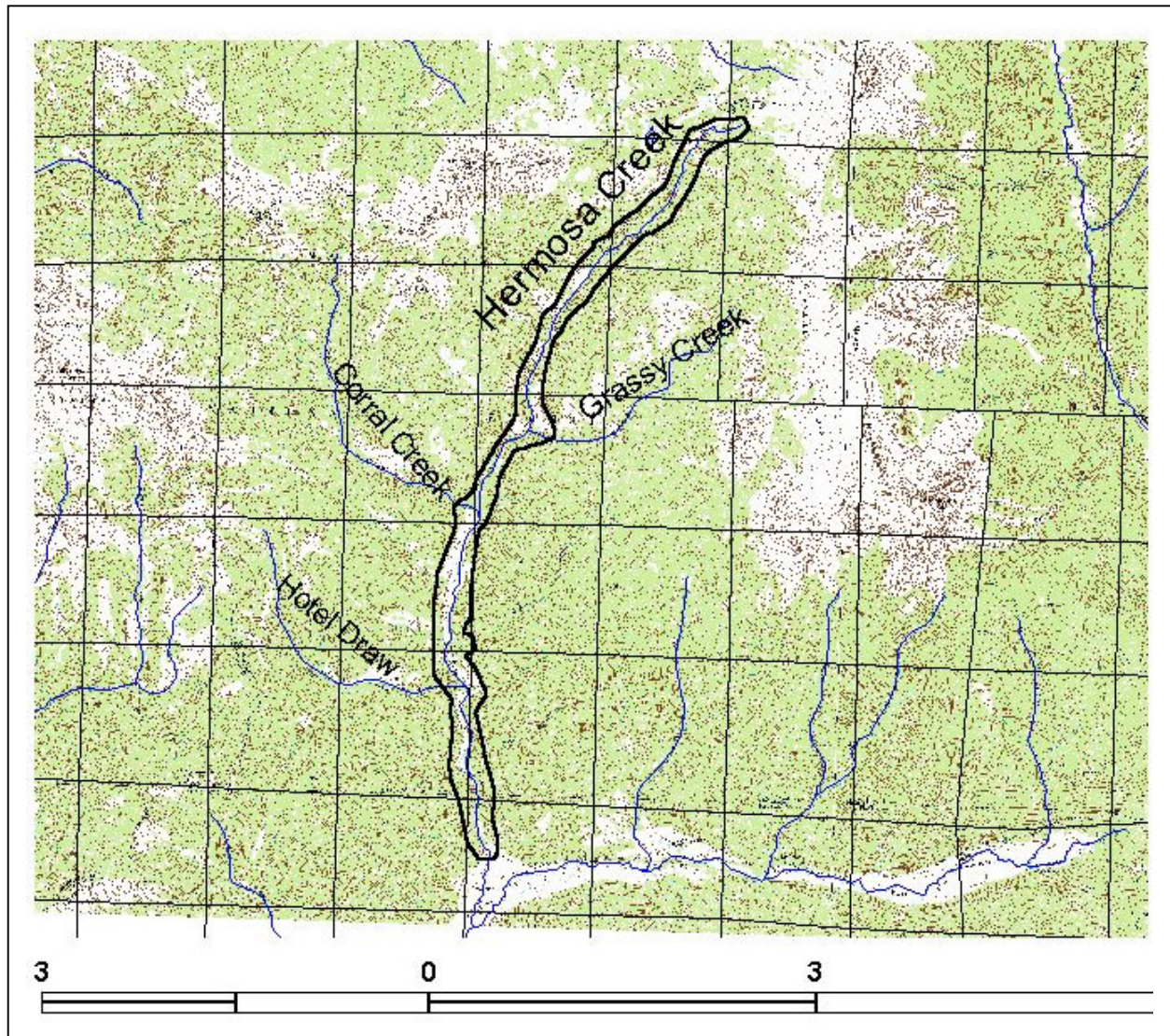


Figure 68. *Machaeranthera coloradoensis*, above. Figure 69. Habitat, with conglomerates at Grand Turk, left.

Hermosa Creek Potential Conservation Area



Location in San Juan County

Hermosa Creek Potential Conservation Area

Biodiversity Rank: B3. High Biodiversity Significance. The site is drawn for a good occurrence of a globally vulnerable montane riparian forest.

Protection Urgency rank: P3. Protection actions may be needed, but probably not within the next 5 years. It is estimated that stresses may reduce the viability of the elements within the site if protection action is not taken. The Potential Conservation Area is located on USFS land with private in-holdings. There is currently no special protection for the area.

Management Urgency rank: M3. New management actions may be needed within five years to maintain the current quality of the riparian wetland. Dispersed campsites are located throughout the floodplain and have the potential to negatively impact the riparian vegetation. There are several active mining claims located at the headwaters. If developed, these claims could also have a deleterious effect on the occurrence.

Location: San Juan and La Plata counties, about seven miles west of Durango Mountain Resort

Legal Description: U.S.G.S. 7.5 minute quadrangle: Hermosa Peak. T40N R9W Sections 19, 20, 30; T40N R10W Sections 25, 36; T39N R10W Sections 1, 2, 11, 13, 14, 23, 24

Size: Approximately 60 acres

Elevation: 8,900 ft. to 11,400 ft.

General Description: The Hermosa Creek PCA is located in a scenic, riparian corridor in southern San Juan County. The narrow valley flows through Precambrian rock between the Rico Mountains to the west and Graysill and Engineer Mountains to the east. Hermosa Creek headwaters start at the boundary of Dolores and San Juan counties near Bolam Pass. The creek is fed by several tributaries that include Hotel Draw, Grassy, Corral, Black and Petty Creeks.

Soils of the PCA are a complex of deep and shallow well drained soils derived from redbed sandstone and shale and rhyolite. They are mapped as Haviland-Needleton complex, 30 to 60 percent slopes; Graysill-Scotch complex, 30 to 60 percent slopes; and Hourglass-Wander complex, 5 to 30 percent slopes (USDA 2003).

Vegetation in the riparian corridor is dominated by blue spruce (*Picea pungens*) with thinleaf alder (*Alnus incana*), Drummond's willow (*Salix drummondiana*), and Rocky Mountain willow (*Salix monticola*). Other common species in the riparian zone include elderberry (*Sambucus racemosa*), meadowrue (*Thalictrum fendleri*), chokecherry (*Prunus virginiana*) and Richardson's geranium (*Geranium richardsonii*). Many springs feed the creek in the upper sections, and support small, mossy wetlands. The drier slopes are dominated by Engelmann spruce (*Picea engelmannii*). The Graysill Mine is located near the headwaters but is currently inactive and serves as a historic landmark.

Natural Heritage element occurrences at the Hermosa Creek PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Picea pungens</i> / <i>Alnus incana</i>	Montane forests	G3	S3		B

Biodiversity comments: The Hermosa Creek PCA supports a good (B ranked) occurrence of montane forests dominated by blue spruce and thinleaf alder. This plant community is considered globally vulnerable (G3).

Boundary Justification: The boundary is drawn to include the Hermosa Creek floodplain from its headwaters near Bolam Pass to Hermosa Park. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain a healthy montane forest community. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Any upstream activities such as water diversions, impoundments, and mining development could potentially be detrimental to the riparian forest. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Rank Comments: Protection actions may be needed, but probably not within the next 5 years. The PCA is located on the San Juan National Forest, with private in-holdings. There is currently no special protection for the area.

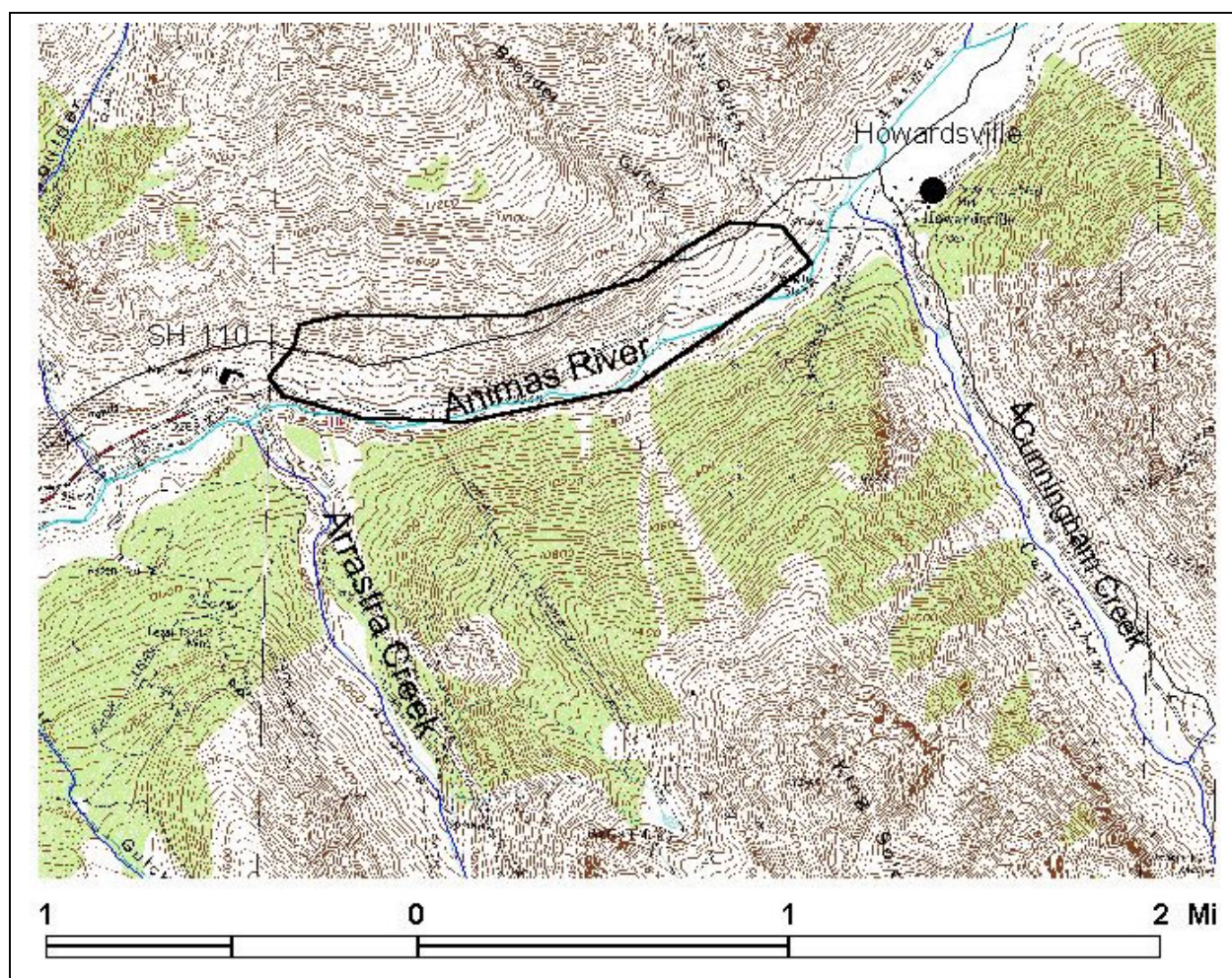
Management Rank Comments: Dispersed campsites are located throughout the floodplain. There are several active mining claims located at the headwaters. These activities have the potential to have negative effects on the riparian plant community. This is the only part of San Juan County where cattle grazing was observed, and it has altered some areas, particularly in the southern part of the PCA. Non-native plants observed include Canada thistle (*Cirsium arvense*), common dandelion (*Taraxacum officinale*) and meadow timothy (*Phleum pratense*).

Wetland Soils Description: Soils are rocky, derived from alluvial outwash. Texture is sandy with large gravel.

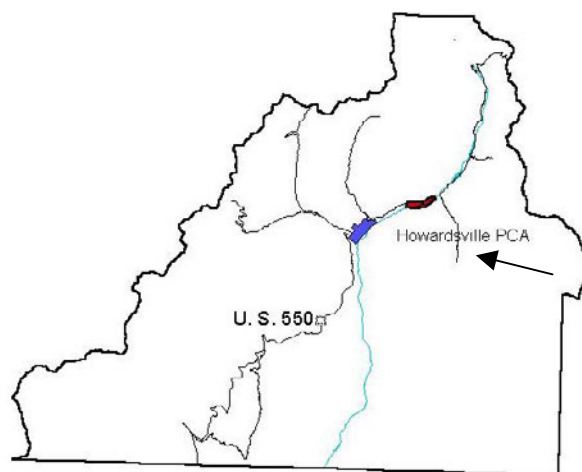
Wetland Functional Assessment for the Hermosa Creek PCA

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	High	The wetland is large > 20 acres, vegetation is dense, presence of microtopography, presence of ponds, sloughs, and pools, low to moderate gradient
Sediment/Shoreline Stabilization	High	Hermosa Creek is moderately vegetated with shrubs and herbaceous species, some evidence of bank erosion due to recreational and grazing activity
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan Mountains, and therefore is naturally acidic; however because of current and past mining activities the acidity has probably increased due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	Moderate	Wetland does not contain peaty soils, high flushing due to flooding.
Biological Functions		
Habitat Diversity	Moderate	Wetland supports 2 Cowardin Classes
General Wildlife Habitat	High	Deer and elk sign
General Fish/Aquatic Habitat	High	Native and non-native fish observed.
Production Export/Food Chain Support	High	Wetland receives flushing of organic material, nutrients, supports overhanging vegetation, outlet for flushing flows.
Uniqueness	Moderate	Wetland type is common, but the plant community is globally rare.

Howardsville Potential Conservation Area



Parry oatgrass (*Danthonia parryi*) grassland at Howardsville



Location in San Juan County

Howardsville Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, Alpine Loop, Highway 110, north side of Animas River west of Howardsville, about two miles east of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Howardsville. T41N R7W Sections 2, 10, 11

Size: 230 acres

Elevation: 9,500 to 12,000 ft.

General Description: This PCA represents the only example of Parry oatgrass (*Danthonia parryi*) grassland found in San Juan County. The site is on a south facing slope above the Animas River. These natural openings surrounded by aspen forest are in excellent condition, and could provide a good reference area for revegetation of reclamation areas at this elevation.

Soils are deep and well drained, derived from volcanic rocks. They are mapped as Quazar very cobbly loam 5 to 25 percent slopes and Howardsville gravelly loam 1 to 6 percent slopes (USDA 2003).

Other plants found in the site include Thurber fescue (*Festuca thurberi*), which is the dominant grass at slightly higher elevations, and wooly cinquefoil (*Potentilla hippiana*). Parry oatgrass represents 80 to 90% of the vegetative cover. Several patches, separated by aspens, cover about 24 acres.

Natural Heritage element occurrences at the Howardsville PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Danthonia parryi</i>	Montane grasslands	G3	S3		B

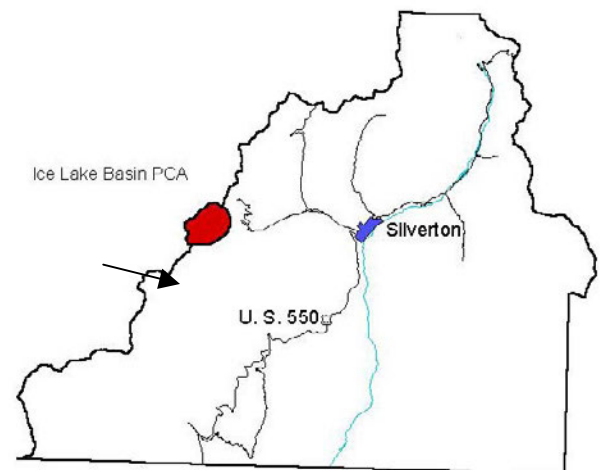
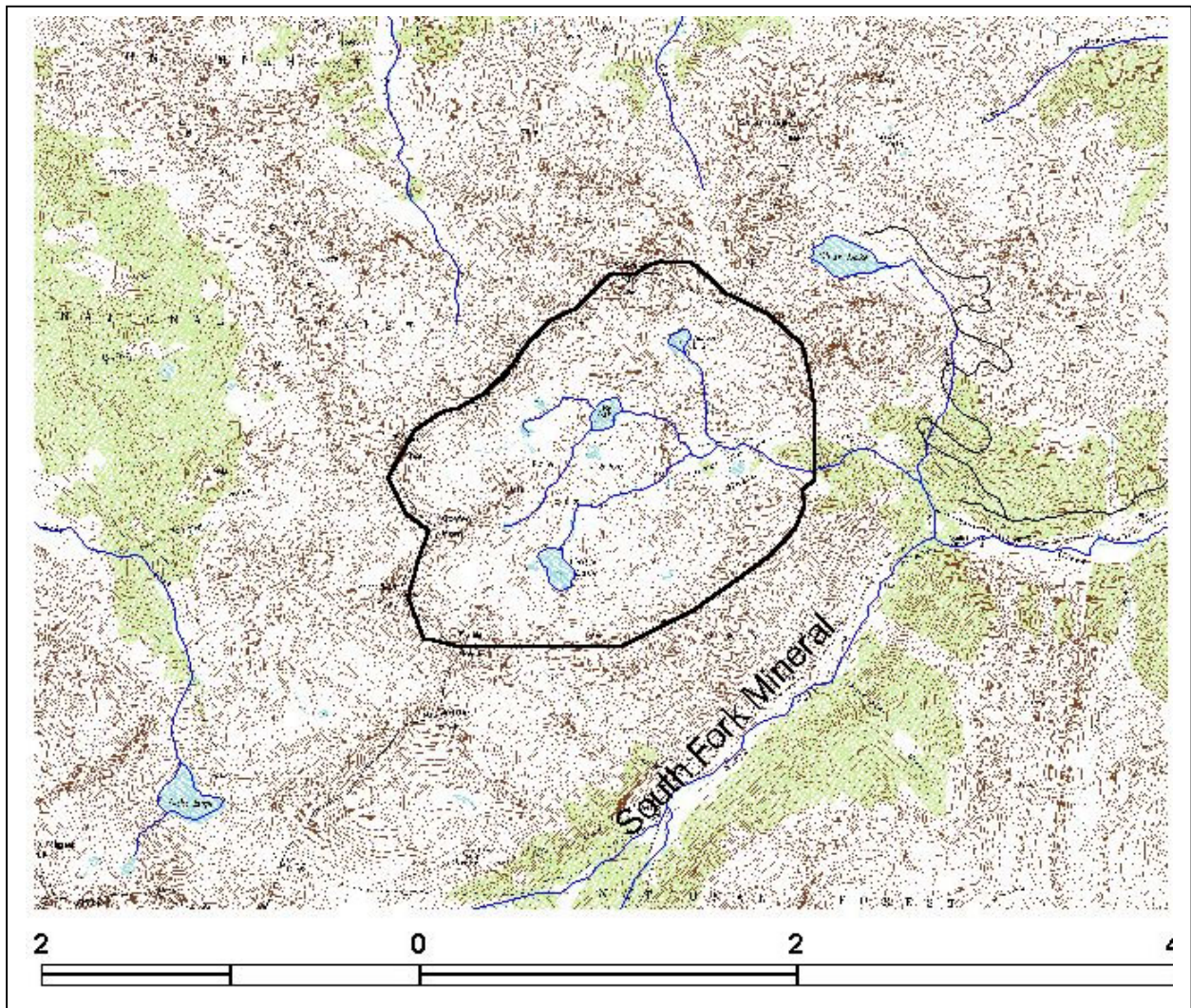
Biodiversity comments: The Howardsville PCA supports a good (B ranked) occurrence of *Danthonia parryi* montane grasslands, a globally vulnerable (G3) community.

Boundary Justification: The boundary is drawn to encompass five sub-populations of montane grassland that are separated by aspen forest, and includes a small area upslope that contributes to the moisture needed by the grassland.

Protection Rank Comments: The PCA includes both BLM land and private mining claims. The site is adjacent to reclamation areas and is visible from Highway 110.

Management Rank Comments: Oxeye daisy (*Leucanthemum vulgare*) grows along the highway at these sites, and could invade the grassland.

Ice Lake Basin Potential Conservation Area



Location in San Juan County

Ice Lake Basin Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, South Mineral Creek drainage, about 7 air miles west of Silverton.

Legal Description: U.S.G.S. quadrangle: Ophir. T41N R8W Sections 7, 18, 19; T41N R9W Sections 12-14, 23, 24

Size: 1,986 acres

Elevation: 11,080 ft. to 13,767 ft.

General Description: This PCA is one of the most popular hiking destinations in San Juan County. It includes two large basins (Upper and Lower) rimmed by high peaks on the north, east and west. The highest of these is Vermillion Peak (13,884 ft), followed by U. S. Grant Peak (13,767 ft.), Fuller Peak (13,761 ft.), and Pilot Knob (13,738 ft.). On the northeast, a high ridge separates this basin from Clear Lake. Several small lakes are found within the PCA, of which Ice Lake is the largest.

The Lower Ice Lake Basin supports a large wetland dominated by cornhusk lily (*Veratrum tenuipetalum*). It has a rich diversity of typical wetland species, including chiming bells (*Mertensia ciliata*), larkspur (*Delphinium barbeyi*), monkshood (*Aconitum columbianum*), marsh marigold (*Caltha leptosepala*), osha (*Ligusticum porteri*), arrowleaf ragwort (*Senecio triangularis*), bittercress (*Cardamine cordifolia*), tufted hairgrass (*Deschampsia cespitosa*), planeleaf willow (*Salix planifolia*) and shortfruit willow (*Salix brachycarpa*). Some small Engelmann spruces (*Picea engelmannii*) surround the picturesque lake, while tall rocky cliffs stand at the head of the basin. On the south facing slope above the lower basin, kittentails (*Besseya ritteriana*) is abundant, with thousands of plants extending from the wetland to the base of the cliffs.

From here a fairly steep trail leads to the upper basin, with several small lakes. Vegetation of the Upper Basin is a mosaic of several distinct plant communities. Streamside vegetation is represented by the alpine wetland community dominated by bittercress and chiming bells. Low lying level areas with poor drainage support wet meadows dominated by marsh marigold. Somewhat better drained areas are dominated by native sedge (*Carex vernacula*). Dry tundra supports a community of alpine avens (*Geum rossii*) or snow willow (*Salix reticulata* ssp. *nivalis*). Several areas, including

Fuller Lake, were surveyed for the Uncompahgre fritillary butterfly (*Boloria improba acrocnema*), which feeds on snow willow, but were not found to be suitable habitat.

Soils in the PCA are shallow and well drained, mixed with rock outcrops. They are derived from volcanic rocks, and mapped as Telluride-Rock outcrop complex (USDA 2003).

To the west of Ice Lake, next to the stream that feeds the lake, is a rock outcrop that supports a large population of San Juan whitlow-grass (*Draba graminea*). This shaded area retains snow late in the year, providing the moisture needed by the plants. The tiny yellow plants can be found in gravelly areas at the foot of the outcrop, and in crevices of the rock. The population continues to the north where the plants grow in gravelly soil at the base of a large talus slope, along with alpine spring beauty (*Claytonia megarhiza*). Associated species in the San Juan whitlow-grass' habitat include subalpine bluegrass, Oregon saxifrage, ebony sedge, blackhead fleabane, buttercup, podistera and true saxifrage (*Poa alpina*, *Draba crassifolia*, *Micranthes oregana*, *Carex ebenea*, *Erigeron melanocephalus*, *Ranunculus macauleyi*, *Podistera eastwoodiae*, and *Saxifraga cernua*). Other common species in the area are alpine avens, snow willow, paintbrush (*Castilleja sulphurea*), golden saxifrage (*Hirculus platysepalus*), pygmy gentian (*Chondrophylla prostrata*), and rose crown (*Sedum rhodanthum*).

Natural Heritage element occurrences at the Ice Lake Basin PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		A
<i>Besseyia ritleriana</i>	Kittentails	G3	S3		A
<i>Cardamine cordifolia</i> - <i>Mertensia ciliata</i> - <i>Senecio triangularis</i>	Alpine wetlands	G4	S4		A
<i>Caltha leptosepala</i>	Montane wet meadows	G4	S4		A
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	A
<i>Carex vernacula</i>	Alpine wetlands	GU	SU		A

Biodiversity comments: The Ice Lake Basin PCA supports an excellent (A ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) plant. It also includes excellent (A ranked) occurrences of kittentails, a globally vulnerable (G3) plant, and Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*), a subspecies that is listed as sensitive by the U.S. Forest Service. In addition, there are excellent (A ranked) occurrences of three wetland plant communities: Alpine wetlands dominated by bittercress and chiming bells; montane wet meadows dominated by marsh marigold; and alpine wetlands dominated by mud sedge.

Boundary Justification: The boundary is drawn to include the slopes above the basin to the top of the ridges and surrounding peaks, which provide the snow required for the survival of all of these species and communities. It is drawn to include both the upper and lower basins. The PCA incorporates an area that will allow for natural processes such as pollination and seed dispersal to maintain the rare plant populations.

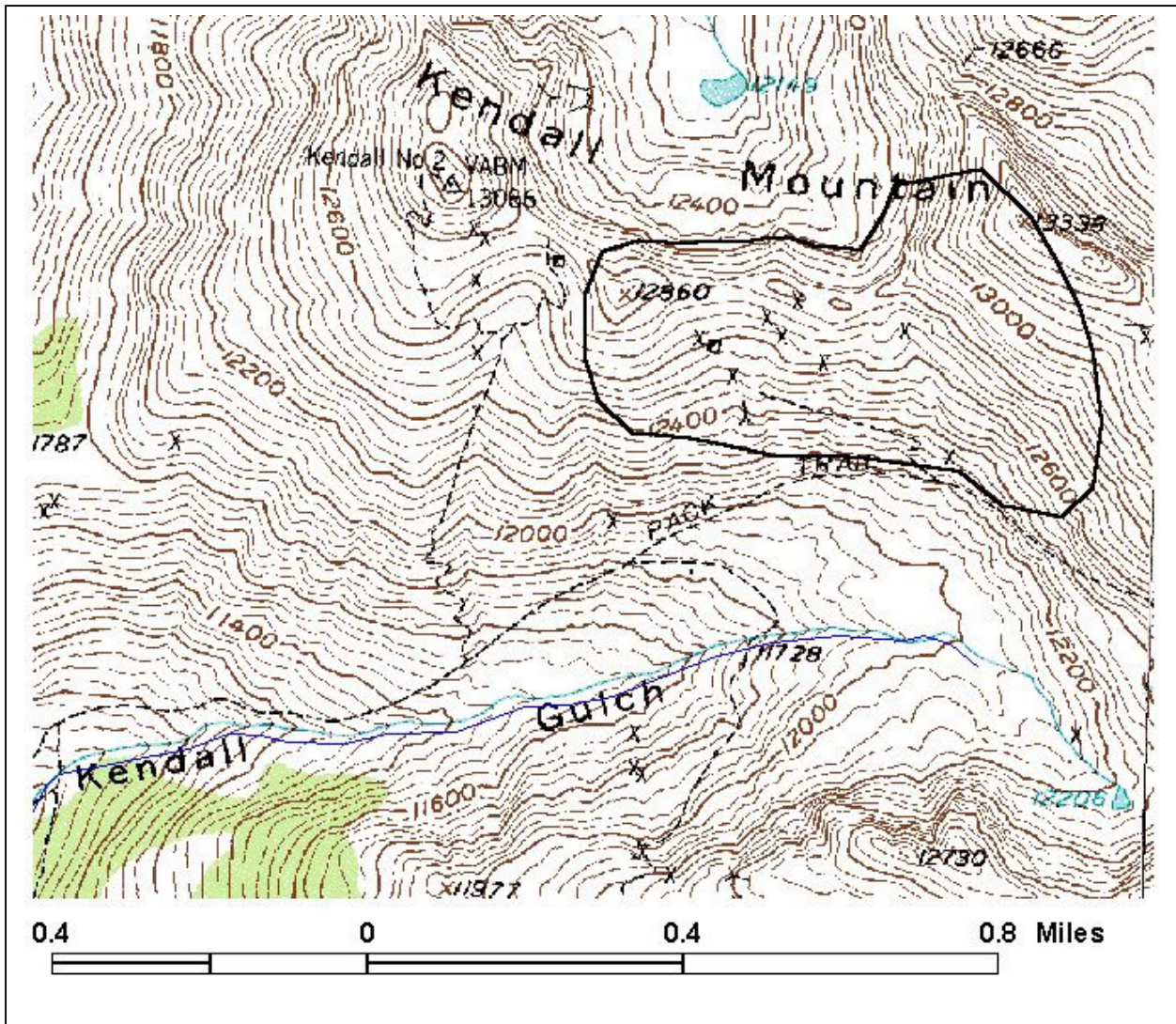
Protection Rank Comments: The site is within the San Juan National Forest, and includes several mining claims.

Management Rank Comments: Foot travel is heavy on the trails leading to the upper basin, but off trail use appears to be minimal. No exotic species were observed in the PCA.



Figures 70 and 71. Alpine meadows at Ice Lake Basin

Kendall Mountain Potential Conservation Area



View southwest from Kendall Mountain



Location in San Juan County

Kendall Mountain Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, San Juan County Road 23, about two air miles southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Silverton. T41N R7W Sections 21, 22, 27

Size: 121 acres

Elevation: 12,200 ft. to 13,338 ft.

General Description: This PCA is located on the southeast flank of Kendall Mountain, a popular 4-wheel drive and snowmobile destination. Kendall Mountain is carved from ash flow tuff and andesitic lava, adjacent to the Silverton caldera. Several mines are scattered through the area, with many old mining roads and debris.

Soils in the PCA are mapped as Moran very gravelly loam, 30 to 65 percent slopes, a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite; and Whitecross-Rock outcrop complex, 45 to 75 percent slopes. This soil map unit is described as a complex of shallow or very shallow, well drained soils and rock outcrop on alpine valley floors, mountain slopes and ridges, formed in colluvium and slope alluvium derived from rhyolite, tuff and other volcanic rocks, and in some places from granite, quartzite and similar rocks (USDA 2003).

Vegetation is alpine, with a good diversity of species, including orange sneezeweed (*Dugaldia hoopsii*), alpine sagebrush (*Artemisia scopulorum*), king's crown (*Rhodiola integrifolia*), paintbrush (*Castilleja rhexifolia*), yarrow (*Achillea lanulosa*), Whipple's penstemon (*Penstemon whippleanus*), Oregon saxifrage (*Micranthes oregana*), old-man-of-the-mountain (*Rydbergia grandiflora*), golden saxifrage (*Hirculus platysepalus*), arctic bluegrass (*Poa arctica*), sky pilot (*Polemonium viscosum*), blackroot sedge (*Carex elynoides*), two species of cinquefoil (*Potentilla pulcherrima* and *P. diversifolia*), dwarf clover (*Trifolium nanum*), alpine sandwort (*Lidia obtusiloba*), alpine speedwell (*Veronica nutans*), American bistort (*Bistorta bistortoides*), and ebony sedge (*Carex ebenea*). The lower south-facing meadows of the PCA are home to a good population of kittentails (*Besseyia ritteriana*), while Harbour beardtongue (*Penstemon harbourii*) was found growing in the talus, particularly in areas where old roads have

cleared the larger rocks and exposed more soil. The lower elevations of the mountain, outside the PCA boundaries, have mixed aspen and spruce forest, with openings of Thurber fescue (*Festuca thurburi*) meadows. The alpine areas were grazed by domestic sheep, and some erosion from sheep trails was evident.

Natural Heritage element occurrences at the Kendall Mountain PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		B
<i>Penstemon harbourii</i>	Harbour beardtongue	G3G4	S3S4		B

Biodiversity comments: The Kendall Mountain PCA supports a good (B ranked) occurrence of kittentails, a globally vulnerable (G3) plant; and a good (B ranked) occurrence of Harbour beardtongue, also considered to be globally vulnerable, but watchlisted in Colorado. Both species are endemic to the San Juan Mountains.

Boundary Justification: The boundary is drawn to encompass the occurrences of Harbour beardtongue and kittentails, and includes the south facing slope to the ridge above, which provides the moisture needed for these species. It encompasses an area large enough to allow for natural processes such as pollination and seed dispersal.

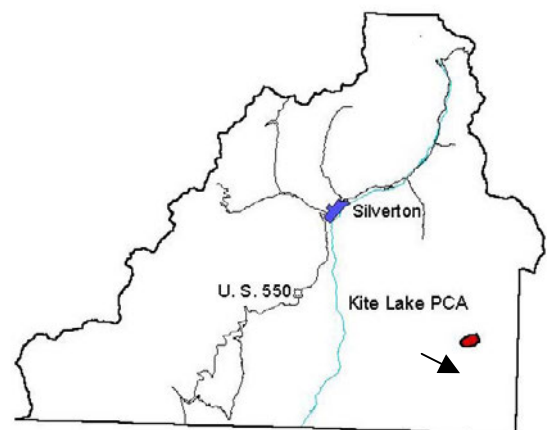
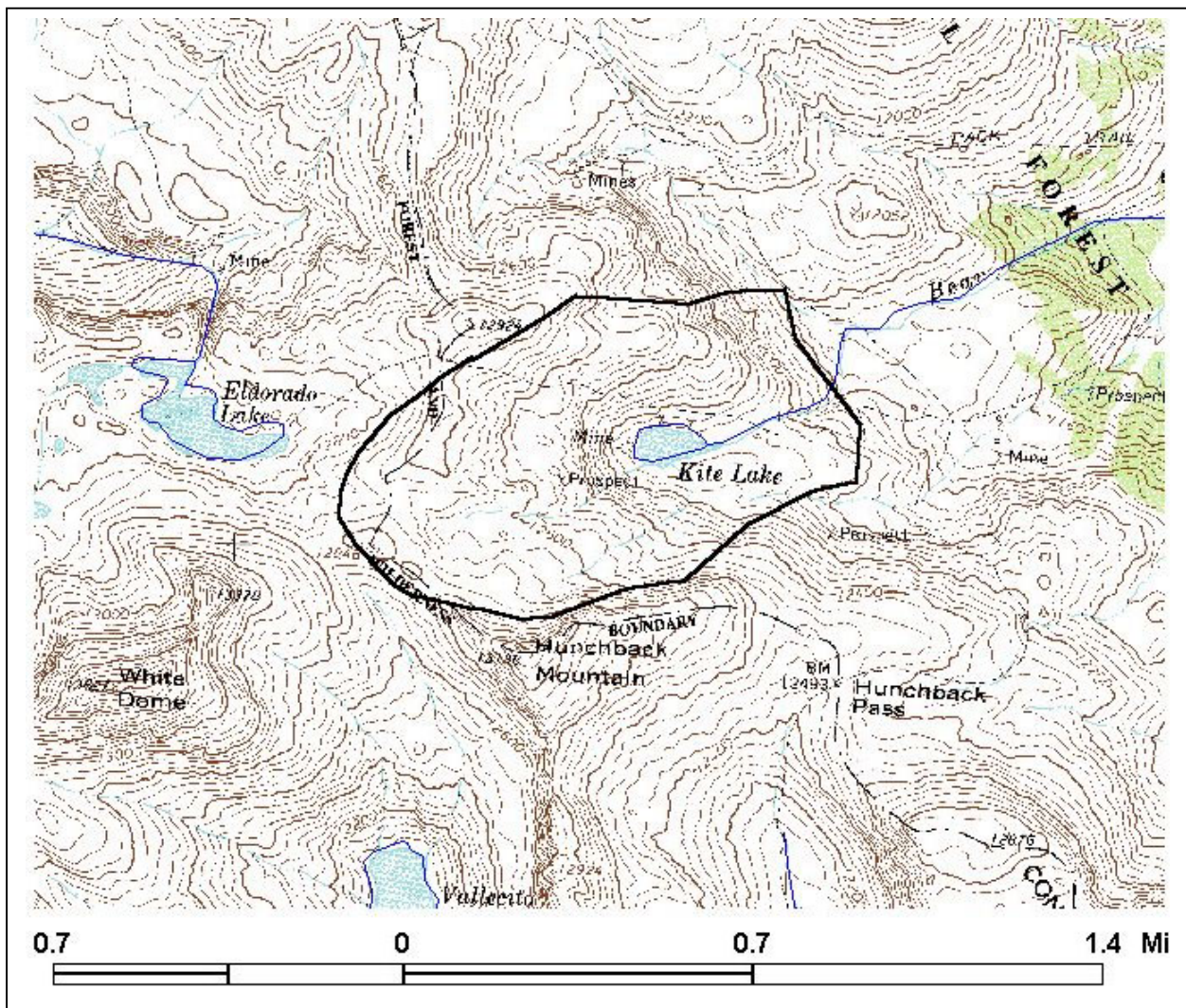
Protection Rank Comments: The PCA is comprised of BLM land and private mining claims.

Management Rank Comments: Sheep grazing has caused some erosion, and probably some changes in plant species composition, although this could not be documented. The access road to the site, County Road 23, has yellow toadflax growing along it near the bottom, and a patch of Canada thistle about halfway up.



Figure 72. Habitat of *Besseyia ritteriana*, Kendall Mountain.

Kite Lake Potential Conservation Area



Location in San Juan County

Kite Lake Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Rio Grande drainage, about 10 air miles southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Storm King Peak. T40N R6W Section 21, 22, 27, 28

Size: 272 acres

Elevation: 11,800 ft. to 12,800 ft.

General Description: The Kite Lake PCA is a natural alpine lake, with unusual geological surroundings. Located in the far eastern part of San Juan County, it falls into the Rio Grande drainage, on the east side of the Continental Divide. The lake is nearly surrounded by spectacular mountains composed of Precambrian rocks of the Uncompahgre Formation, containing pink quartzite. A small cabin sits at the edge of the lake, at the end of the county road. Colorado Divide whitlow-grass (*Draba streptobrachia*) was found in rock crevices near the lake and adjacent to the trail over the Continental Divide. Small depressional wetlands above the lake support good populations of Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*), along with water sedge (*Carex aquatilis*) and marsh marigold (*Caltha leptosepala*).

Natural Heritage element occurrences at the Kite Lake PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		C
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		C
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	A

Biodiversity comments: The Kite Lake PCA supports a fair (C ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) species. It also includes a fair (C ranked) occurrence of Colorado Divide whitlow-grass, another globally vulnerable (G3) species and an excellent (A ranked) occurrence of of Altai cottongrass, a subspecies that is listed as sensitive by the U.S. Forest Service.

Boundary Justification: The boundary is drawn to encompass occurrences of the two *Draba* species, which share similar habitat requirements in the rocky outcrops above Kite Lake and Eldorado Lake. Wetlands that support Altai cottongrass occur in a mosaic with the rocky areas, and are included in the site.

Protection Rank Comments: The site is primarily Rio Grande National Forest Land, with some private mining claims. A small part of the site west of the Continental Divide falls within the Weminuche Wilderness.

Management Rank Comments: No management needs were noted. The area is accessed by a very rough 4-wheel drive road, which limits the amount of human traffic.

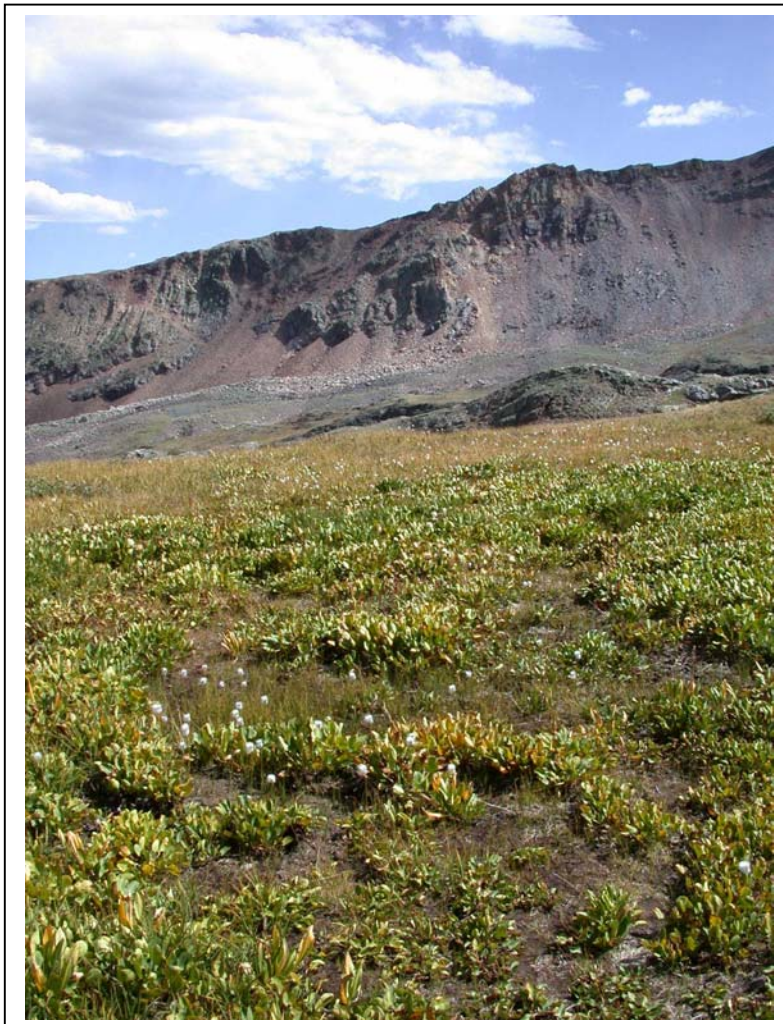
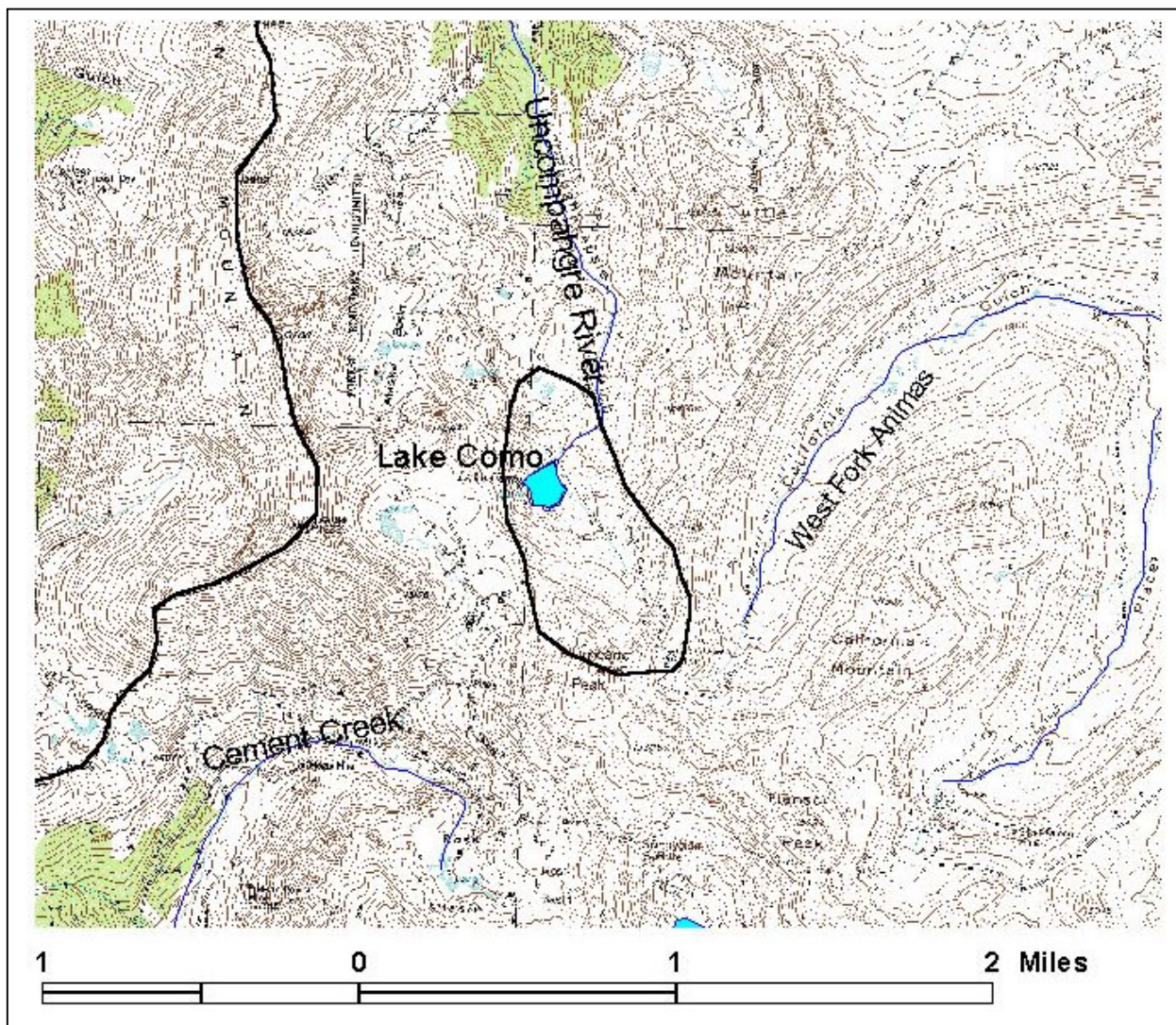


Figure 73. Habitat of *Eriophorum altaicum* var. *neogaeum* above Kite Lake.

Lake Como Potential Conservation Area



Location in San Juan County

Lake Como Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, Alpine Loop, Uncompahgre River drainage, about seven air miles north-northeast of Silverton

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak, Ironton. T43N R7W Sections 3, 10

Size: 232 acres

Elevation: 12,000 ft. to 13,447 ft.

General Description: Lake Como is a beautiful, bright turquoise jewel of a lake, at the headwaters of the north-flowing Uncompahgre River. The PCA is in the northern portion of the Silverton caldera, composed of andesitic lavas and ashflows from the Tertiary volcanic period. Soils in the PCA are mapped as Whitecross-Rock outcrop complex, 15 to 45 percent slopes. This is a complex of shallow or very shallow, well drained soils and rock outcrop on alpine valley floors, mountain slopes and ridges, formed in colluvium and slope alluvium derived from rhyolite, tuff and other volcanic rocks, and in some places from granite, quartzite and similar rocks (USDA 2003).

The lake is a popular stop for 4-wheel drive sightseers. Hurricane Peak, at 13,447 ft. marks the southwest boundary of the PCA, while California Pass marks the southeastern boundary.

Below California Pass, at the base of a rock glacier, late melting snowbanks support a large population of San Juan whitlow-grass (*Draba graminea*). Associated plant species here include moss campion (*Silene acaulis*), Fremont ragwort (*Senecio fremontii*), Holm's ragwort (*Ligularia holmii*), Colorado ragwort (*Ligularia soldanella*), and alpine spring beauty (*Claytonia megarhiza*). A second population of San Juan whitlow-grass was found north of Lake Como, in exposed north-facing rocks, again in an area where snow persists late in the season. Small rock outcrops near Lake Como are home to Colorado Divide whitlow-grass (*Draba streptobrachia*) in rock crevices. Talus slopes at California Pass support Harbour beardtongue (*Penstemon harbourii*), a San Juan endemic plant.

Natural Heritage element occurrences at the Lake Como PCA

Scientific Name	Common name	Global rank	State rank	State/ Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		A
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		C
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3		C
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		C
<i>Penstemon harbourii</i>	Harbour beardtongue	G3G4	S3S4		C

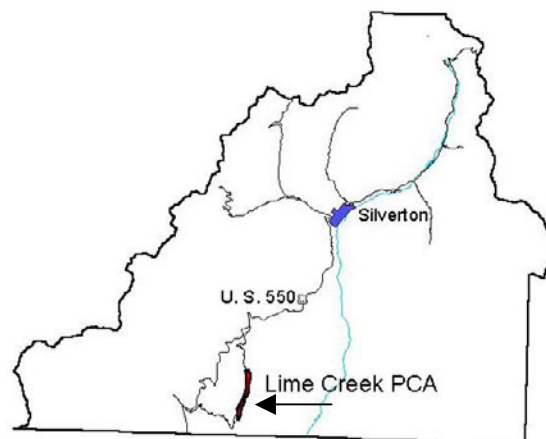
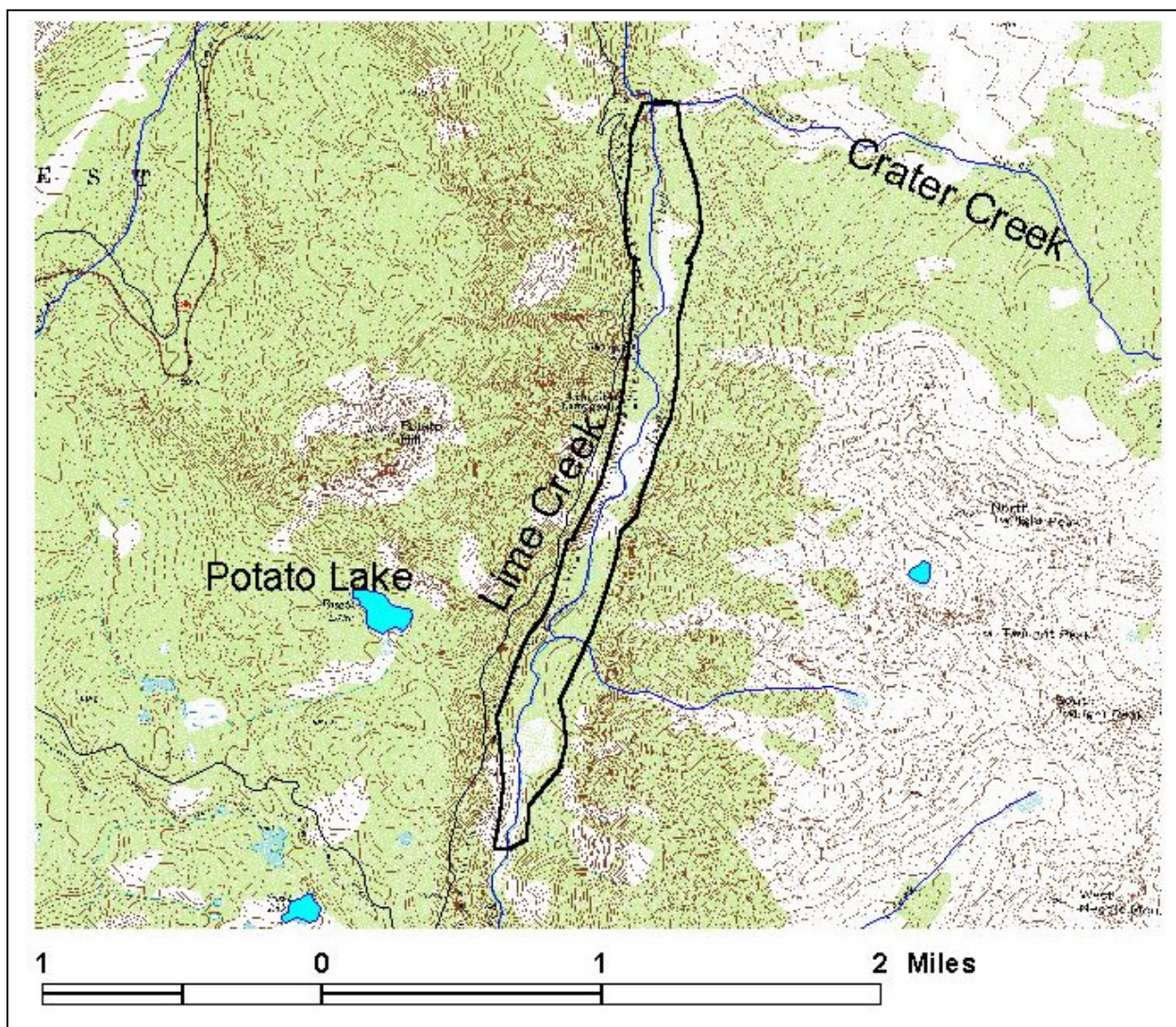
Biodiversity comments: The Lake Como PCA supports an excellent (A ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) species. It also has fair (C ranked) occurrences of three *Draba* species (*D. graminea*, *D. crassa* (globally vulnerable – G3) and *D. streptobrachia* (globally vulnerable – G3). There is a fair (C ranked) occurrence of globally vulnerable (G3) Harbour beardtongue, a San Juan endemic plant that is considered to be secure in Colorado (S3S4).

Boundary Justification: The boundary is drawn to encompass the occurrences of San Juan whitlow-grass (*Draba graminea*), a plant that requires cool areas with late melting snow. These occurrences are interspersed with areas that support two other *Draba* species, growing in crevices and on ledges of rock outcrops.

Protection Rank Comments: The site is about evenly divided between BLM land and private mining claims. There is no special protection.

Management Rank Comments: Heavy 4-wheel drive traffic has impacted the area around Lake Como. So far, no exotic species have been noted, but continued monitoring is recommended.

Lime Creek Potential Conservation Area



Location in San Juan County

Lime Creek Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The PCA is entirely within the San Juan National Forest.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, County Road 1, about 9 air miles south-southwest of Silverton

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain and Snowdon Peak. T39N R8W Section 4, 9, 16; T40N R8W Section 33

Size: 324 acres

Elevation: 8,920 ft. to 9,400 ft.

General Description: The Lime Creek PCA encompasses a three mile stretch of Lime Creek in the area of Lime Creek Campground, which contains high quality riparian communities. Lime Creek is a major drainage of San Juan County, originating in the high mountains of the county, near Twin Sisters (West Lime Creek) and Molas Pass (East Lime Creek), and flowing south to its confluence with Cascade Creek at Purgatory Flats.

At the upstream end of this PCA, beginning about 1.3 miles north of the campground, narrowleaf cottonwood (*Populus angustifolia*) and Engelmann spruce (*Picea engelmannii*) occupy the flood plain, while Rocky Mountain willow (*Salix monticola*) and Drummond's willow (*Salix drummondiana*) line the river bank. The forested area supports a lush understory of shrubs and forbs, with a deep mulch of litter. The only weedy species seen were small amounts of Kentucky bluegrass (*Poa pratensis*) and common dandelion (*Taraxacum officinale*). Understory species include starry false solomonseal, larkspur, monkshood, orange sneezeweed, thinleaf alder, cow parsnip, willow herb, fireweed, ragwort, ticklegrass, tufted hairgrass, Parry's thistle, valerian, two species of strawberry, geranium, lousewort, baneberry, fragrant bedstraw, sweet cicely, goldenrod, chainpod, thimbleberry, choke cherry, and red raspberry (*Maianthemum stellatum*, *Delphinium barbeyi*, *Aconitum columbianum*, *Dugaldia hoopsii*, *Alnus incana*, *Heracleum lanatum*, *Epilobium angustifolium*, *Chamerion subdentatum*, *Senecio atrata*, *Agrostis scabra*, *Deschampsia cespitosa*, *Cirsium parryi*, *Valeriana edulis*, *Fragaria virginiana*, *F. vesca*, *Geranium richardsonii*, *Pedicularis procera*, *Actaea rubra*, *Galium triflorum*, *Osmorhiza depauperata*, *Solidago simplex*, *Hedysarum occidentale*, *Rubacer parviflorum*, *Prunus virginiana*, and *Rubus idaeus*). This community extends downstream for about two miles, to about 0.7 miles south of the campground. In areas where the flood plain widens, large willow carrs of Rocky Mountain willow and Drummond willow are interspersed with the forest.

Natural Heritage element occurrences at the Lime Creek PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Salix monticola</i> /Mesic forb	Rocky Mountain willow/Mesic forb	G3	S3		B
<i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> - <i>Populus angustifolia</i> / <i>Lonicera involucrata</i>	Montane riparian forest	G4	S3		A
<i>Populus angustifolia</i> / <i>Salix (monticola, drummondiana)</i> woodland	Narrowleaf cottonwood/Mixed willows montane riparian forests	G4	S4		A

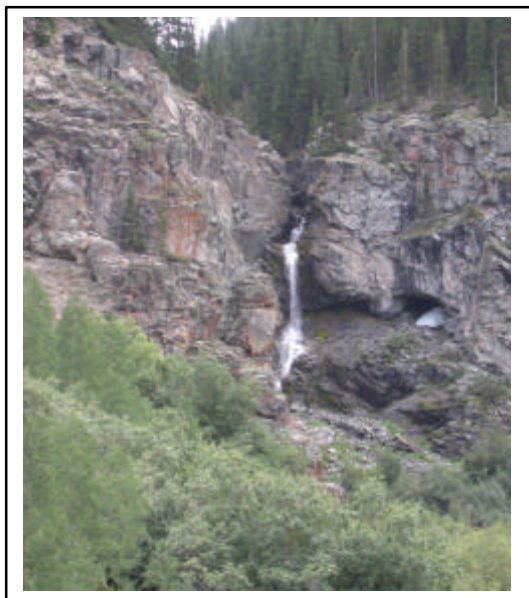
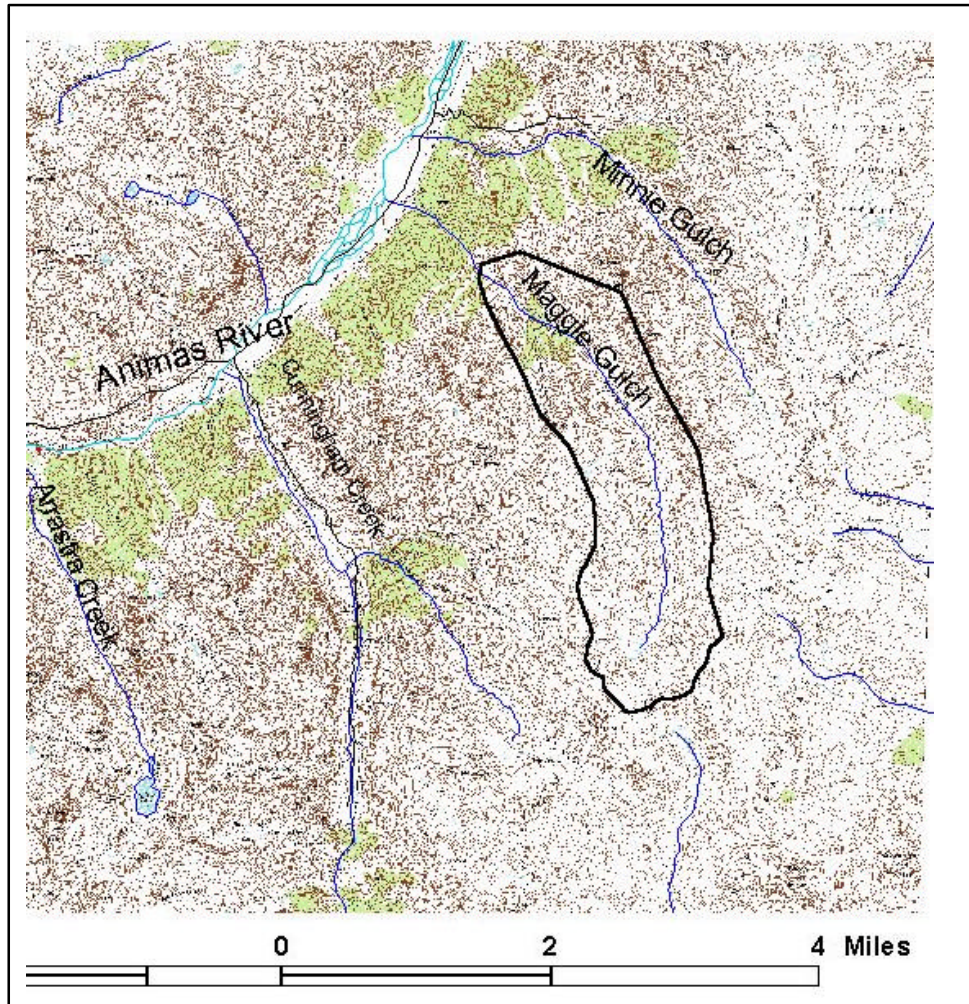
Biodiversity comments: The Lime Creek PCA supports a good (B ranked) occurrence of a Rocky Mountain willow community, considered vulnerable globally and in Colorado (G3S3); and excellent (A ranked) occurrences of two riparian forest communities that are globally secure (G4). The montane riparian forest is considered vulnerable (S3) in Colorado.

Boundary Justification: The boundary is drawn to include two adjacent montane riparian forest communities. It extends upslope a short distance to include uplands that are critical to water supply and quality.

Protection Rank Comments: The PCA is entirely within the San Juan National Forest.

Management Rank Comments: Oxeye daisy (*Leucanthemum vulgare*) and yellow toadflax (*Linaria vulgaris*) are present on the roadsides in the area of the PCA, and even more abundant farther downstream. Within the PCA, weed control is needed for oxeye daisy (*Leucanthemum vulgare*), yellow sweet clover (*Melilotus officinalis*) and Canada thistle (*Cirsium arvense*) to sustain the high quality of this area. Maintenance of the county road that is adjacent to the river could cause siltation.

Maggie Gulch Potential Conservation Area



Waterfall at Maggie Gulch, home of Black Swifts and thick-leaf whitlow-grass



Location in San Juan County

Maggie Gulch Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, Alpine Loop, County Road 23, about six air miles east of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Howardsville. T41N R6W Sections 4-6, 9, 21; T42N R6W Section 32.

Size: 1,946 acres

Elevation: 10,200 ft. to 12,843 ft.

General Description: Maggie Gulch is a major tributary of the Animas River, originating at the Continental Divide, and passing through a series of different habitats as it progresses downstream. A county road follows the gulch to a mine, and from there a hiking trail continues up across the divide to Stony Pass.

The PCA is in the eastern portion of the Silverton Caldera, composed of andesitic lavas and ashflows from the Tertiary volcanic period. Soils vary from shallow to very deep and are well drained, derived from volcanic rocks. They have been mapped as Telluride-Rock outcrop complex, 45 to 75 percent slopes; Quazar-Varden complex, 15 to 65 percent slopes; Moran very gravelly loam, 10 to 30 percent slopes; and Needleton-Snowdon complex, 30 to 80 percent slopes.

The landscape is typical of several of the drainages in the area. At the head of the gulch, steep walls surround a large glacial cirque with ponds and wetlands; then the drainage narrows to a steep sided canyon. At the highest elevations, dry, rocky tundra harbors a good population of Colorado Divide whitlow-grass (*Draba streptobrachia*), growing in rock crevices and ledges. Other species here include blackroot sedge, false strawberry, American bistort, cinquefoil, sky pilot, and snow willow (*Carex elynoides*, *Sibbaldia procumbens*, *Bistorta bistortoides*, *Potentilla subjuga*, *Polemonium viscosum* and *Salix reticulata* ssp. *nivalis*). Below this is a large wetland dominated by water sedge (*Carex aquatilis*), with alpine bistort, marsh marigold, reedgrass, rose crown, alpine speedwell, gray sedge, black sedge, bentgrass, paintbrush, elephant head, brook saxifrage, alpine timothy and fringed gentian (*Bistorta vivipara*, *Caltha leptosepala*, *Calamagrostis canadensis*, *Sedum rhodanthum*, *Veronica nutans*, *Carex canescens*, *Carex nova*, *Agrostis thurberi*, *Castilleja sulphurea*, *Pedicularis groenlandica*, *Micranthes odontoloma*, *Phleum commutatum*, and *Gentianopsis thermalis*). As the land

slopes downward from the level wetland, alpine meadows have a high diversity of plant species, including showy whitlow-grass, tufted hairgrass, hairy arnica (dominant in large areas), shortfruit willow, alpine avens, small-winged sedge, alpine timothy, orange sneezeweed, larkspur, reedgrass, king's crown, slender wheatgrass, cinquefoil, planeleaf willow, two species of fleabane, fireweed, rockcress, nodding ragwort, and wild candytuft (*Draba spectabilis* var. *oxyloba*, *Deschampsia cespitosa*, *Arnica mollis*, *Salix brachycarpa*, *Geum rossii*, *Carex microptera*, *Phleum commutatum*, *Dugaldia hoopsii*, *Delphinium barbeyi*, *Calamagrostis canadensis*, *Rhodiola integrifolia*, *Elymus trachycaulus*, *Potentilla pulcherrima*, *Salix planifolia*, *Erigeron coulteri*, *Erigeron elatior*, *Chamerion subdentatum*, *Arabis lemonii*, *Ligularia bigelovii*, and *Noccaea montana*). Where the canyon narrows, steep talus slopes support Harbour beardtongue (*Penstemon harbourii*), a San Juan endemic that grows in the barren rock. In less recently disturbed areas with soil, Thurber fescue grassland (*Festuca thurberi*) dominates. The lower part of the PCA contains dense spruce-fir forests. Here, two smaller streams tumble down in waterfalls that provide a nesting site for Black Swifts (*Cypseloides niger*), and rock crevices for rare plants. Some extensive active beaver ponds are found in the stream at this elevation. All of these varied habitats depend on the processes of snowfall and erosion that occur on the upper slopes.

Natural Heritage element occurrences at the Maggie Gulch PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		A
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		B
<i>Draba crassa</i>	Thick leaf whitlow-grass	G3	S3		C
<i>Penstemon harbourii</i>	Harbour beardtongue	G3G4	S3S4		C
<i>Cypseloides niger</i>	Black Swift	G4	S3B		E
<i>Cypseloides niger</i>	Black Swift	G4	S3B		E

Biodiversity comments: The Maggie Gulch PCA supports a variety of rare elements, including an excellent (A ranked) occurrence of showy whitlow-grass, a globally vulnerable subspecies (G3?T3Q), and a good (B ranked) occurrence of Colorado Divide whitlow-grass, a globally vulnerable (G3) species. There are also fair (C ranked) occurrences of two globally vulnerable (G3) plants, thick leaf whitlow-grass (*Draba crassa*) and Harbour beardtongue. Black Swifts, a species vulnerable in Colorado (S3B), were nesting behind two waterfalls in the PCA (Schultz 2002). These occurrences are unranked.

Boundary Justification: The boundary is drawn to include all of the element occurrences in Maggie Gulch. Areas between occurrences are included to provide habitat for pollinators and movement of plant populations over time. The boundary follows the Continental Divide at the upper end of the gulch. These varied species and habitats are united by their dependence on the hydrological and erosional processes that occur in the entire gulch. The PCA does not contain the entire foraging area of the Black Swifts.

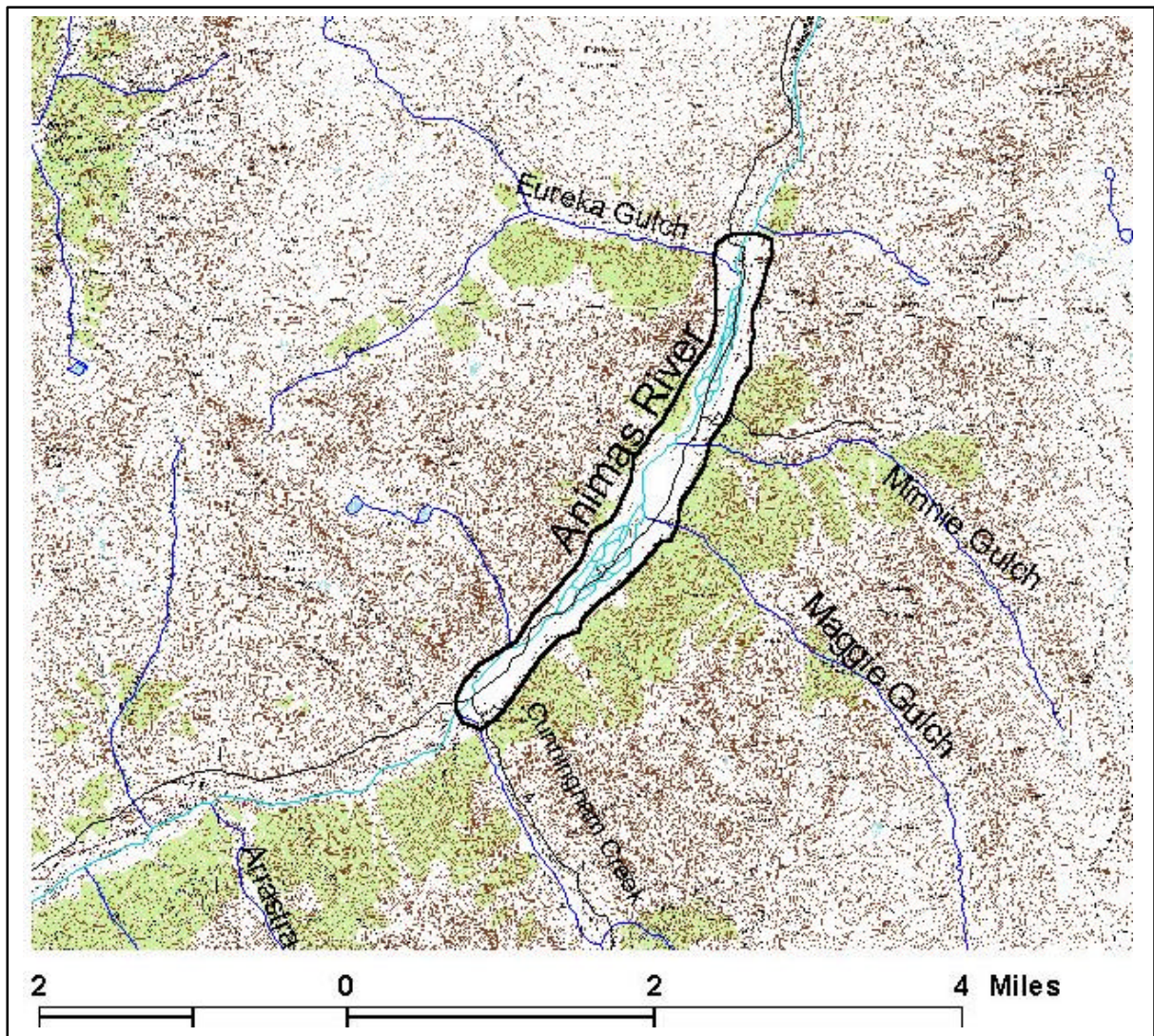
Protection Rank Comments: Ownership is a combination of BLM land and private mining claims. There is no special protection in place.

Management Rank Comments: Some erosion from sheep trailing was noted. Monitoring the effects of sheep grazing would help to determine if management action is necessary.



Figure 74. Alpine tundra and talus at head of Maggie Gulch near Continental Divide.

Middleton Potential Conservation Area



Location in San Juan County

Middleton Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P2 Protection actions may be needed within 5 years. Easements or agreements among diverse landowners will be necessary to facilitate remediation at this site.

Management Urgency Rank: M2 New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.

Location: San Juan County, Alpine Loop, about three miles northeast of Silverton, between Howardsville and Eureka.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Howardsville. T41N R7W S1; T42N R7W S 36; T42N R6W S19, 30, 31

Size: 746 acres

Elevation: 9644 ft. to 10,000 ft.

General Description: This two-mile section of the Animas River has been significantly altered by mining activities, dredging, and road construction. There are many springs in the area. Vegetated areas have peaty soils, and there is evidence of beaver activity. The stream bed is braided, and there are large gravel deposits from mine tailings that have been washed downstream. South of Maggie Gulch, willows have successfully established on the gravels where beavers have dammed the stream. According to local residents, the site was dry before the beavers were present (Simon 2003).

Soils in the southern part of the PCA are mapped as cryaquolls-typic cryaquents complex, 1 to 5 percent slopes. These are very deep, poorly drained soils on floodplains and valley floors of major drainage ways, formed of alluvium derived from mixed sources. The upstream portion of the PCA is mapped as Howardsville gravelly loam, deep, well drained soil on alluvial fans and river terraces, derived from volcanic rocks.

At present the area has poor potential as wildlife habitat, although brook trout and kingfishers were observed. Water quality has improved since the closing of the Sunnyside Mine. However, this area is still a major contributor of acid and heavy metals in the Animas River. Much of the site is gravel, lacking in vegetation. Where the willow community occurs, is it composed of approximately 60% Drummond willow (*Salix drummondiana*), 30% Rocky Mountain willow (*Salix monticola*) and 20% planeleaf willow (*Salix planifolia*). Graminoids are represented by about 10% bluejoint (*Calamagrostis canadensis*), 5% tufted hairgrass (*Deschampsia cespitosa*), and 5% sedges (*Carex aquatilis* and *C. canescens*).

This site is a high priority for restoration. Major progress has already been made by the closing of the Sunnyside Mine and removal of tailings. Future measures to

improve water quality, fish habitat and aesthetics of the site may entail removing or capping contaminated gravels and/or re-channelization of the river. Revegetation of the flood plain will be an important part of improving this site (BLM 2000).

Natural Heritage element occurrences at the Middleton PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i> shrubland	Montane willow carrs	G3	S3		C
<i>Cypseloides niger</i>	Black Swift				E
<i>Cypseloides niger</i>	Black Swift				E

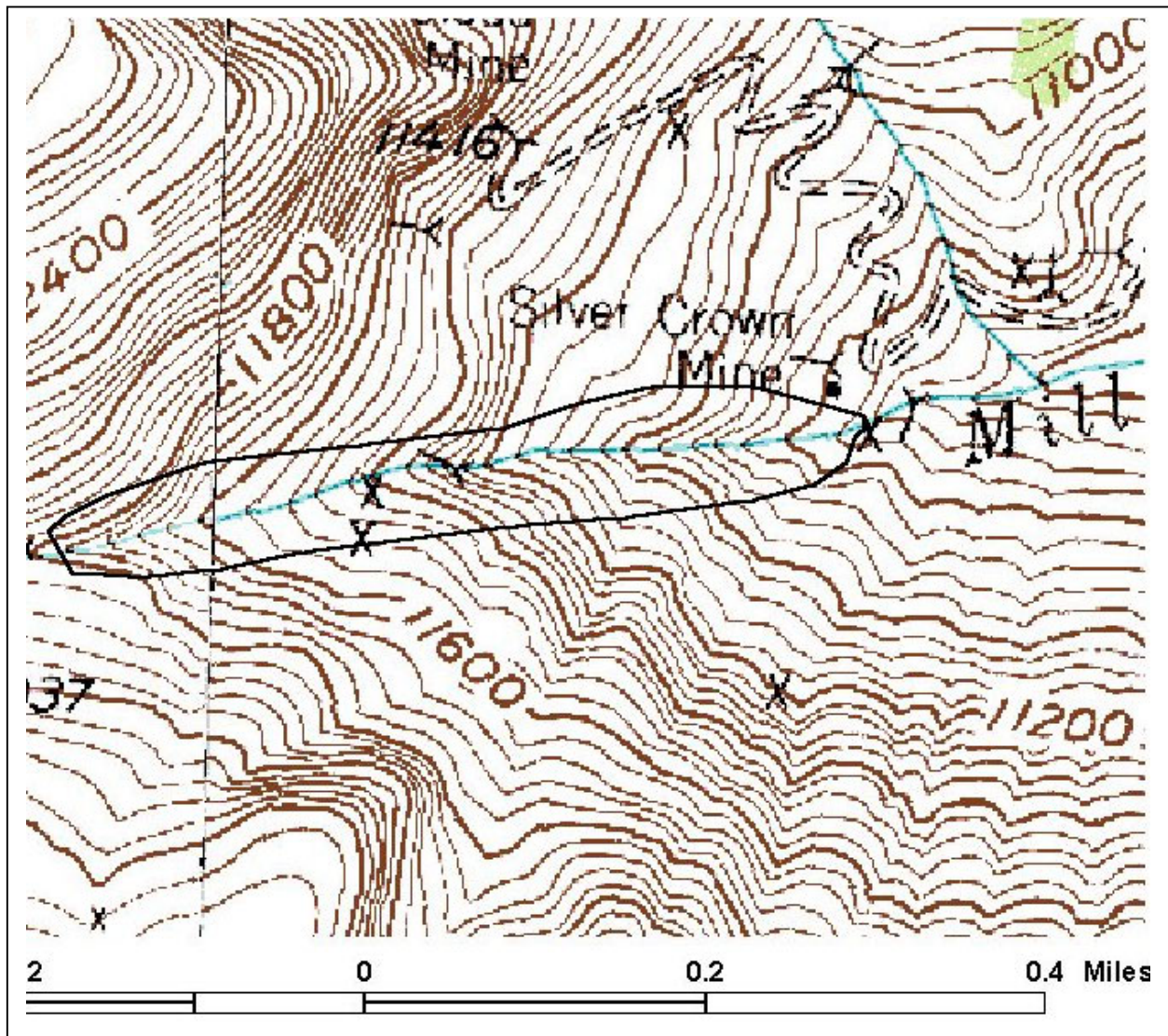
Biodiversity comments: The Middleton PCA has a fair (C ranked) occurrence of a montane willow carr dominated by Drummond's willow (*Salix drummondiana*) and bluejoint (*Calamagrostis canadensis*), a globally vulnerable (G3) plant community.

Boundary Justification: The PCA is drawn to include the Animas River and its flood plain between Howardsville and Eureka. This represents an area that could be improved to attain more natural hydrology and vegetation. Although the proper hydrologic functioning of the river is dependent on upstream activities, that area is not included in the PCA. Two waterfalls containing black swift nesting sites fall within the PCA boundaries. However, the PCA is not drawn to contain areas that support the hydrology of the waterfalls or the foraging area that is needed for the birds.

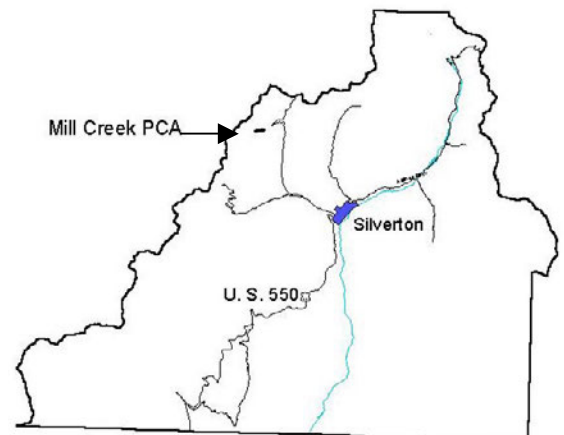
Protection Rank Comments: The PCA is composed of a complicated pattern of private and BLM land. Boundaries are not precisely known. If restoration were to be attempted, purchases or agreements between owners would be a necessary first step. Adjacent private land is being developed for residential use. Restoration of the river and its flood plain would benefit water quality, wildlife and aesthetics of this stretch of the Animas.

Management Rank Comments: The river has been severely altered, and there are noxious weeds present. Restoration of the site would require streambank restoration, removal of gravel piles left from dredging, and revegetation of tailing areas. Protection of beavers that are improving the area is recommended.

Mill Creek at Chattanooga Potential Conservation Area



Steller's cliff brake at Mill Creek



Location in San Juan County

Mill Creek at Chattanooga Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, County Road 15 from U. S. 550 at first switchback south of Red Mountain Pass, about six air miles northwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ophir, Silverton. T42N R8W Section 28

Size: 17 acres

Elevation: 10,800 ft. to 11,800 ft.

General Description: A waterfall in a steep sided canyon of Mill Creek provides moisture from spray to support ferns and mosses that thrive on wet rock surfaces. Slender rock-brake, also called Steller's cliff brake (*Cryptogramma stelleri*) was found on the north side of the canyon, in deeply shaded crevices of vertical rock faces. There is much more potential habitat for the rare slender rock higher up on cliffs that were not accessible. Two other more common ferns found at the site are rockbrake (*Cryptogramma acrostichoides*) and brittlefern (*Cystopteris fragilis*). The PCA is located above a mine and a tailings pile, and is accessed by a county road.

Natural Heritage element occurrences at the Mill Creek at Chattanooga PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Cryptogramma stelleri</i>	Slender rock- brake	G5	S2		B

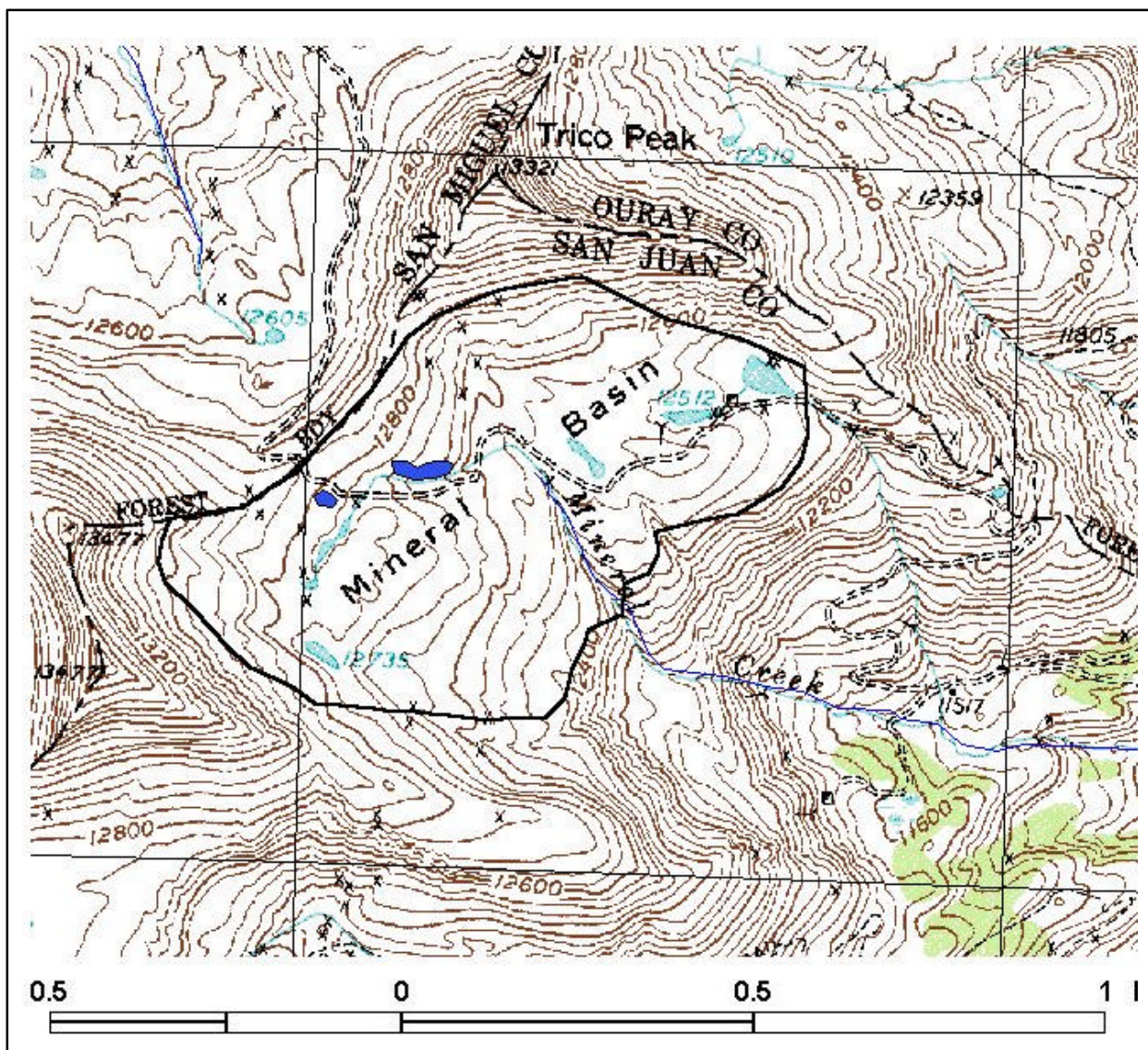
Biodiversity comments: This PCA supports a good (B ranked) occurrence of Steller's cliff brake, a fern that is rare in Colorado (S2).

Boundary Justification: The boundary is drawn to include the occurrence of Steller's cliff brake, and some additional area upstream which is essential for the water supply for the ferns.

Protection Rank Comments: The site is comprised of San Juan National Forest land and private mining claims.

Management Rank Comments: Any alterations to the flow of Mill Creek originating upstream would negatively affect the Steller's cliff brake.

Mineral Basin Potential Conservation Area



Habitat of San Juan whitlow-grass at Mineral Basin



Location in San Juan County

Mineral Basin Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The PCA is almost entirely on National Forest land.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, South Mineral Creek watershed, Black Bear Road (County Road 16), at summit, about seven miles northwest of Silverton.

Legal Description: U.S.G.S. quadrangle: Ironton. T42N R8W Sections 15 and 16

Size: 222 acres

Elevation: 12,400 ft. to 13,000 ft.

General Description: Black Bear Pass, at the headwaters of Mineral Creek, separates San Juan County from San Miguel County, and the Animas watershed from the San Miguel drainage. In San Juan County, just below the pass is a large, fairly level basin. It is accessed from Red Mountain Pass or Telluride by a rough 4-wheel drive road that has the reputation among recreational drivers as being one of the most challenging in the San Juans.

The site is comprised of andesitic lavas and ashflow tuff. Soils of the PCA are Dystrocrypts-Rock outcrop, igneous complex, 15 to 30 percent slopes, a complex of very shallow to very deep, well drained soils and rock outcrop on high mesas and mountain slopes, formed in residuum.

Vegetation of the area is a mosaic of rocky alpine tundra and wet alpine meadows with high floral diversity dominated by alpine avens (*Geum rossii*). Late melting snow banks provide the necessary habitat for San Juan whitlow-grass (*Draba graminea*). Two other *Draba* species were found in small numbers in drier, rocky sites. The area was also surveyed for Uncompahgre fritillary (*Boloria improba acrocneuma*) habitat, but found not to contain enough snow willow (*Salix reticulata* ssp. *nivalis*) to support a colony.

Natural Heritage element occurrences at the Mineral Basin PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		C
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		D
<i>Draba fladnizensis</i>	Arctic draba	G4	S2S3		D

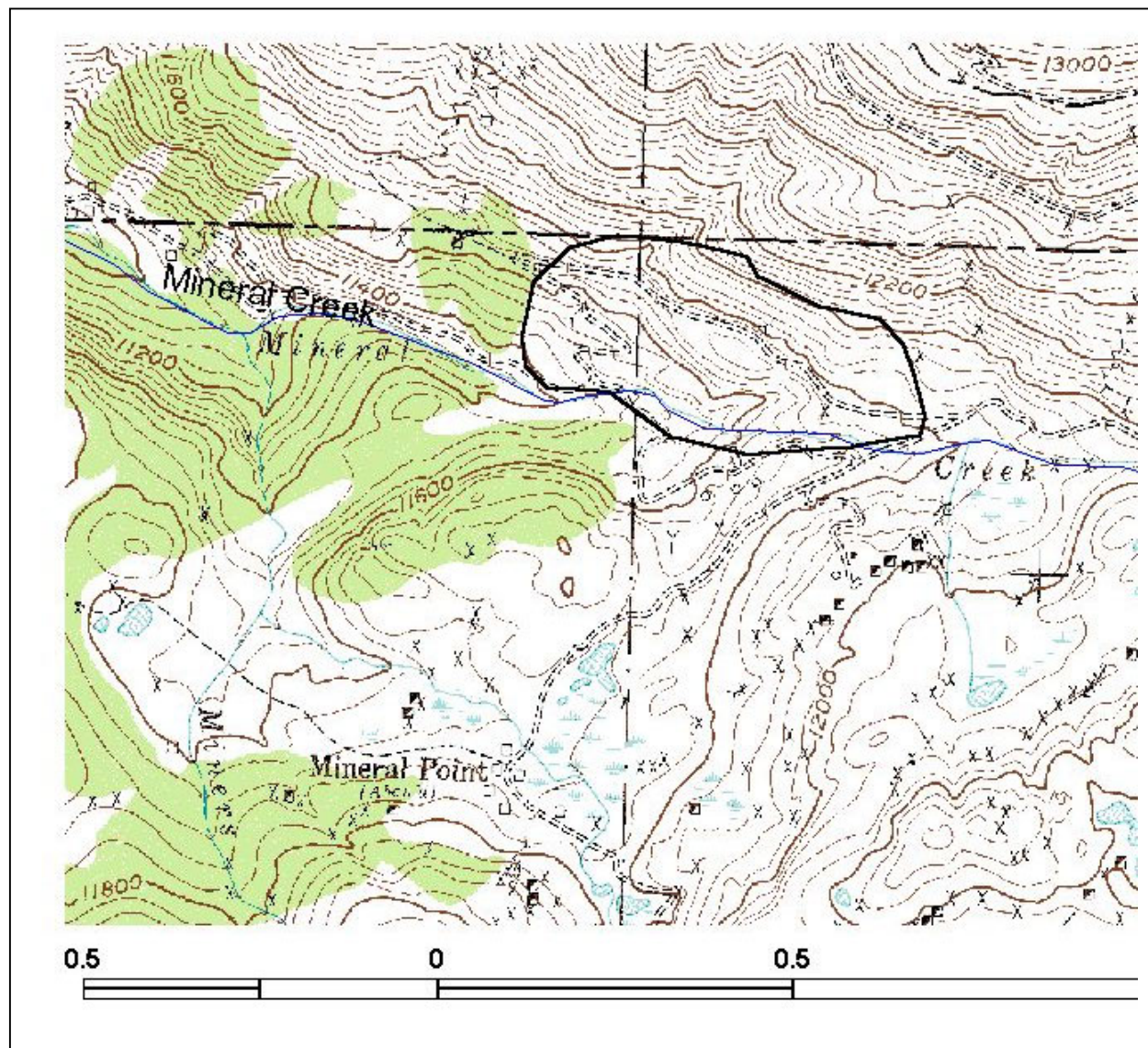
Biodiversity comments: The Mineral Basin PCA supports a fair (C ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) plant. There are also small populations (D ranked) of Colorado Divide whitlow-grass (*Draba streptobrachia*), a globally vulnerable (G3) plant, and Arctic draba (*Draba fladnizensis*), a plant that is globally secure but rare in Colorado (S2S3).

Boundary Justification: The boundary is drawn to include the entire basin, which contains habitat for the three *Draba* species.

Protection Rank Comments: The site is on San Juan National Forest land, with one small private mining claim extending into the southeast part of the basin.

Management Rank Comments: Vehicle traffic at the summit is heavy, and many alternate routes have been initiated. Additional survey of this site in a year with more moisture could result in finding more robust populations of all three rare plants.

Mineral Point Potential Conservation Area



Leaves of Kittentails (*Besseyia ritteriana*)



Location in San Juan County

Mineral Point Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The PCA is located on both BLM and National Forest land.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, Upper Animas watershed, County Road 17, about 11 air miles northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T43N R7W Sections 24 and 25

Size: 77 acres

Elevation: 11,400 ft. to 12,000 ft.

General Description: The Mineral Point PCA looks over a historic mining area that attracts many tourists. The site has talus fields that support a San Juan endemic plant, Harbour beardtongue (*Penstemon harbourii*), and wet meadows that have a large population of kittentails (*Besseya ritteriana*), a globally vulnerable species. The south-facing hillside supports a high diversity of mesic forb species, in spite of the fact that it is crisscrossed with switchbacks of the county road. Dominant plants are cornhusk lily, osha, tall blacktip ragwort and tall larkspur (*Veratrum tenuipetalum*, *Ligusticum porteri*, *Senecio atratus*, and *Delphinium barbeyi*).

Natural Heritage element occurrences at the Mineral Point PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseya ritteriana</i>	Kittentails	G3	S3		B
<i>Penstemon harbouri</i>	Harbour beardtongue	G3	S3S4		A

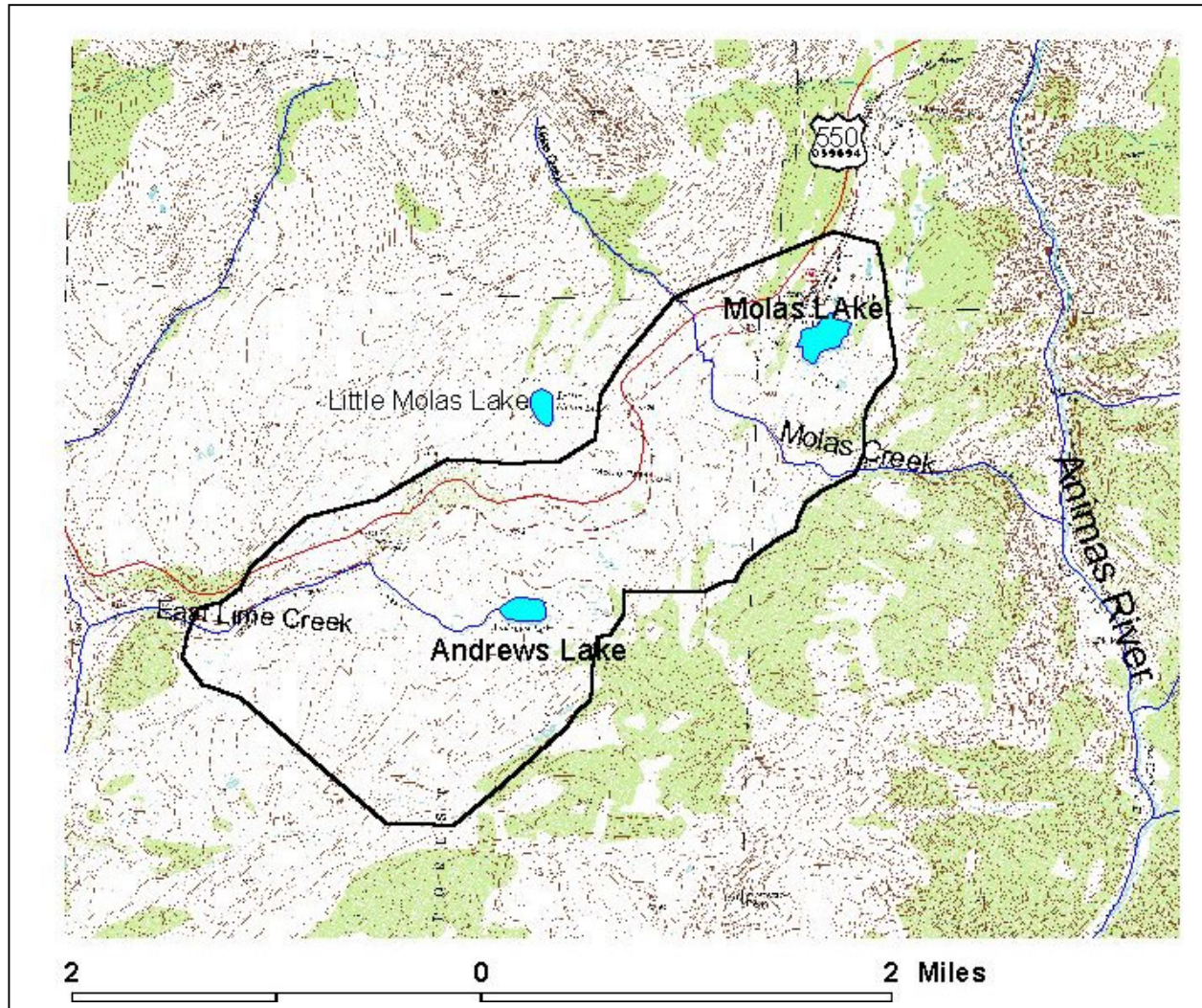
Biodiversity comments: This PCA supports a good (B ranked) occurrence of kittentails, a San Juan endemic species considered to be globally vulnerable (G3). There is also an excellent (A ranked) occurrence of Harbour beardtongue, a globally vulnerable (G3) species that is now watchlisted in Colorado.

Boundary Justification: The boundary is drawn to include the two rare plant occurrences, both of which depend on the flow of water on this south facing slope.

Protection Rank Comments: The PCA includes BLM and National Forest land, with some private mining claims.

Management Rank Comments: Heavy vehicle traffic could introduce exotic species in the future.

Molas Pass Potential Conservation Area



Molas Pass in autumn fog



Location in San Juan County

Molas Pass Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The majority of the site is within the San Juan National Forest. About 25% in the northeast part of the PCA at Molas Lake includes private land owned by the Town of Silverton surrounded by BLM land.

Management Urgency Rank: M2 New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.

Location: San Juan County, Lower Animas and Lime Creek drainages, Highway 550, about 3.5 miles south-southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangles: Snowdon Peak, Silverton. T40N R7W Sections 7, 18; T40N R8W Sections 12-15, 22-24

Size: 2,769 acres

Elevation: 10,000 ft. to 11,010 ft.

General Description: This large PCA is a fairly level, park-like area at the divide between the headwaters of Molas Creek and Lime Creek. It contains a mosaic of lakes, wetlands, and small patches of subalpine forest just below timberline. The unusual karst geology of the area is striking, with limestone terraces forming a stair-step topography, created by cycles of sedimentation in the Pennsylvanian Period. Karst topography is a broken land surface over limestone created by limestone solution, and results in having sink holes, solution caves, easily eroded depressions and irregular surfaces that create holes and low spots for lakes, ponds and moist ecosystems (wetlands and fens) (Blair 1996 and Chronic1980).

Tributaries of the Animas River that originate in areas with limestone have the capability of helping to buffer the high acidity of the upstream waters, reducing metal concentrations and carrying capacities. (Church *et al.*1997).

Wetland soils in the PCA are mapped as Needleton-Snowdon complex, 15 to 30 percent slopes, a complex of very deep and shallow, well drained soils on structural benches and mountain slopes, formed in outwash and slope alluvium derived from rhyolite, limestone and sandstone. Around Andrews Lake, the Silex-Rock outcrop complex occurs, consisting of a shallow, well drained soil and rock derived from limestone and sandstone. Soils around Molas Lake are mapped as Needleton-Snowdon complex, 5 to 15 percent slopes, a complex of very deep and shallow, well drained soils on structural benches and mountain slopes, formed in outwash and slope alluvium derived from rhyolite, limestone and sandstone (USDA 2003).

This is the site of a large forest fire known as the Lime Creek Burn that occurred in 1879. The lodgepole pines (*Pinus contorta* var. *latifolia*) found in this area were planted after the fire, and are not native to the area. Although originally intended as temporary reforestation with the expectation that Engelmann spruce (*Picea engelmannii*) would replace them, the lodgepole pines have persisted (Redders, personal comm.).

The site is traversed by U.S. Highway 550. A campground at Molas Lake, owned by the City of Silverton, is a popular destination for fishing and camping. The area receives heavy recreational use year round, with snowmobilers and skiers enjoying the gentle terrain in the winter.

The PCA contains two major lakes, Andrews Lake on the south side of the pass, and Molas Lake on the north. These and several smaller lakes are surrounded by sedge meadows dominated by beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*), and willow dominated wetlands with planeleaf willow (*Salix planifolia*) and shortfruit willow (*Salix brachycarpa*). Deep layers of *Sphagnum* moss form a soft, spongy carpet beneath the sedges. Small, highly acid pools are scattered throughout the wetlands. Wetlands associated with both lakes support the rare green sedge (*Carex viridula*), with the largest population of over 1,000 individuals occurring above Andrews Lake. This area also has patches of an unusual sedge community dominated by buxbaum sedge (*Carex buxbaumii*), with hair sedge (*C. capillaries*), and alpine bistort (*Bistorta vivipara*). Other species in this wetland include shrubby cinquefoil, elephant head, star gentian, false hellebore, osha, and pussytoes (*Potentilla fruticosa*, *Pedicularis groenlandica*, *Swertia perennis*, *Veratrum tenuipetalum* *Ligusticum porteri*, and *Antennaria luzuloides*). Small depressions in the wetland, where more moisture accumulates, support tall cottongrass (*Eriophorum angustifolium*). Green sedge occurs on the margins of these wetter areas. Small ponds that dot the wetland are home to salamanders.

Drier areas on gentle hills above the wetlands are the site of several species of *Botrychium*. These tiny ferns have been observed over several years, but failed to appear in 2002, probably due to the extreme drought conditions. However, they are likely to be persisting underground, to reappear in a wetter year. Continued monitoring of these populations is necessary to affirm this.

Above Andrews Lake, along the trail to Crater Lake, wet meadows dominated by false hellebore support showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) and kittentails (*Besseya ritteriana*). Showy whitlow-grass also occurs in moist forested areas with Engelmann spruce and whortleberry (*Vaccinium myrtillus*) above 11,000 ft. Associated species in this site include sky pilot, fleabane, reedgrass, lousewort, small-tipped sedge and wild candytuft (*Polemonium pulcherrimum*, *Erigeron peregrinus*, *Calamagrostis canadensis*, *Pedicularis racemosa*, *Carex microglochin*, and *Noccaea montana*).

Natural Heritage element occurrences at the Molas Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Townsendia rothrockii</i>	Rothrock townsendia	G2	S2		C
<i>Botrychium echo</i>	Reflected moonwort	G3	S3	S-FS	B
<i>Botrychium echo</i>	Reflected moonwort	G3	S3	S-FS	D
<i>Botrychium pallidum</i>	Pale moonwort	G3	S2	S-FS	D

<i>Botrychium hesperium</i>	Western moonwort	G3	S2		D
<i>Botrychium hesperium</i>	Western moonwort	G3	S2		C
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		C
<i>Carex buxbaumii</i> herbaceous vegetation	Buxbaum's sedge wet meadow	G3	SU		B
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		B
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		C
<i>Botrychium minganense</i>	Mingan moonwort	G4	S1		E
<i>Asplenium trichomanes-ramosum</i>	Green spleenwort	G4	S1S2		E
<i>Salix brachycarpa/mesic forb</i>	Alpine willow scrub	G4	S4		B
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	E
<i>Carex viridula</i>	Green sedge	G5	S1	(C2),S-FS/BLM	C
<i>Carex viridula</i>	Green sedge	G5	S1	(C2),S-FS/BLM	B?
<i>Carex viridula</i>	Green sedge	G5	S1	(C2),S-FS/BLM	A

Biodiversity comments: The Molas Pass PCA supports a total of 16 occurrences of rare plants and natural communities, all of which share dependence on the mosaic of habitats present in the area. The site rank is based on the fair (C ranked) occurrence of Rothrock townsendia, a globally imperiled (G2) species. Four species of moonwort (*Botrychium*) are also found in the site. They share the same ecological requirements, and all five species have been found growing together. Both the *Townsendia* and the moonworts prefer areas that have been naturally or humanly disturbed, and appear to be associated with the Lime Creek burn at this location. Although the tiny plants are difficult to find, and may not appear in any given year, there is abundant habitat throughout the PCA for them. Areas that were occupied in 2000 were re-surveyed in 2002, and no *Botrychiums* were found, apparently due to the drought. Wet meadows in the PCA support showy whitlow-grass (*Draba spectabilis* var. *oxyloba*), kittentails (*Besseyia ritteriana*), green spleenwort (*Asplenium trichomanes-ramosum*), and Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*), as well as the rare sedge (*Carex viridula*) and the wetland plant communities dominated by *Carex buxbaumii* and *C. praegracilis*. Although there is much that we do not understand about the interdependence of species and communities, it is likely that the same processes of rainfall and snowmelt are essential to all of these elements.

Boundary Justification: The boundary is drawn to encompass occurrence of Rothrock townsendia, and additional suitable habitat. Sedge wetlands, wet meadows, disturbed areas and patches of forest that support additional rare species and communities occur in a mosaic within the boundary.

Protection Rank Comments: The majority of the site is within the San Juan National Forest. About 25% in the northeast part of the PCA at Molas Lake includes private land owned by the Town of Silverton, surrounded by BLM land.

Management Rank Comments: Both Molas Lake and Andrews Lake area receive heavy recreational use. More exotic species were found around Andrews Lake than anywhere else in San Juan County except for the Town of Silverton. Oxeye daisies (*Leucanthemum vulgare*) are present, apparently planted, in the planting area in the center of the parking lot. They are also found around the lake. Other non-native species in the area are Canada thistle (*Cirsium arvense*), growing along the trail near the lake, orchard grass, dandelion, timothy, white Dutch clover, red clover and Kentucky bluegrass (*Dactylis glomerata*, *Taraxacum officinale*, *Phleum pratensis*, *Trifolium repens*, *Trifolium pratense*, and *Poa pratensis*). These species pose a threat to the native plants in the back country, especially the area that is accessed by the Crater Lake trail, as they may be transported by hikers and horses.



Figure 75. Molas Lake

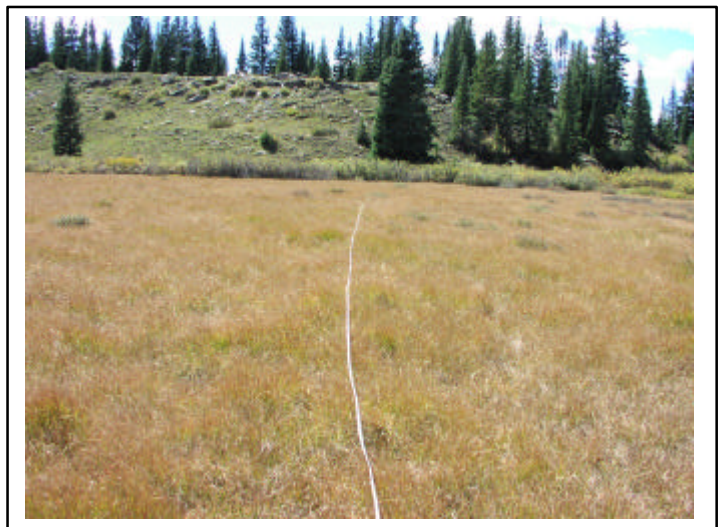
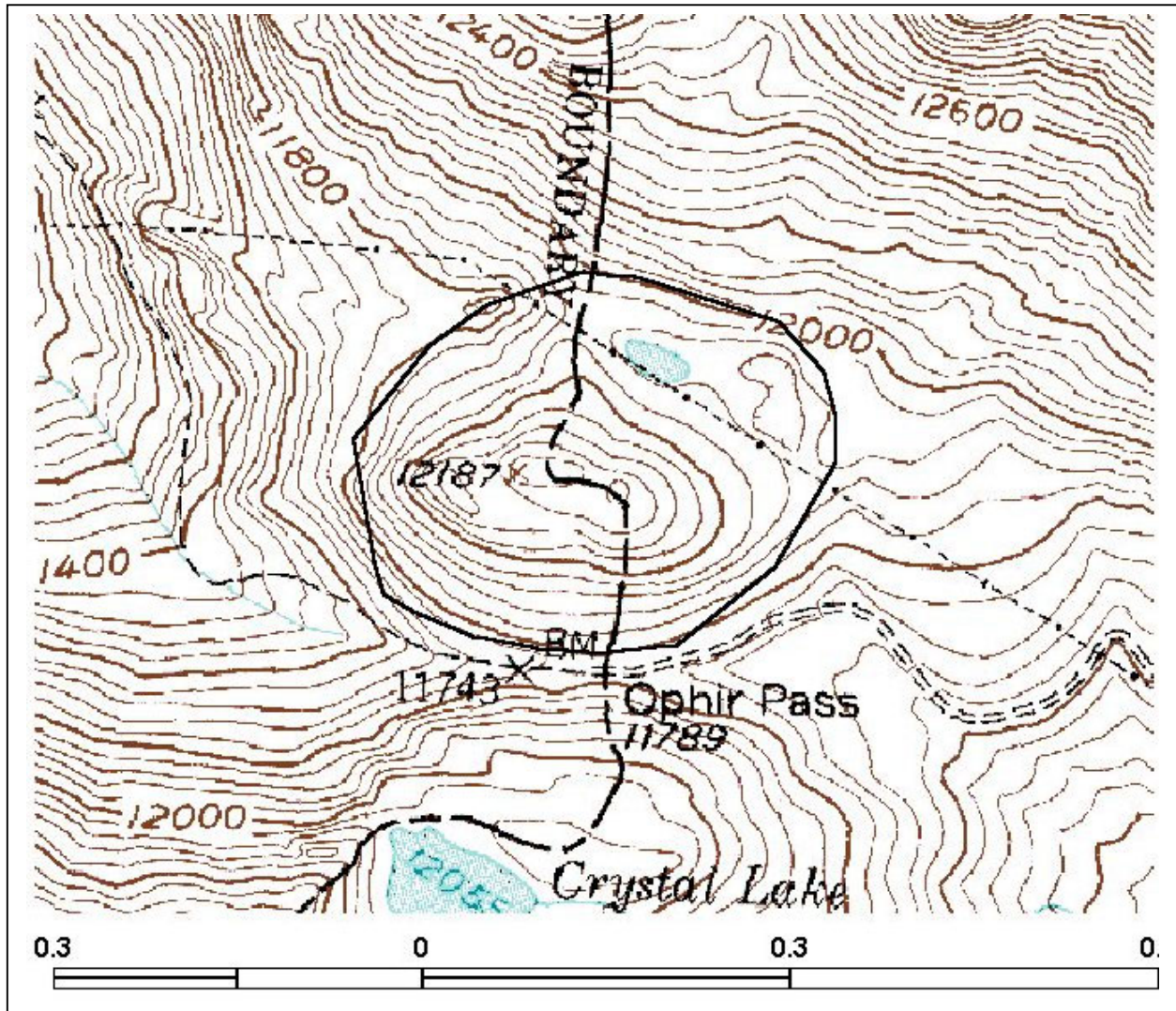
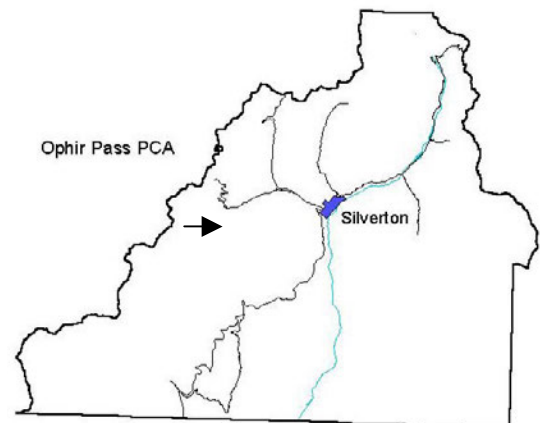


Figure 76. *Carex buxbaumii* meadow above Andrews Lake.

Ophir Pass Potential Conservation Area



Rocky alpine tundra at Ophir Pass



Location in San Juan County

Ophir Pass Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The PCA is entirely within the San Juan National Forest.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan and San Miguel counties, at county line, about 6.6 air miles west of Silverton and 2.3 air miles east of Telluride.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ophir. T42N R8W Sections 31, 32

Size: 59 acres

Elevation: 11,800 ft. to 12,380 ft.

General Description: Ophir Pass is an area of rocky tundra and talus fields, home to several rare alpine plant species. Three species of whitlow-grass, two species of moonwort, and Altai chickweed were found here in 1999. The PCA straddles the county line and extends into San Miguel County. A gravel county road provides access to the pass. The PCA is located north of the pass, and can be accessed by a trail that follows the power line just east of the pass. There are two small lakes in the PCA. Common plant species in the site include cutleaf daisy (*Erigeron pinnatisectus*), snow lover (*Chionophila jamesii*), alpine harebell (*Campanula uniflora*), rose paintbrush (*Castilleja rhexifolia*), wild candytuft (*Noccaea montana*), moss campion (*Silene acaulis*), three-toothed groundsel (*Senecio tridenticulata*), snow willow (*Salix reticulata* ssp. *nivalis*), and alpine avens (*Geum rossii*). Several sub-populations of Altai chickweed (*Stellaria irrigua*) were found on the summit, north of the pass, and on the northeast-facing slope at the saddle southwest of the power line. They were found in scree, where few other plants were growing. Most of the tiny plants were vegetative, and could be easily overlooked. The Arctic draba, (*Draba fladnizensis*) on the other hand, was growing among fairly dense vegetation dominated by alpine avens. Associated species included diamond-leaf saxifrage (*Micranthes rhomboidea*), American bistort (*Bistorta bistortoides*), alpine sandwort (*Lidia obtusiloba*), old man of the mountain (*Rydbergia grandiflora*), dwarf clover (*Trifolium nanum*), moss campion (*Silene acaulis*), cushion phlox (*Phlox condensata*), Rocky Mountain lousewort (*Pedicularis parryi*), alpine fescue (*Festuca brachyphylla* subsp. *coloradensis*), and curly sedge (*Carex rupestris*). There were no exotic plant species found in the PCA.

The south side of the county road, to Crystal Lake, was surveyed in 2002. Although the habitat is similar and appears especially suited to Altai chickweed, no rare species were found in this area. However, results could be different in a wetter year, and

additional survey is warranted. The area was also surveyed for potential Uncompahgre fritillary (*Boloria improba acrocneuma*) habitat. Although snow willow, its host plant, was present, it was not considered extensive enough to provide good habitat for the butterfly.

Natural Heritage element occurrences at the Ophir Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		D
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3		D
<i>Draba fladnizensis</i>	Arctic draba	G4	S2S3		B
<i>Stellaria irrigua</i>	Altai chickweed	G4?	S2		B
<i>Botrychium pinnatum</i>	Northern moonwort	G4?	S1		D

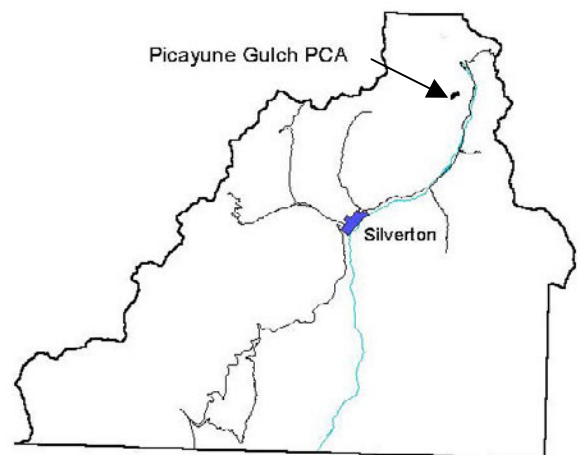
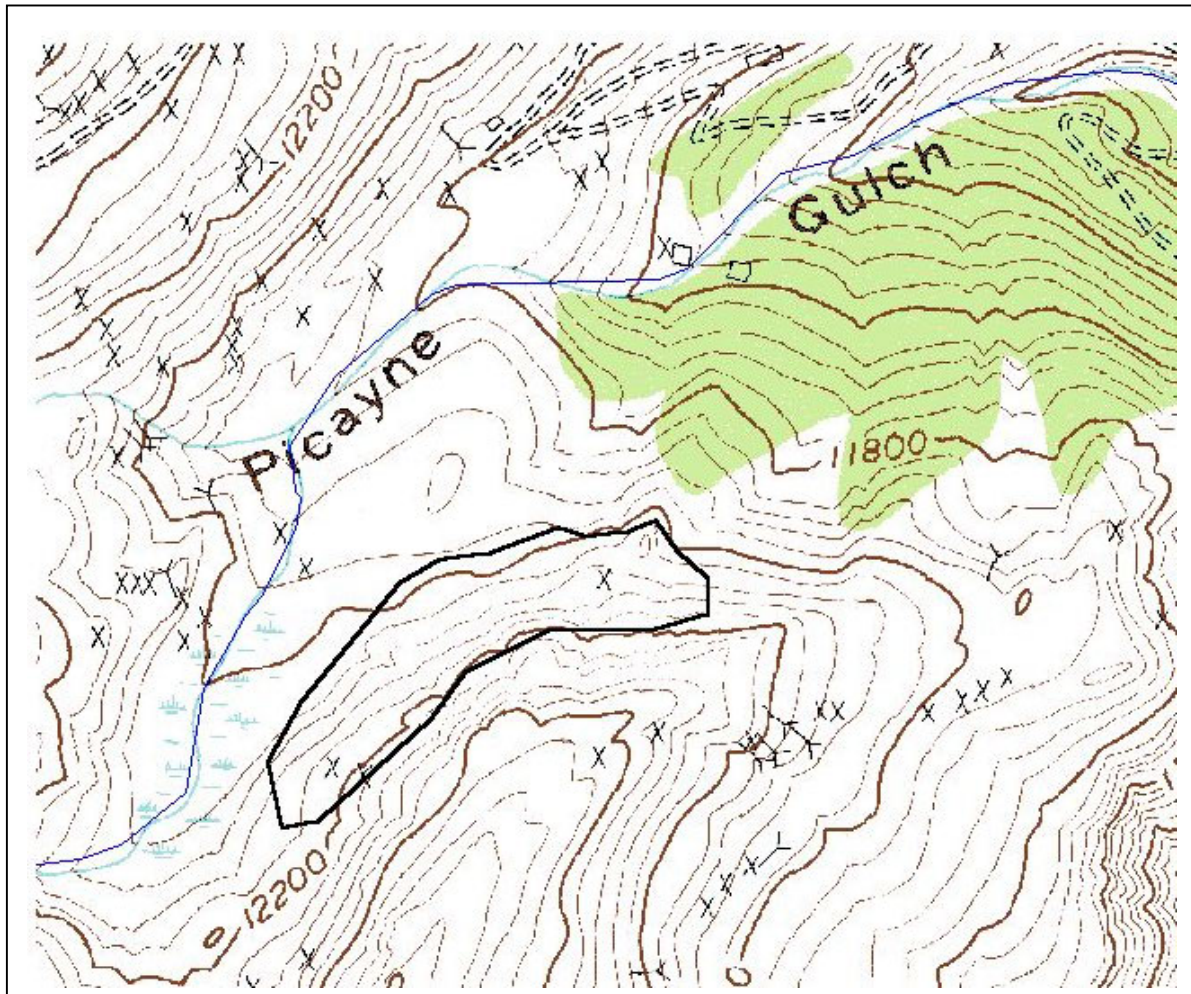
Biodiversity comments: The Ophir Pass PCA is home to poor (D ranked) occurrences of two plants, Colorado Divide whitlow-grass (*Draba streptobrachia*) and Thick-leaf whitlow grass (*Draba crassa*), that are globally vulnerable (G3). Although the populations noted so far are very small, and therefore possibly not viable in the long term, abundant suitable habitat exists, and the populations may expand in favorable years. There are good (B ranked) occurrences of arctic draba (*Draba fladnizensis*) and Altai chickweed (*Stellaria irrigua*), both thought to be secure globally (G5) but rare in Colorado (S2). A small population of northern moonwort (*Botrychium pinnatum*), globally secure but very rare in Colorado (S1), was ranked poor (D). Again, this species may be found to be more abundant with further survey in a year with favorable moisture.

Boundary Justification: The boundary was drawn in 1998 to include the occurrences of five rare plants that share similar ecological requirements.

Protection Rank Comments: The PCA is entirely within the San Juan National Forest.

Management Rank Comments: A popular 4-wheel drive road and a powerline traverse the PCA. Maintenance of the power line could pose a threat in the future. No exotic plants were noted. However, monitoring of this site will aid in the detection of changes in the number of individuals and the condition of the population that would warrant revising the element occurrence rank or management intervention.

Picayune Gulch Potential Conservation Area



Location in San Juan County

Rocky outcrops, habitat of Colorado Divide whitlow-grass (*Draba streptobrachia*) and thick leaf whitlow-grass (*Draba crassa*) at Picayune Gulch

Picayune Gulch Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, Alpine Loop, County Road 9, about 7.4 air miles northeast of Silverton

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T42N R6W Sections 7, 18

Size: 25 acres

Elevation: 12,000 ft. to 12,200 ft.

General Description: Picayune Gulch (spelled Picayne on U.S.G.S. topographic maps) is a valley of gently rolling hills, with extensive wetlands dominated by water sedge (*Carex aquatilis*), and dotted with many small ponds. North facing hillsides above the wetland are dominated by marsh marigold (*Caltha leptosepala*) in moist areas and alpine avens (*Geum rossii*) and false strawberry (*Sibbaldia procumbens*) in drier sites. Rock outcrops on the north facing slope support two rare plants, Colorado Divide whitlow-grass and thick leaf whitlow-grass (*Draba streptobrachia* and *D. crassa*). The plants were found in shaded crevices and at the base of these outcrops. Associated species included alpine avens, false strawberry, meadow rue (*Thalictrum fendleri*), alpine smelowskia (*Smelowskia calycina*), old-man-of-the-mountain (*Rydbergia grandiflora*) and brittlefern (*Cystopteris fragilis*). The wetland was surveyed for rare plants, and none were found. The area was also surveyed for potential Uncompahgre fritillary (*Boloria improba acrocneuma*) habitat. The butterfly's host plant, snow willow (*Salix reticulata* ssp. *nivalis*), was present in small patches, but was not extensive enough to support a colony.

Natural Heritage element occurrences at the Picayune Gulch PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		A
<i>Draba crassa</i>	Thick leaf whitlow-grass	G3	S3		D

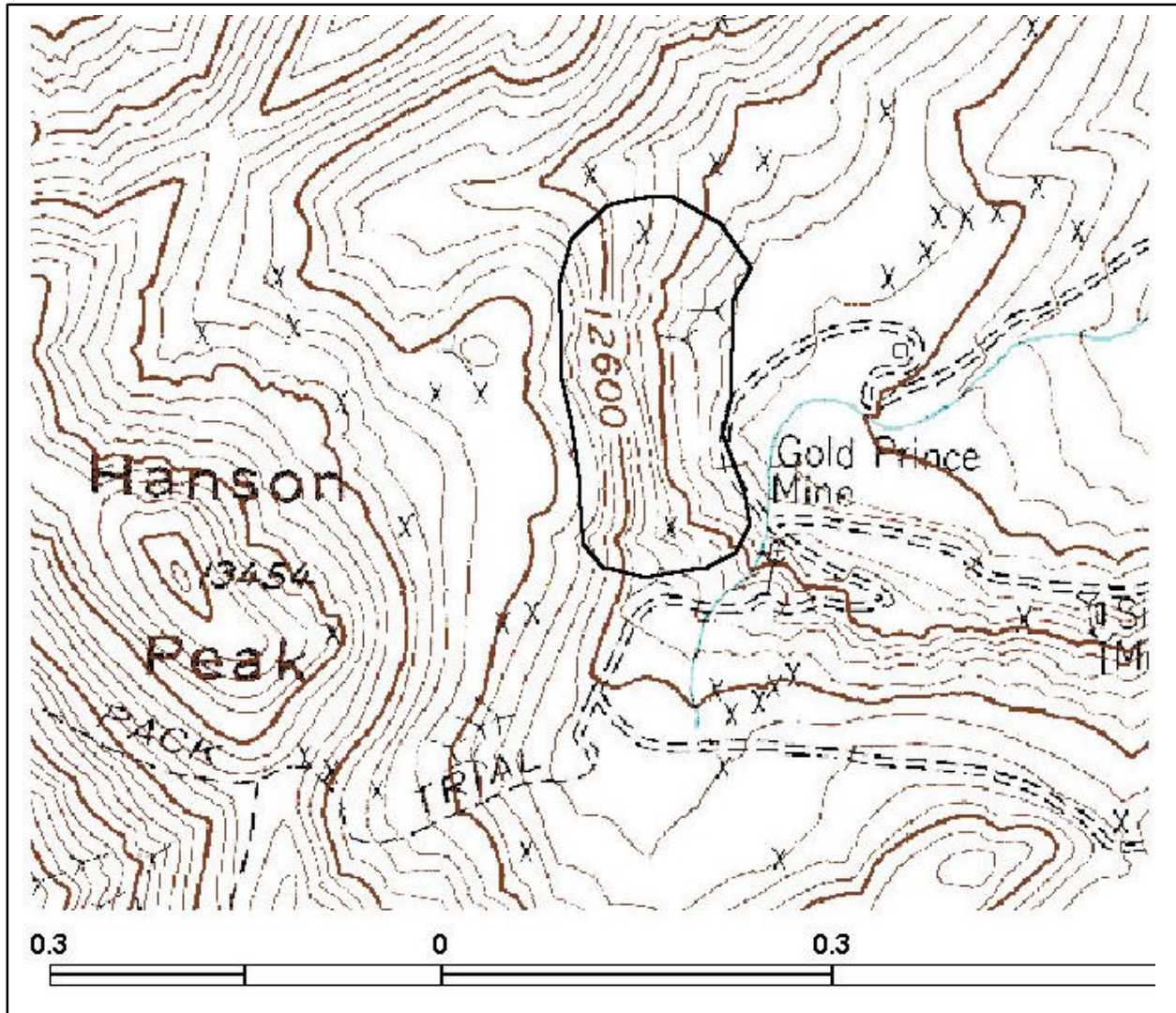
Biodiversity comments: The Picayune Gulch PCA supports an excellent (A ranked) occurrence of Colorado Divide whitlow-grass, a globally vulnerable (G3) plant. It also has a small (D ranked) occurrence of thick leaf whitlow-grass, another globally vulnerable species.

Boundary Justification: The boundary is drawn to encompass the occurrence of Colorado Divide whitlow-grass, with some surrounding area to allow for movement of the population over time.

Protection Rank Comments: The PCA is primarily on BLM land, with some private mining claims extending into it.

Management Rank Comments: Sheep use in this area appears to be high. Willows in the valley bottom were browsed to the ground.

Placer Gulch Potential Conservation Area



Showy whitlow-grass (*Draba spectabilis* var. *oxyloba*)



Location in San Juan County

Placer Gulch Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, County Road 9, about 7 air miles north-northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Handies Peak. T42N R7W Section 11

Size: 22 acres

Elevation: 12,200 ft. to 12,720 ft.

General Description: This PCA is located at the head of Placer Gulch, south of California Mountain and above the Gold Prince mine. The area consists of a mix of dry tundra and more mesic meadows dominated by Alpine avens (*Geum rossii*). Soils in the PCA are mapped as Henson very gravelly loam, 30 to 60 percent slopes, a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite.

Showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) was found in fairly dense vegetation. Other associated species were false strawberry (*Sibbaldia procumbens*), small-winged sedge (*Carex microptera*), slender wheatgrass (*Elymus trachycaulus*), tufted hairgrass (*Deschampsia cespitosa*), paintbrush (*Castilleja rhexifolia*), thickleaf ragwort (*Senecio crassulus*) and mountain thistle (*Cirsium scopulorum*). A 4-wheel drive road runs parallel to and above the gulch. The bottom of the valley has extensive wetlands that were not surveyed.

Natural Heritage element occurrences at the Placer Gulch PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		C

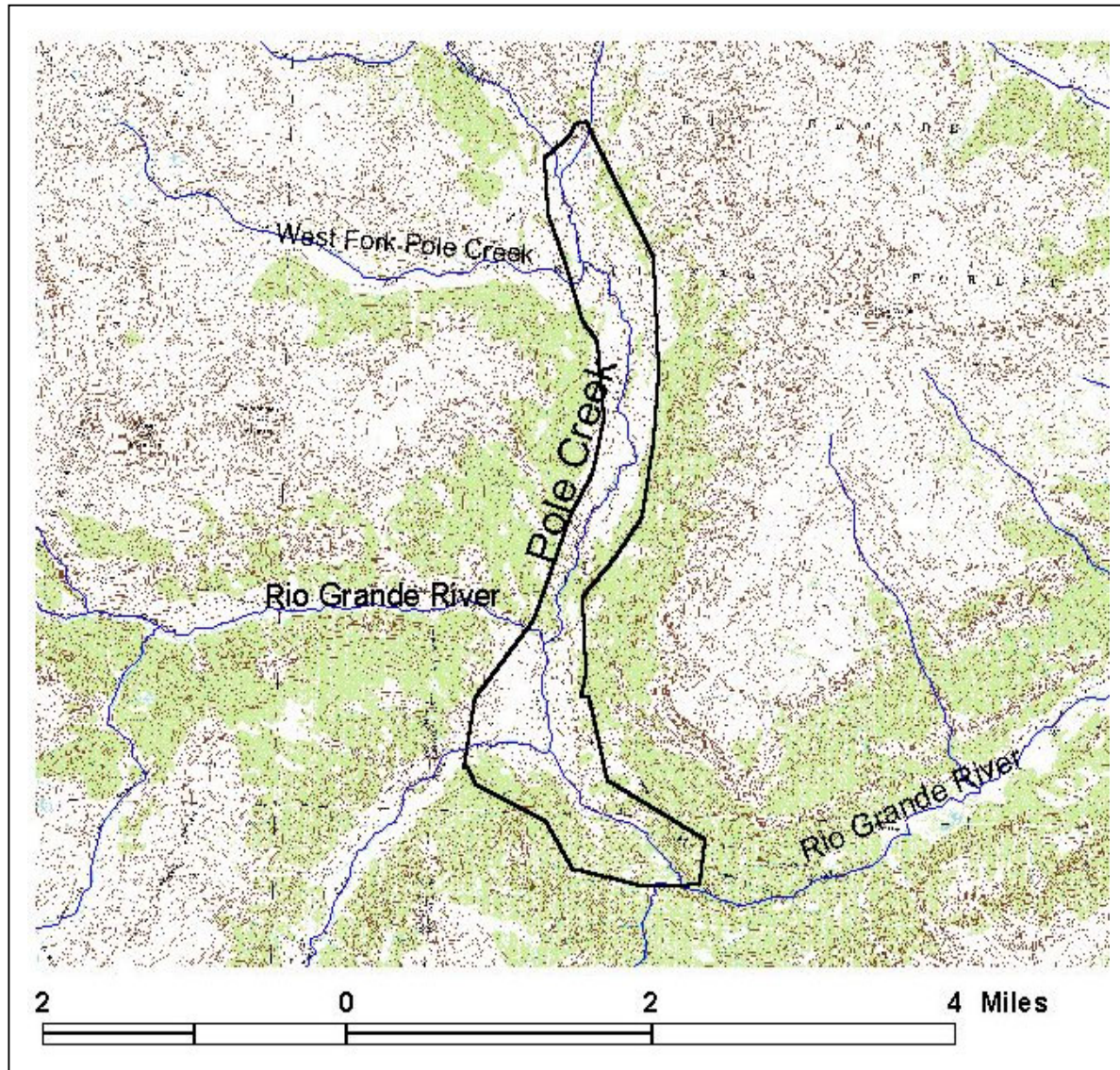
Biodiversity comments: The Placer Gulch PCA is home to a fair (C ranked) occurrence of Showy whitlow-grass, globally vulnerable subspecies (G3?T3Q).

Boundary Justification: The boundary for this PCA was drawn to include the occurrence of Showy whitlow-grass, with a small buffer to allow for expansion of the population over time.

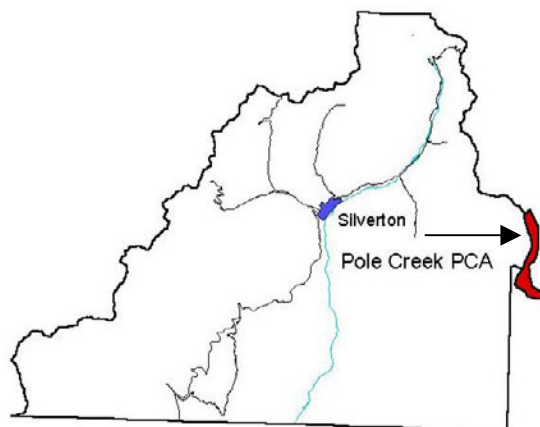
Protection Rank Comments: The site is owned by BLM with some private mining claims.

Management Rank Comments: The area is a popular 4-wheel drive route. Mine areas were disturbed in the past; however, no exotic species were noted.

Pole Creek Potential Conservation Area



Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), found in Pole Creek PCA



Location in San Juan County

Pole Creek Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is entirely in the Rio Grande National Forest. There is no special protection.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan and Hinsdale counties, Rio Grande National Forest, Pole Creek and Rio Grande River, about 11 air miles east of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Pole Creek Mountain. T40N R5W Sections 6, 7; T40N R6W Sections 1, 12; T41N R6W Section 36; T41N R5W Sections 18, 19, 30 and 31

Size: 1,638 acres

Elevation: 10,400 ft. to 11,200 ft.

General Description: Pole Creek forms the boundary between San Juan and Hinsdale counties, and is a major tributary of the upper Rio Grande River. The PCA is a Forest Service Recreation Site used for hunting, fishing and hiking. The valley is U-shaped, and was probably glaciated. The stream is low gradient with a relatively wide, well-defined floodplain. To the south the slope is dominated by Engelmann spruce and subalpine fir (*Picea engelmannii* and *Abies lasiocarpa*). To the north, the slope is open, with a community of mesic forbs.

Two good quality riparian willow communities were documented here by CNHP in 1995. The wolf willow (*Salix wolfii*) dominated community was located on Bear Creek at the confluence of the Rio Grande River during a CNHP riparian survey in 1995. Shrub cover in this community was 80%, with 60% wolf willow (*Salix wolfii*) and 20% Booth's willow (*Salix boothii*). Associated species included water sedge (*Carex aquatilis*), Baltic rush (*Juncus balticus*), strawberry (*Fragaria virginiana*), and violet (*Viola* sp.).

The Colorado Division of Wildlife stocked Rio Grande cutthroat trout from brood stock in the creek in 1996. The purity rank of these fish was A.

Natural Heritage element occurrences at the Pole Creek PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Salix boothii</i> /mesic forb	Booth's willow/mesic forb	G3	S3		B
<i>Salix wolfii</i> /mesic forb	Subalpine riparian willow carr	G3	S3		B
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat trout	G4T3	S3		E
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat trout	G4T3	S3		E

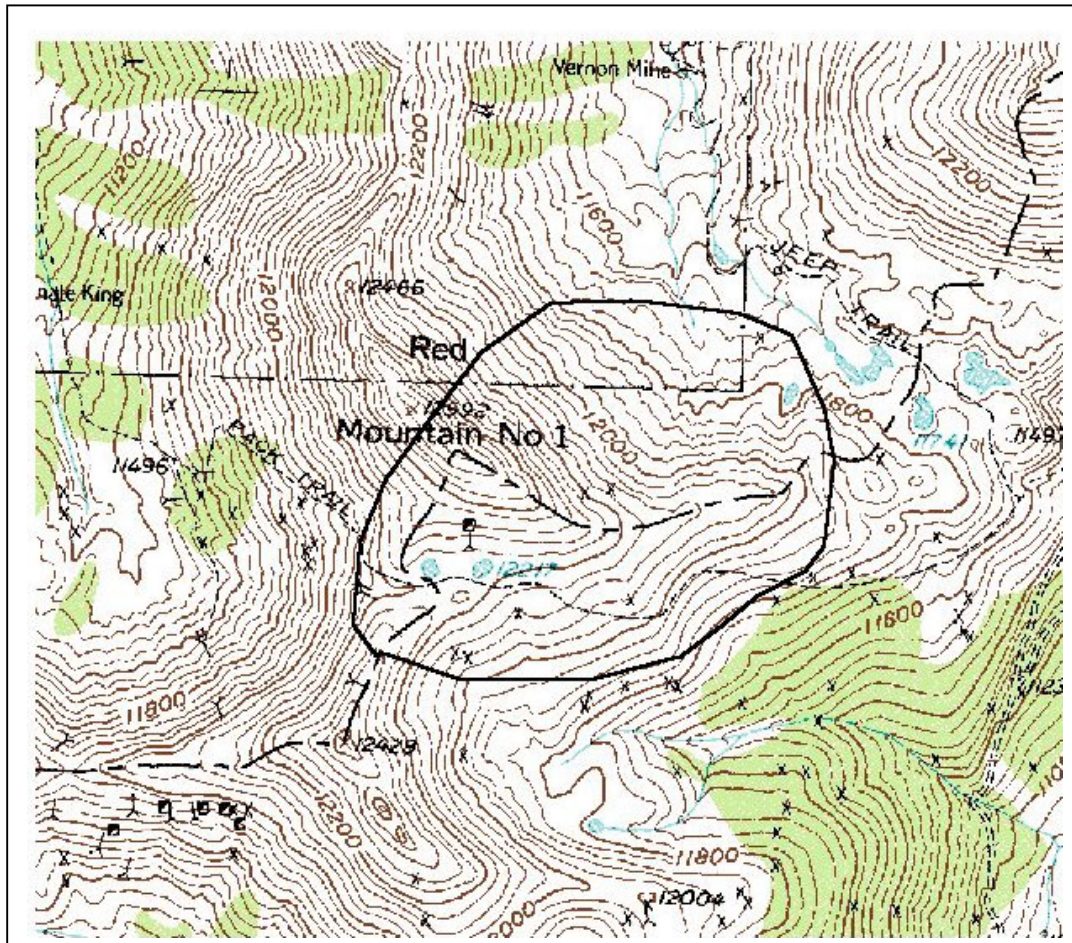
Biodiversity comments: The Pole Creek PCA contains good (B ranked) occurrences of two riparian communities, one dominated by Booth's willow and one by Wolf willow. Both communities are considered to be globally vulnerable (G3). There is also an extant but unranked (E) occurrence of Rio Grande cutthroat trout, a globally vulnerable (T3) subspecies.

Boundary Justification: The boundary is drawn to include the Booth's willow/mesic forb community, and the upstream area upon which its water flow and quality depend.

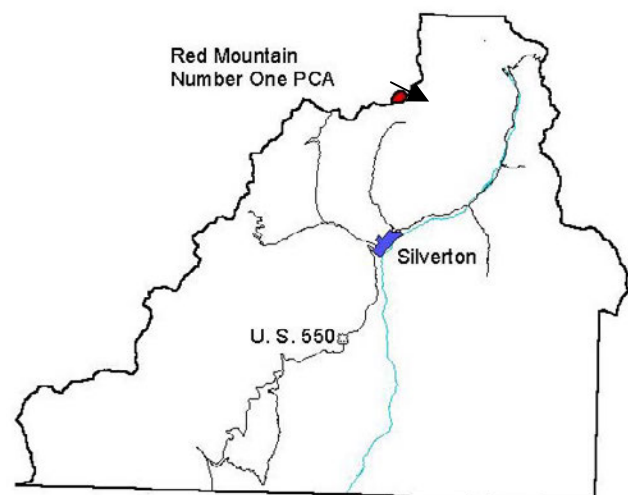
Protection Rank Comments: The site is entirely in the Rio Grande National Forest. There is no special protection.

Management Rank Comments: There are some eroded slopes leading into the riparian area. A road parallels the creek on the northern side and several other four-wheel drive roads are in the area. There is some common dandelion (*Taraxacum officinale*) in the site, particularly abundant in the Booth's willow community. Continued monitoring of recreational use, exotic species, water quality and flows will indicate whether any management needs to be undertaken to protect the occurrences.

Red Mountain Number One Potential Conservation Area



Colorado Divide whitlow-grass



Location in San Juan County

Red Mountain Number One Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan and Ouray counties, Alpine Loop, County Road 11, about six air miles north of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ironton. T42N R7W Section 8

Size: 178 acres

Elevation: 11,800 ft. to 12,592 ft.

General Description: This PCA is located along the east side of Red Mountain Number One, one of three spectacular Red Mountains brightly colored with iron oxides. The site is in rocky alpine tundra. Ownership is mixed, with private mining claims interspersed with National Forest lands and a small area of BLM land. Colorado Divide whitlow-grass (*Draba streptobrachia*) was found in rock outcrops on the south side of the county road at Corkscrew Pass. Common alpine plants in the area include tufted hairgrass (*Deschampsia cespitosa*), moss campion (*Silene acaulis*), alpine avens (*Geum rossii*), American bistort (*Bistort bistortoides*), alpine sandwort (*Lidia obtusiloba*), snow willow (*Salix reticulata* ssp. *nivalis*), alpine willow (*Salix arctica*), alpine spring beauty (*Claytonia megarhiza*), pygmy goldenweed (*Tonestus pygmaea*), alpine smelowskia (*Smelowskia calycina*), little club moss (*Selaginella densa*), featherleaf fleabane (*Erigeron pinnatisectus*), black-head daisy (*Erigeron melanocephalus*), dwarf blueberry (*Vaccinium cespitosum*) and Patterson's wormwood (*Artemisia pattersonii*). There are a few islands of stunted spruce krummholz. The areas where the alpine *Draba* species were found appear pristine; however, nearby areas are subject to impacts of four-wheel drive vehicles, roads and foot traffic.

Natural Heritage element occurrences at the Red Mountain Number One PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		C
<i>Draba borealis</i>	Northern rockcress	G4	S2		C

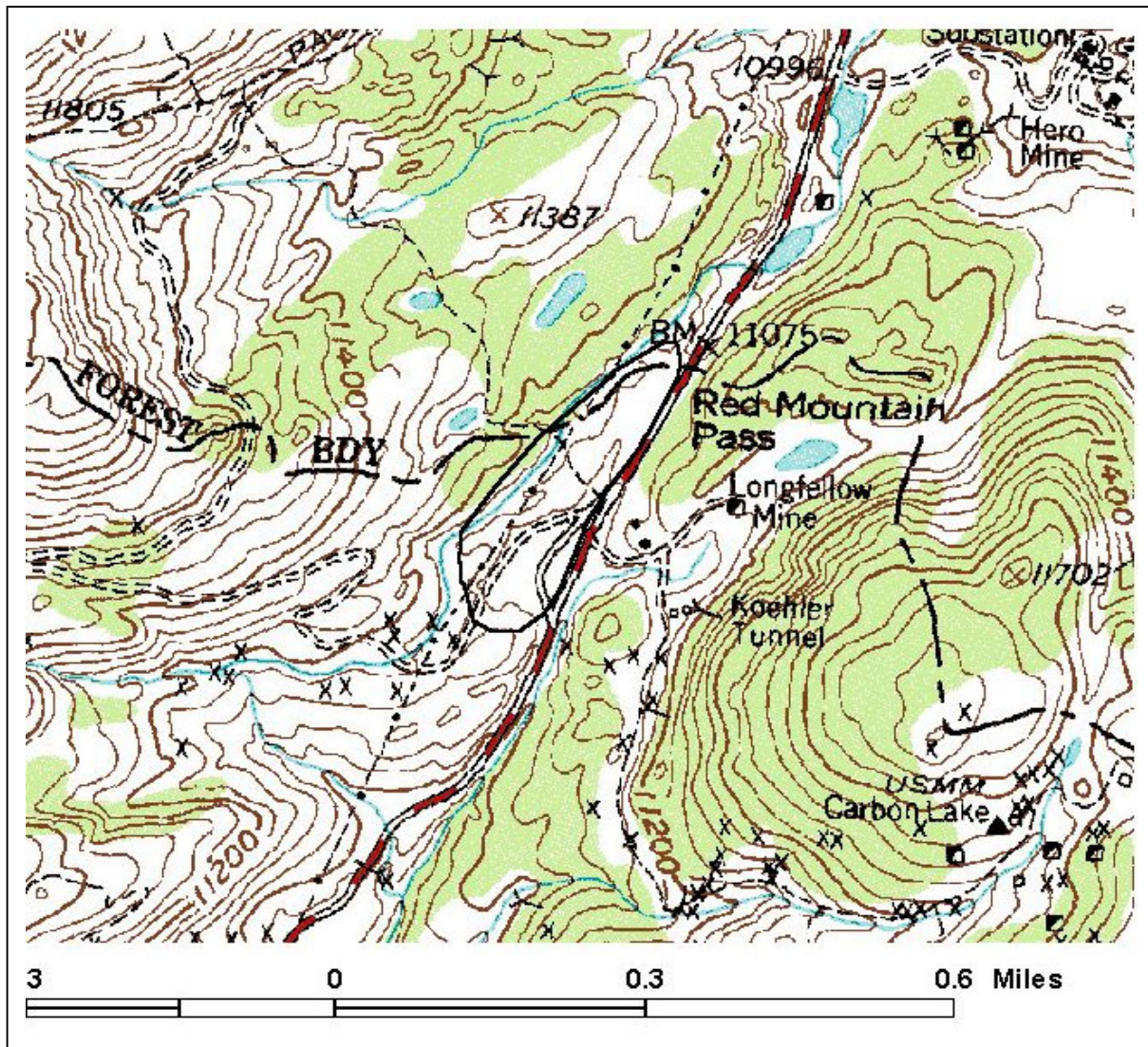
Biodiversity comments: The Red Mountain Number One PCA is home to a fair (C ranked) occurrence of Colorado Divide whitlow-grass, a globally vulnerable (G3) species. A fair population (C ranked) of northern rockcress (*Draba borealis*) also occurs in the site, in similar habitats.

Boundary Justification: The boundary is drawn to include two sub-populations of Colorado Divide whitlow-grass, and some surrounding area to allow for expansion of the population over time.

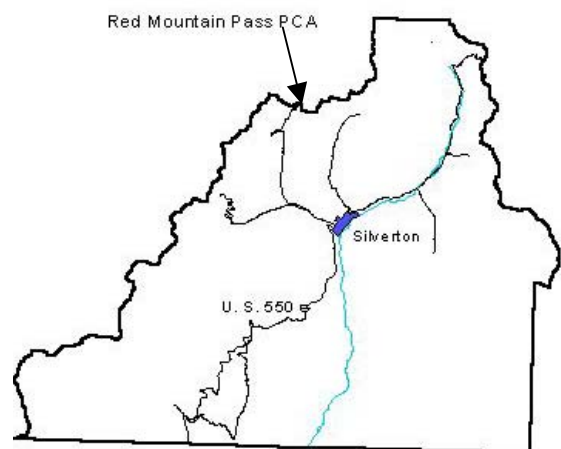
Protection Rank Comments: Ownership of the PCA is divided among National Forest, private mining claims and BLM land.

Management Rank Comments: No exotic species were noted. A four-wheel drive road is popular with tourists, and causes some disturbance.

Red Mountain Pass Potential Conservation Area



Land for Sale signs at Red Mountain Pass



Location in San Juan County

Red Mountain Pass Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, Highway 550 south of Red Mountain Pass, about five air miles north-northwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ironton. T42N R8W Section 14

Size: 16 acres

Elevation: 11,000 ft. to 11,200 ft.

General Description: At the San Juan-Ouray county line, Red Mountain Pass divides headwaters of south-flowing Mineral Creek from north-flowing Red Mountain Creek. The area has a small wetland with planeleaf willow (*Salix planifolia*), marsh marigold (*Caltha leptosepala*) and a good diversity of other alpine plants, fed by seeps in the east facing hillside. In addition to the highway, a 4-wheel drive county road (C.R. 16) heads west from here. A small irrigation ditch moves water from San Juan County to Ouray County. Two plants that are endemic to the San Juan Mountains are found on the moist hillside below the ditch.

Soils at Red Mountain Pass are mapped as the Snowdon-Rock outcrop complex, 30 to 65 percent slopes, a complex of shallow, well drained soils and rock outcrop on mountain slopes, formed in residuum and slope alluvium derived from rhyolite, sandstone and limestone.

Natural Heritage element occurrences at the Red Mountain Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		C
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		C

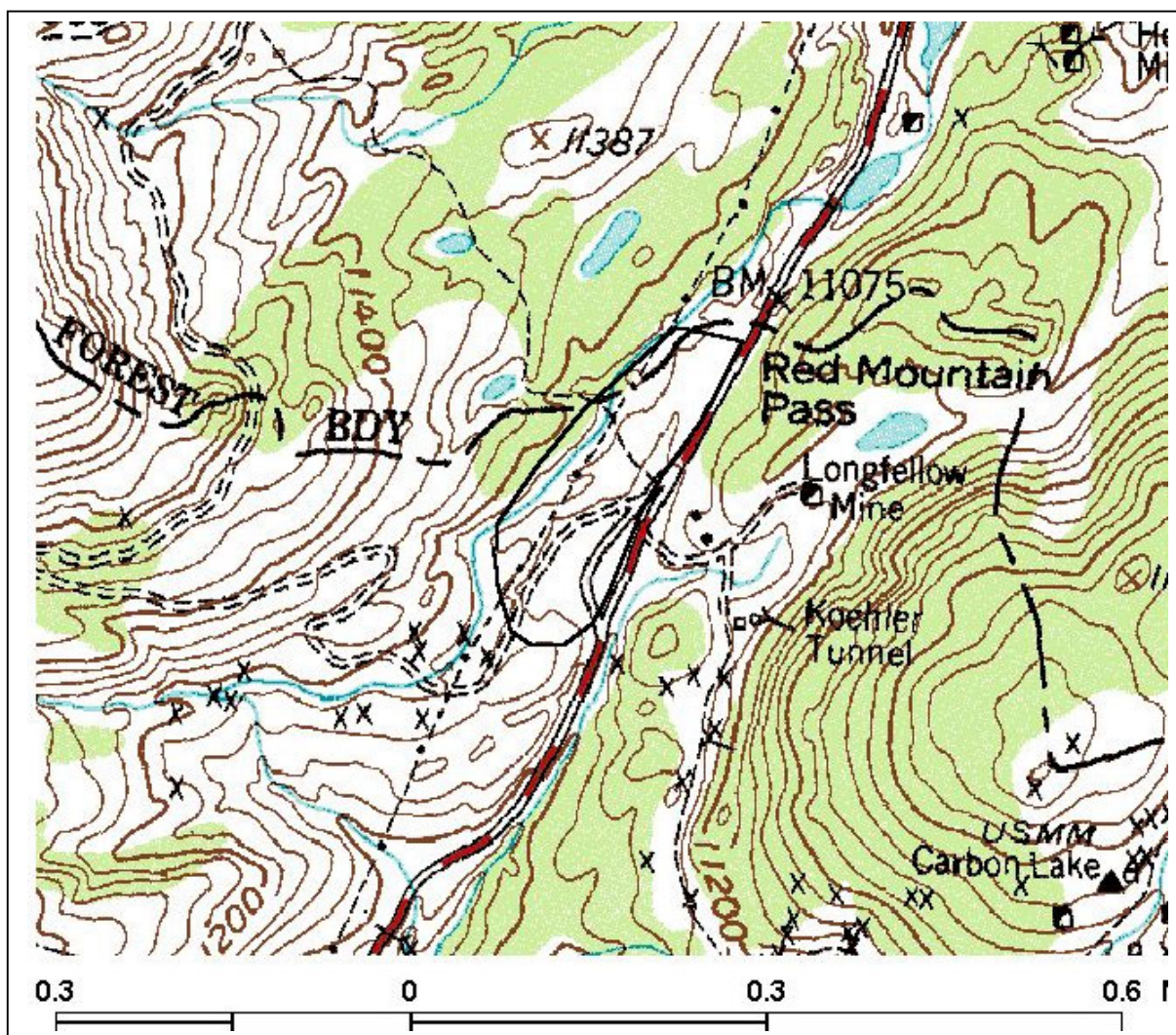
Biodiversity comments: The Red Mountain Pass PCA supports fair (C ranked) occurrences of two plants that are vulnerable (G3) on a global scale.

Boundary Justification: The boundary was drawn to include the occurrences of showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) and kittentails (*Besseyia ritteriana*), which grow together on the moist hillside.

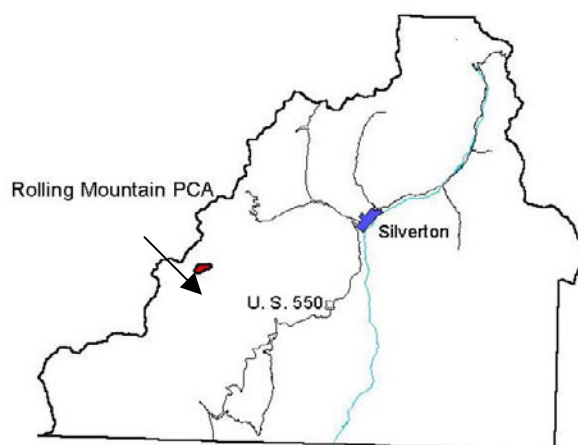
Protection Rank Comments: The site is within the San Juan National Forest. There is private land for sale for residential development nearby.

Management Rank Comments: The area is vulnerable to disturbance from the highway and county road. It receives heavy visitor use, as many tourists make the pass a rest and scenery stop. Some Canada thistle (*Cirsium arvense*) was found along the irrigation ditch, and could expand into the surrounding areas if not controlled.

Rolling Mountain Potential Conservation Area



Kittenails (*Besseyia ritteriana*)



Location in San Juan County

Rolling Mountain Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, South Mineral Creek watershed, about 8 air miles west-southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ophir. T41N R9W Sections 35 and 36

Size: 175 acres

Elevation: 11,600 ft. to 13,693 ft.

General Description: This PCA covers a northeast facing hillside above the South Fork of Mineral Creek. The area is in alpine tundra with extensive talus slopes. The kittentails (*Besseya ritteriana*) population was found in soil pockets of the talus slopes, just below the rock outcrops at the top of the ridge. The Lake Hope trail follows the creek below this PCA.

Natural Heritage element occurrences at the Rolling Mountain PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseya ritteriana</i>	Kittentails	G3	S3		C

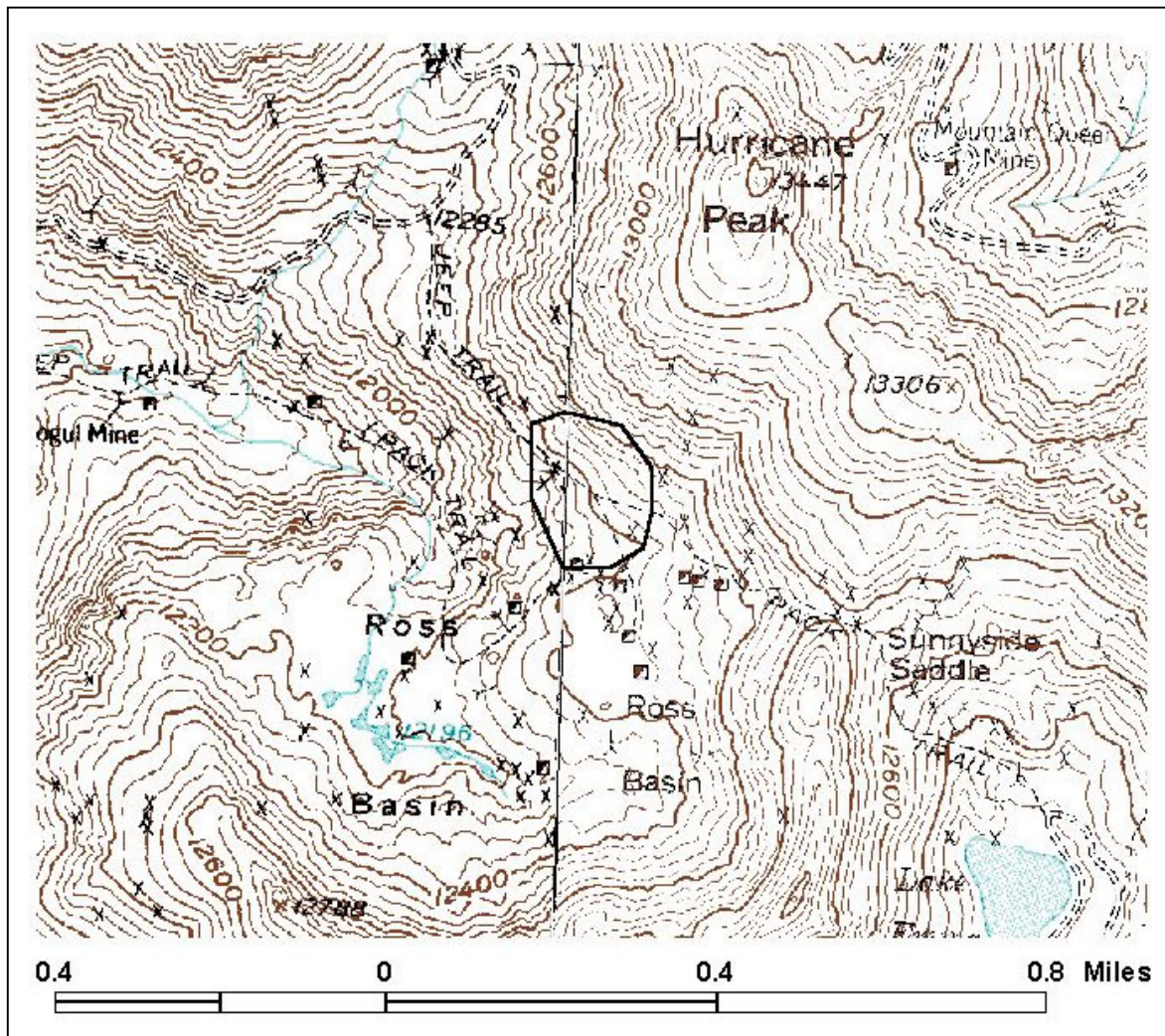
Biodiversity comments: The Rolling Mountain PCA includes a fair (C ranked) occurrence of kittentails (*Besseya ritteriana*), a plant that is considered globally vulnerable (G3).

Boundary Justification: The boundary is drawn to include the observed population, as well as adjacent suitable habitat that may be occupied. This area includes space for the population to expand over time, and habitat for potential pollinators.

Protection Rank Comments: The site is entirely within the San Juan National Forest.

Management Rank Comments: No management needs are known. The site is away from trails and roads. Sheep grazing may affect the occurrence.

Ross Basin Potential Conservation Area



Habitat of Colorado Divide whitlow-grass (*Draba streptobrachia*) at Ross Basin



Location in San Juan County

Ross Basin Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, County Road 10A, about 6.5 air miles north-northeast of Silverton.

Legal Description: U.S.G.S. quadrangle: Handies Peak, Ironton. T42N R7W Section 10

Size: 15 acres

Elevation: 12,240 ft. to 12,640 ft.

General Description: This area of alpine tundra is located on the southwest facing slope above Ross Basin, on the south side of Hurricane Peak. It is accessed by a county road that is popular with tourists. The site is situated on andesitic lavas, fine-grained igneous rocks composed chiefly of feldspar. Soils are mapped as Whitecross-Rock outcrop complex, 15 to 45 percent slopes, a complex of shallow or very shallow, well drained soils and rock outcrop on alpine valley floors, mountain slopes and ridges, formed in colluvium and slope alluvium derived from rhyolite, tuff and other volcanic rocks. Colorado Divide whitlow-grass (*Draba streptobrachia*) was found in crevices and on ledges of rock outcrops close to the county road.

Natural Heritage element occurrences at the Ross Basin PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		B

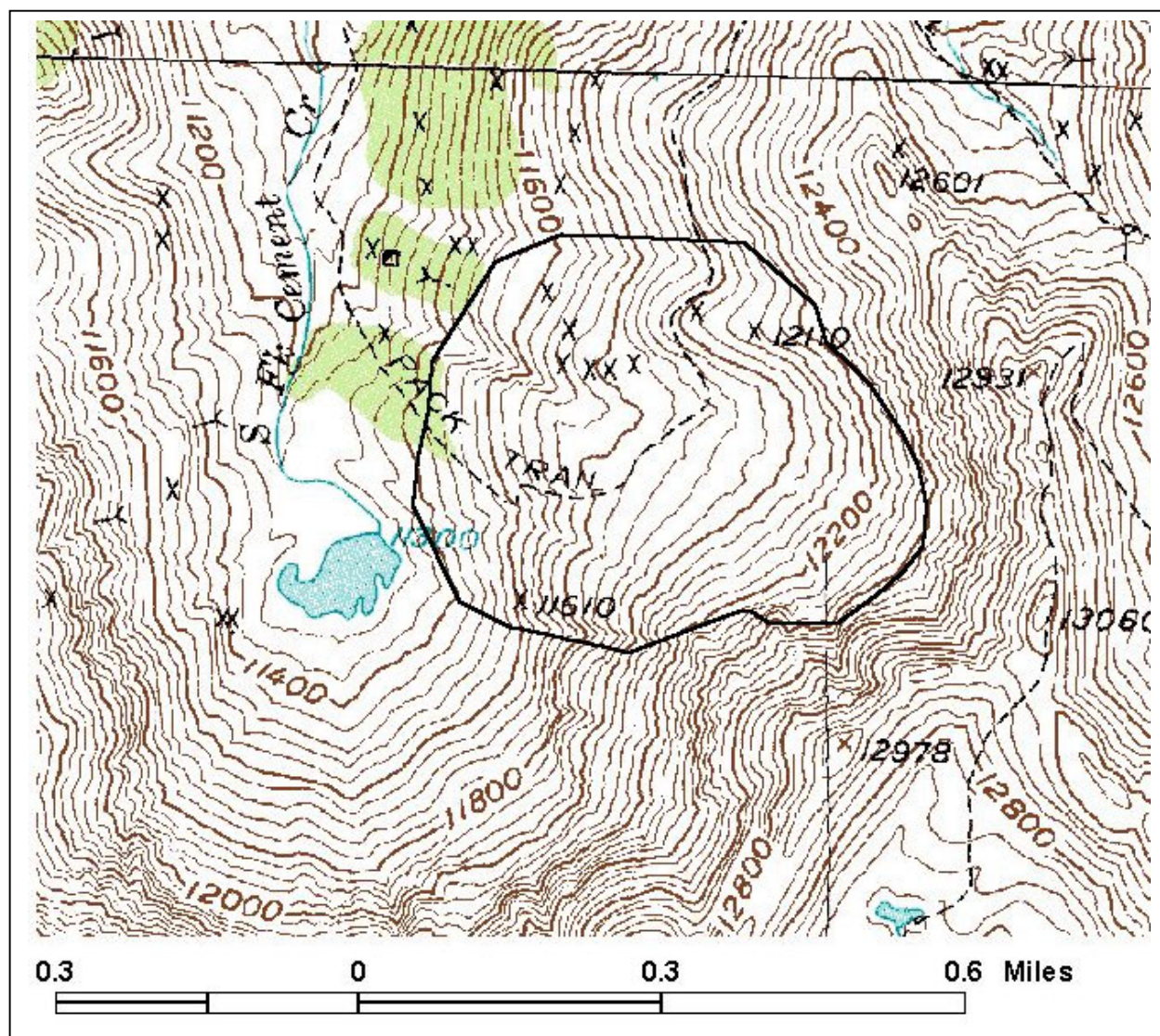
Biodiversity comments: The Ross Basin PCA supports a good (B ranked) occurrence of Colorado Divide whitlow-grass, and globally vulnerable (G3) plant.

Boundary Justification: The boundary is drawn to encompass the occurrence of Colorado Divide whitlow-grass and a small amount of potential habitat surrounding it.

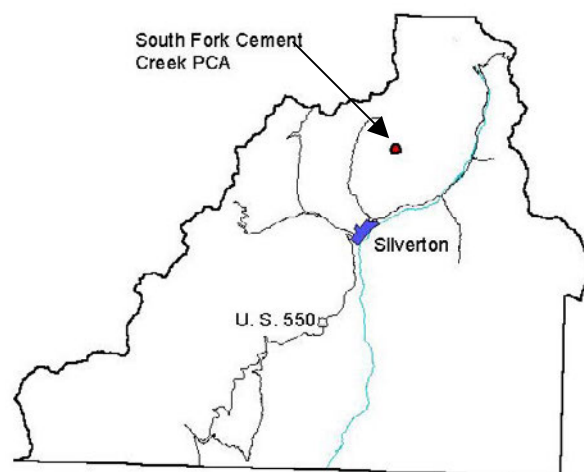
Protection Rank Comments: The site is a combination of BLM land and private mining claims.

Management Rank Comments: Although there is heavy tourist use in the summer, no negative impacts were noted. The location of the rare plants on rock outcrops protects them from most traffic.

South Fork Cement Creek Potential Conservation Area



Habitat of showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) and kittentails (*Besseyia ritteriana*).



Location in San Juan County

South Fork Cement Creek Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, County Road 51, about 3.5 air miles north-northeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Silverton. T42N R7W Section 28.

Size: 106 acres

Elevation: 11,400 ft. to 12,200 ft.

General Description: The South Fork Cement Creek PCA is a glacial cirque, typical of many in San Juan County. Steep talus slopes of Storm Peak ring a small glacial tarn and adjacent wetlands that form the headwaters of Cement Creek. The site is built upon andesitic lavas, volcanic igneous rocks with a high content of feldspar. Soils are shallow, and well drained, and are mapped as Whitecross-Rock outcrop complex, 45 to 75 percent slopes (USDA 2003).

Wetlands in the cirque support a diversity of sedges and forbs, including water sedge (*Carex aquatilis*), marsh marigold (*Caltha leptosepala*), reedgrass (*Calamagrostis Canadensis*), elephant head (*Pedicularis groenlandica*), star gentian (*Swertia perennis*), rose crown (*Sedum rhodanthum*) and tufted hairgrass (*Deschampsia cespitosa*). Small channels of flowing water and crystal-clear pools are lined with bittercress (*Cardamine cordifolia*), arrowleaf ragwort (*Senecio triangularis*) and Oregon saxifrage (*Micranthes oregana*). The moderately steep hillside on the east side of the lake is clothed with alpine meadow species dominated by alpine avens (*Geum rossii*) and Drummond's rush (*Juncus drummondii*). This is the site of two rare plants, showy whitlow-grass (*Draba spectabilis* var. *oxyloba*) and kittentails (*Besseya ritteriana*). Other species in the community include subalpine fleabane (*Erigeron peregrinus*), Richardson's geranium (*Geranium richardsonii*), timber oatgrass (*Danthonia intermedia*), hairy arnica (*Arnica mollis*), yarrow (*Achillea lanulosa*), onion (*Allium geyeri*), false strawberry (*Sibbaldia procumbens*) and alpine bluegrass (*Poa alpina*).

Natural Heritage element occurrences at the South Fork Cement Creek PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba spectabilis</i> var. <i>oxyloba</i>	Showy whitlow-grass	G3?T3Q	S3		A
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		B

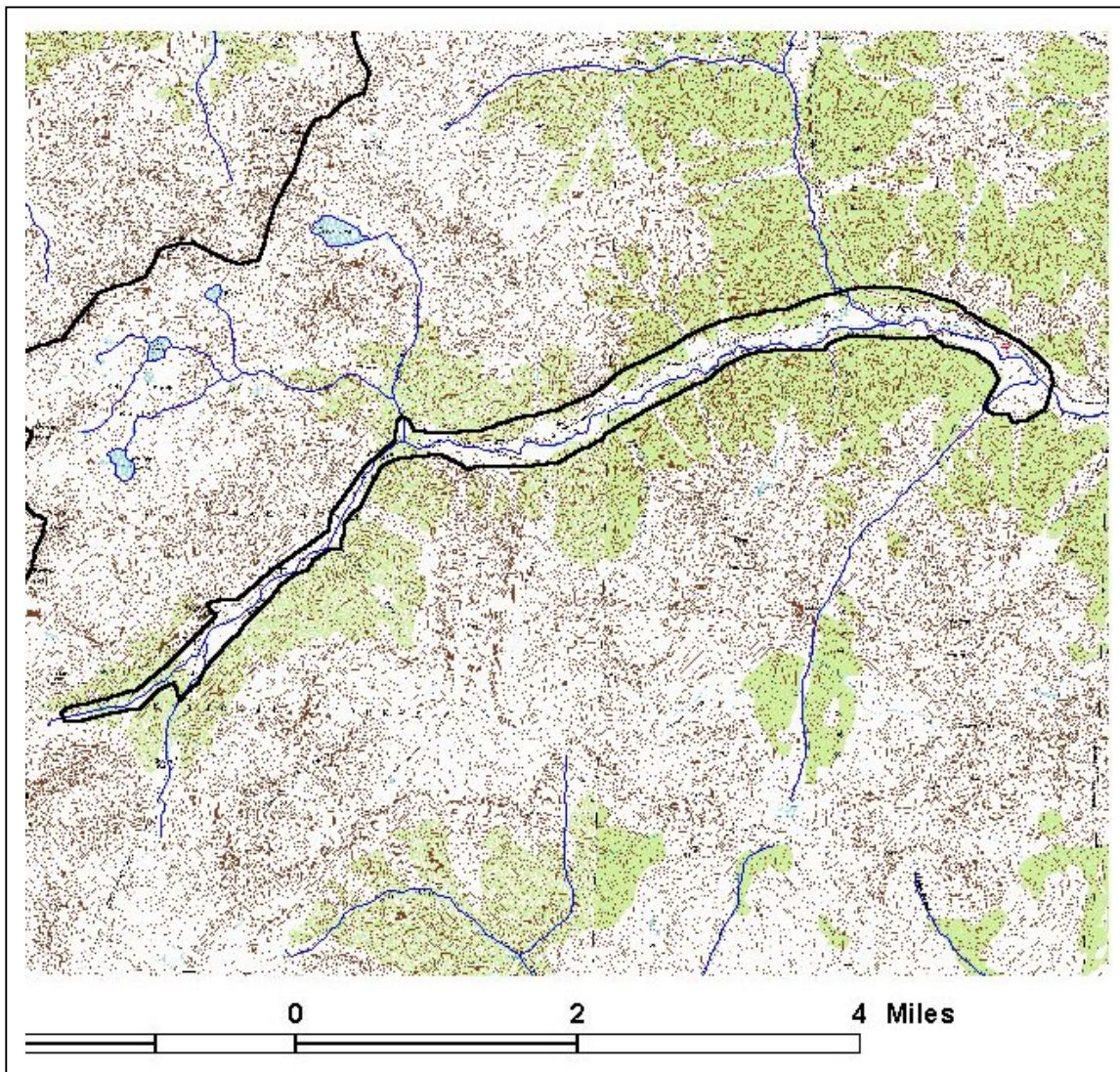
Biodiversity comments: The South Fork Cement Creek PCA supports an excellent (A ranked) occurrence of showy whitlow-grass, a globally vulnerable (T3) variety; and a good (B ranked) occurrence of kittentails, a globally vulnerable (G3) species. The two plants often occur together in moist meadow hillsides, and apparently share the same ecological requirements. Although locally abundant, both species are endemic to the San Juan Mountains, and their small range, in a global perspective, makes them vulnerable to extinction from large scale environmental changes such as global climate change.

Boundary Justification: The boundary is drawn to include the south-facing hillside with meadow vegetation where the two rare plant occurrences were located.

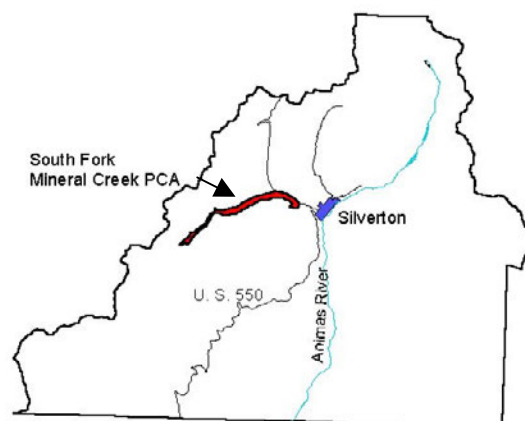
Protection Rank Comments: The PCA has mixed ownership of BLM land and private mining claims.

Management Rank Comments: The area is grazed by sheep, and some effects of trailing were noted.

South Fork Mineral Creek Potential Conservation Area



Iron fen at South Fork Mineral Creek



Location in San Juan County

South Fork Mineral Creek Potential Conservation Area

Biodiversity Rank: B2. Nearly irreplaceable. An excellent occurrence of a globally imperiled wetland, two good occurrences of globally vulnerable montane riparian shrublands, a good occurrence of a globally vulnerable plant, and a good and fair occurrence of state rare ferns.

Protection Urgency rank: P2. Protection actions may be needed within five years. It is estimated that stresses may reduce the viability of the elements within this approximate time frame. Potential conservation area is located on both USFS and private lands. There is currently no special protection for the area.

Management Urgency rank: M2. New management actions may be needed within five years to prevent the loss of the element occurrences. The area is located adjacent State Highway 110 and within the impact area of several active mining claims.

Location: San Juan County, County Road 7, along South Mineral Creek, about 1.8 miles northwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Silverton, Ophir. T41N R8W Sections 10-21, 30; T41N R9W Sections 25, 36.

Size: Approximately 114 acres

Elevation: 9,470 ft. to 11,300 ft.

General Description: The South Mineral Creek PCA is a moderately steep sided valley located at the base of several 12,000 and 13,000 ft peaks. The site begins at the base of Rolling Mountain, a 13,693 ft. peak approximately 5 miles west of Silverton. South Mineral Creek drains west to east through a rolling, glaciated valley flanked by U.S. Forest Road 585. There are two designated USFS campgrounds and several dispersed areas for camping. Areas along the creek bed consist mainly of glacial drift and contain a number of highly mineralized springs. South Mineral Creek meanders only slightly throughout its eight-mile length and eventually joins the main fork of Mineral Creek at Silverton. At the far upper end of the PCA, there are large sedge wetlands in the wide valley that are home to Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*). Farther downstream, at the end of the county road, large willow carrs are dominated by planeleaf willow (*Salix planifolia*) and shortfruit willow (*S. brachycarpa*) with marsh marigold (*Caltha leptosepala*) common in the understory. Still farther downstream, several waterfalls are found along the main stream and on its tributaries. Four of these are home to breeding colonies of Black Swifts (*Cypseloides niger*). Two rare ferns, mountain bladder-fern (*Cystopteris montanus*) and slender cliff-brake (*Cryptogramma stelleri*) are found in conjunction with the waterfalls of the main stream. Iron fen wetlands and limonite terraces are located at Cooper Gulch, Snowslide Gulch, and Zuni Gulch above the creek. At middle elevations the riparian zone supports a community of taller willows, Rocky Mountain willow (*Salix monticola*), Drummond's willow (*Salix drummondiana*)

and Geyer's willow (*Salix geyeriana*). A rare plant, kittentails (*Besseyia ritteriana*) was found in this tall willow community. It was growing with false hellebore (*Veratrum tenuipetalum*), osha (*Ligusticum porteri*), tansy mustard (*Descurainia incisa*), Richardson's geranium (*Geranium richardsonii*), meadowrue (*Thalictrum fendleri*), and other moisture-loving herbs. Other common understory species along the creek are bluejoint (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*) and beaked sedge (*Carex utriculata*). Uplands above the creek consist of a mosaic of dry hillsides with shrubby cinquefoil (*Potentilla fruticosa*) and western wheatgrass (*Pascopyrum smithii*); aspen groves; and moist spruce forest, depending on aspect and moisture availability. (See Appendix for plant species lists for several points within the PCA).

Natural Heritage element occurrences at the South Fork Mineral Creek PCA

Scientific name	Common name	Global rank	State rank	State/federal status	Element occurrence rank
<i>(Picea engelmannii)/Betula glandulosa/Carex aquatilis/Sphagnum angustifolium</i>	Iron fen	G2	S2		A
<i>Salix drummondiana/Calamagrostis canadensis</i>	Lower montane willow carrs	G3	S3		C
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		B
<i>Salix geyeriana-Salix monticola/Calamagrostis canadensis</i>	Montane willow carrs	G3	S3		B
<i>Cypseloides niger</i>	Black swift	G4	S3B		E
<i>Cypseloides niger</i>	Black swift	G4	S3B		E
<i>Cypseloides niger</i>	Black swift	G4	S3B		E
<i>Cypseloides niger</i>	Black swift	G4	S3B		E
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	B
<i>Cryptogramma stelleri</i>	Slender rock-brake	G5	S2		C
<i>Cystopteris montana</i>	Mountain bladder-fern	G5	S1		A

Biodiversity comments: This site supports an excellent (A ranked) occurrence of a globally imperiled (G2) iron fen plant community. It also includes two good (B ranked) occurrences of globally vulnerable (G3) montane riparian plant communities, a good (B ranked) occurrence of a globally vulnerable (G3) plant, and one good (B ranked) and one fair (C ranked) occurrence of state rare (S1 and S2) ferns. Four breeding colonies of Black Swifts (unranked), a bird that is vulnerable (S3B) in Colorado were found at waterfalls within the PCA boundaries.

Boundary Justification: The boundary is drawn to include the South Mineral Creek floodplain and the lower parts of several tributary streams, from Bandora mine to Highway 550. The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain viable populations of the wetlands. It should be noted that the hydrological processes necessary to the riparian elements are not fully contained by the site boundaries. Because the elements are dependent on natural hydrological processes associated with South Mineral Creek, any upstream activities such as water diversions,

impoundments, and mining development could potentially be detrimental to the wetlands and to the black swift's habitat. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Comments: The PCA is owned by USFS, San Juan National Forest and private landowners. There is currently no special protection for the area.

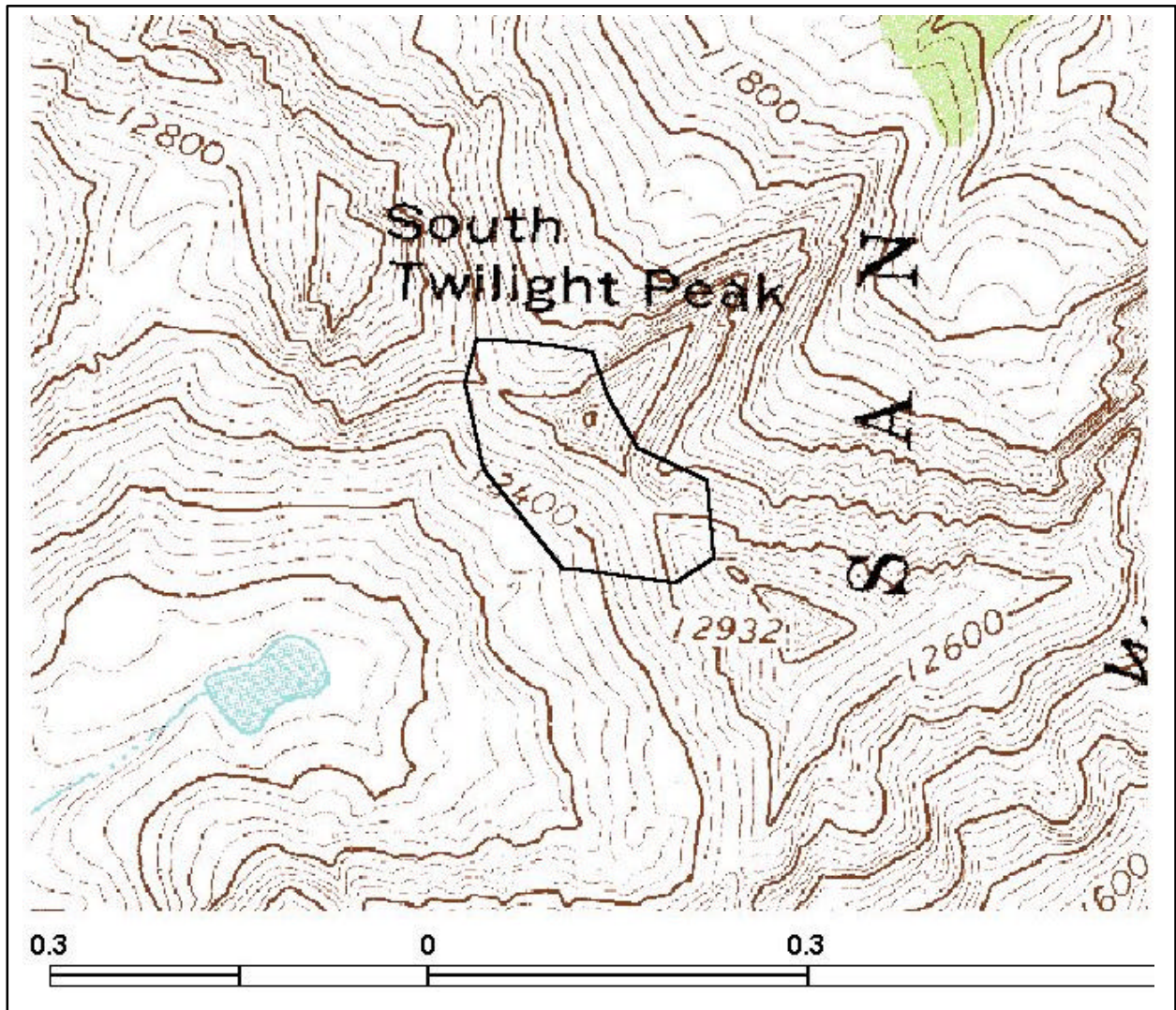
Management Comments: The construction of FR 585 appears to have negatively impacted the hydrology of certain areas of the fen by interrupting the water flow and drying out areas of limonite. Further expansion of the road or campgrounds could exacerbate this impact. Off road vehicle travel could seriously damage the iron fen and riparian areas by disrupting the hydrology.

Wetland Soils Description: Soils have Histic epipedon with fibric to sapric peat up to 60 cm deep cm, many areas of the wetlands were "quaking". In areas where a mineral soil was reached with the shovel it was gleyed Chart 1 6/10Y.

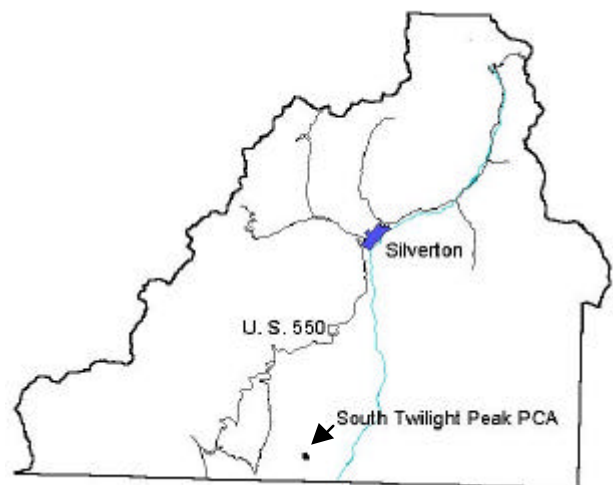
Wetland Functional Assessment for the South Fork Mineral Creek Iron Fen

Function	Ratings	Comments
Overall Functional Integrity	At Potential	This wetland is functioning at potential.
Hydrological Functions		
Flood Attenuation and Storage	High	The wetland is large > 20 acres, vegetation is dense, presence of microtopography, presence of ponds and pools, low gradient
Sediment/Shoreline Stabilization	High	South Mineral Creek is densely vegetated with shrubs and herbaceous species, some evidence of bank erosion due to mining activity
Groundwater Discharge/Recharge	High	Several springs observed.
Dynamic Surface Water Storage	N/A	
Biogeochemical Functions		
Elemental Cycling	Normal	Wetland is located in the mineral belt of the San Juan therefore is naturally acidic, however due to current and past mining activities is likely more acidic due to leaching from tailing piles.
Removal of Imported Nutrients, Toxicants, and Sediments.	High	Wetland contains peaty soils, presence of permanently flooded areas, dense vegetation.
Biological Functions		
Habitat Diversity	Low	Wetland supports 1 Cowardin Class
General Wildlife Habitat	Low	None were observed
General Fish/Aquatic Habitat	Low	Wetland is too acidic to support fish.
Production Export/Food Chain Support	Moderate	Wetland does not support the best habitat for fish or wildlife
Uniqueness	Very High	There are 13 known occurrences of iron fens in the world and all of them occur in Colorado.

South Twilight Peak Potential Conservation Area



San Juan whitlow-grass (*Draba graminea*)



Location in San Juan County

South Twilight Peak Potential Conservation Area

Biodiversity Rank: B3 High biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future. The site is within the Weminuche Wilderness of the San Juan National Forest.

Management Urgency Rank: M5 No serious management needs are known or anticipated.

Location: San Juan County, San Juan National Forest, Weminuche Wilderness, about 10.6 air miles southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Snowdon Peak. T39N R8W Section 11

Size: 15 acres

Elevation: 12,320 ft. to 12,680 ft.

General Description: This PCA is located in the Needle Mountains, on the steep southwest facing side of South Twilight Peak in an area that retains snow late in the season. The mountains are composed of Tertiary andesitic lavas. The occurrence of a fair population of San Juan whitlow-grass (*Draba graminea*) was reported by a Colorado Native Plant Society volunteer in 2002. The plants were located a few feet east below the pass southeast of South Twilight Peak, in a pristine alpine area. They were growing in north-facing narrow rock crevices associated with large, nearly vertical rock slabs. More potential habitat for the plants is available above the occurrence, but was not accessible for survey.

Natural Heritage element occurrences at the South Twilight Peak PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Draba graminea</i>	San Juan whitlow-grass	G2	S2		C

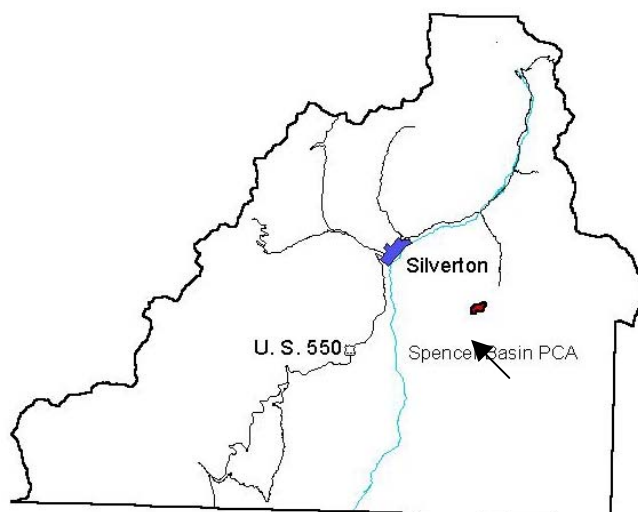
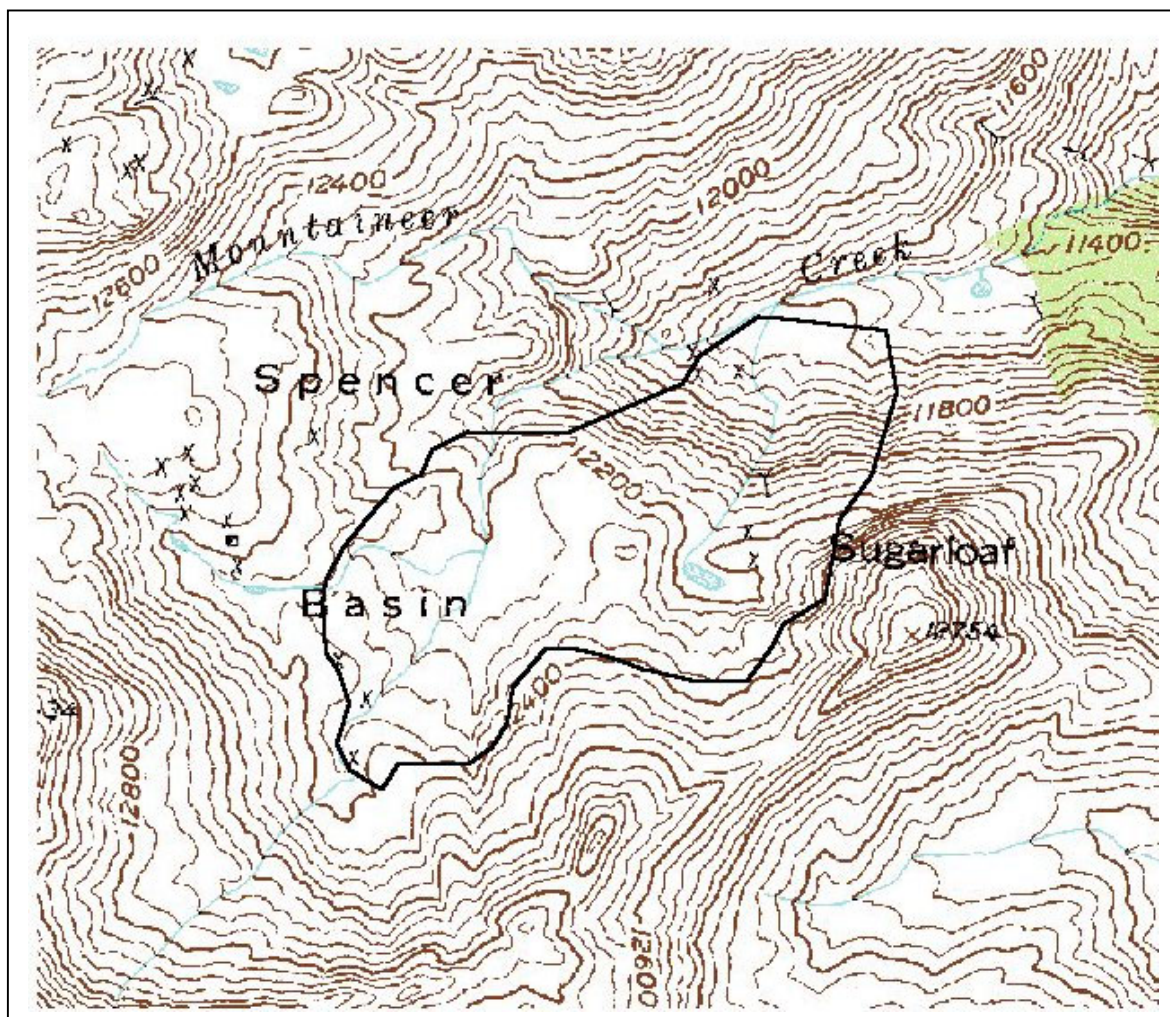
Biodiversity comments: The South Twilight Peak PCA supports a fair (C ranked) occurrence of San Juan whitlow-grass, a globally imperiled (G2) species.

Boundary Justification: The boundary is drawn to include the reported location of the occurrence, and some adjacent habitat above that is likely to be occupied but has not been surveyed.

Protection Rank Comments: The site is within the Weminuche Wilderness of the San Juan National Forest.

Management Rank Comments: Although there is a hiking trail in the area, the occurrence is not likely to be threatened by human disturbance.

Spencer Basin Potential Conservation Area



Location in San Juan County

Spencer Basin Potential Conservation Area

Biodiversity Rank: B5 General biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: M3 New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.

Location: San Juan County, northwest of Sugarloaf Mountain, about 4.3 air miles southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Howardsville. T41N R7W Sections 25 and 36

Size: 49 acres

Elevation: 11,600 ft. to 12,280 ft.

General Description: Spencer Basin is located in a large glacial cirque, with extensive wetlands and several small ponds. Rocks in the area consist of pre-ashflow andesitic lavas. Soils are mapped as Whitecross-Rock outcrop complex, 45 to 75 percent slopes. These are described as a complex of shallow or very shallow, well drained soils and rock outcrop on alpine valley floors, mountain slopes and ridges, formed in colluvium and slope alluvium derived from rhyolite, tuff and other volcanic rocks.

The PCA is accessed by a hiking trail beginning at the Highland Mary mine. Sugarloaf Mountain at 12,754 ft. is located just to the southeast of the PCA. Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*) was growing along snowmelt rivulets, in association with marsh marigold (*Caltha leptosepala*), elephant head (*Pedicularis groenlandica*), tufted hairgrass (*Deschampsia cespitosa*), and native sedge (*Carex vernacula*).

Natural Heritage element occurrences at the Spencer Basin PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3	S-FS	A

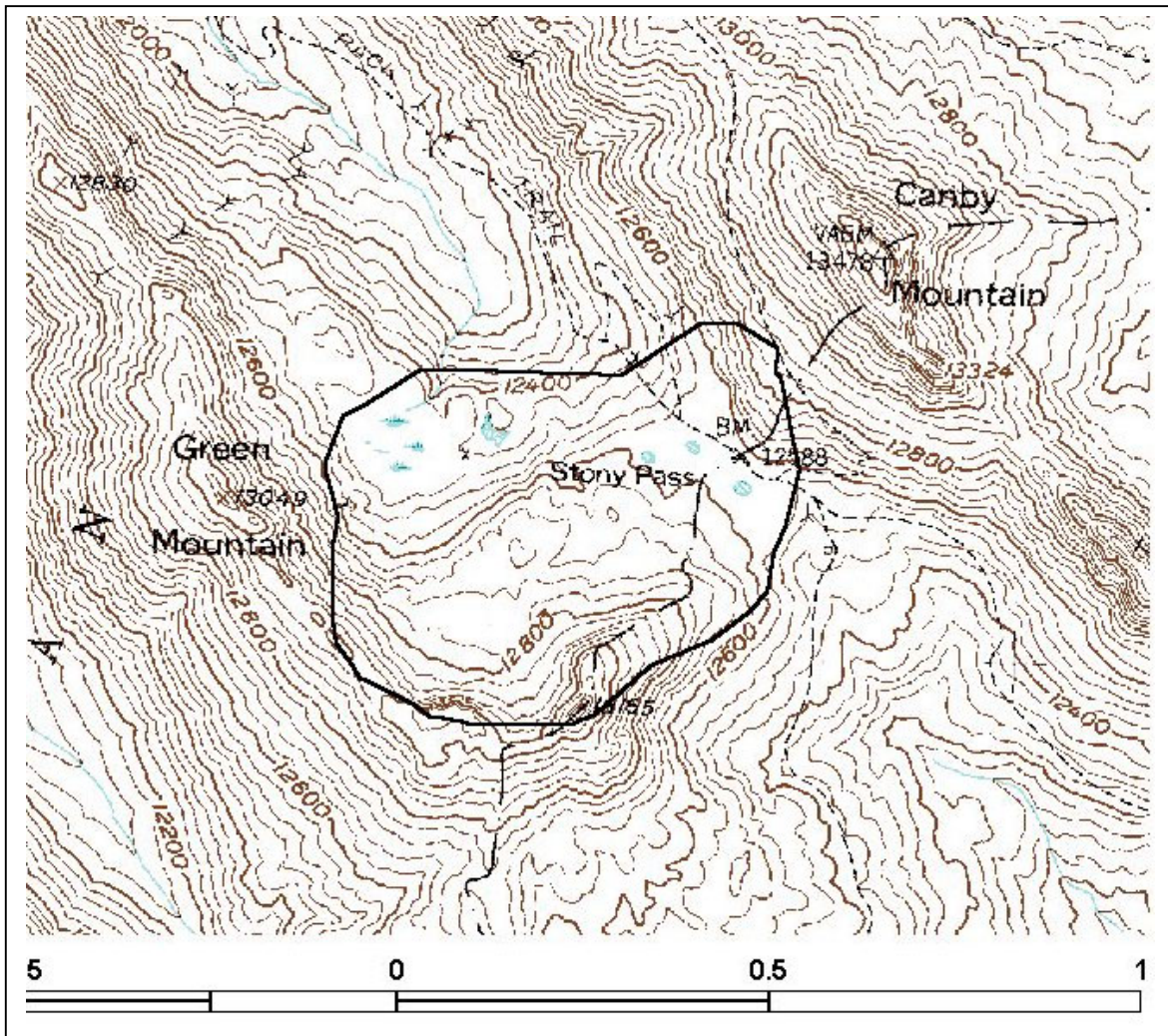
Biodiversity comments: The Spencer Basin PCA supports an excellent (A ranked) occurrence of Altai cottongrass, a subspecies that is listed as sensitive by the U.S. Forest Service.

Boundary Justification: The boundary is drawn to include the occurrence of Altai cottongrass, along with some area above it that provides the moisture from snowmelt to support the occurrence.

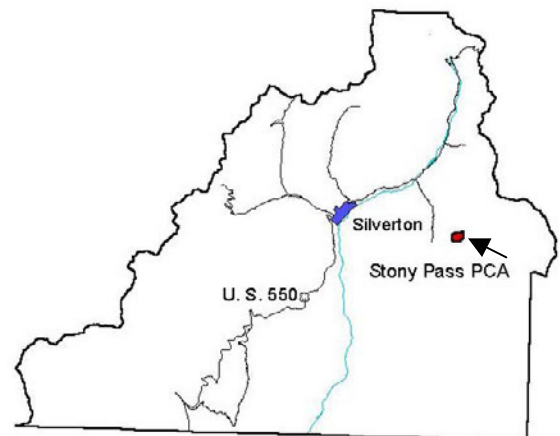
Protection Rank Comments: The site is primarily on BLM land, with some private mining claim inclusions.

Management Rank Comments: The PCA itself is pristine. A nearby mine has created some disturbed soil, and Canada thistle (*Cirsium arvense*) was found along the trail to the basin.

Stony Pass Potential Conservation Area



Habitat of Colorado Divide whitlow-grass (*Draba streptobrachia*) and thick-leaf whitlow-grass (*Draba crasssa*) at Stony Pass.



Location in San Juan County

Stony Pass Potential Conservation Area

Biodiversity Rank: B2 Very high biodiversity significance.

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, County Road 3, at Continental Divide, about 5.6 air miles east-southeast of Silverton.

Legal Description: U.S.G.S. quadrangle: Howardsville. T41N R6W Section 20.

Size: 114 acres

Elevation: 12,400 ft. to 13,165 ft.

General Description: Stony Pass is located on the Continental Divide, between the watersheds of the Animas and Rio Grande rivers. The PCA is in the northern portion of the Silverton Caldera, situated on andesitic lavas, igneous rocks containing a high level of feldspar, deposited during the Tertiary Period. Soils are mapped as the Telluride-Rock outcrop complex, described as shallow, well drained soils and rock outcrop of valley floors, mountain slopes and ridges, formed in slope alluvium and colluvium weathered from rhyolite, tuff and similar volcanic rocks (USDA 2003).

The site is flanked by Green Mountain on the west and Canby Mountain on the east. The area has a mosaic of wetlands, small ponds, rocky outcrops and talus slopes. Alpine vegetation on the hillsides includes a high diversity of species, including alpine avens (*Geum rossii*), alpine sagebrush (*Artemisia scopulorum*), paintbrush (*Castilleja sulphurea*), alpine fescue (*Festuca brachyphylla*), purple fringe (*Phacelia sericea*), blackroot sedge (*Carex elynoides*), old-man-of-the-mountain (*Rydbergia grandiflora*), false strawberry (*Sibbaldia procumbens*), snow willow (*Salix reticulata* ssp. *nivalis*), and arctic willow (*S. arctica*). Two rare species of *Draba*, Colorado Divide whitlow-grass and thick leaf whitlow-grass (*D. streptobrachia* and *D. crassa*), were found in shallow soils and in crevices of rock outcrops south of the county road. They were associated with alpine smelowskia (*Smelowskia calycina*), Holm's ragwort (*Ligularia holmii*) and sticky polemonium (*Polemonium viscosum*). These species prefer broken rock outcrops, rather than solid rock or talus. There is a large amount of additional potential habitat for these species in the area that has not been thoroughly searched. Rothrock townsendia (*Townsendia rothrockii*) was found on barren shale on the sides of a naturally eroded gully that appears to retain snow late in the season. Arctic draba (*Draba fladnizensis*)

was reported from the site in 1983, growing in a rock-strewn meadow below the talus of Green Mountain. It was not re-located in 2002, possibly because of drought conditions.

Natural Heritage element occurrences at the Stony Pass PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Townsendia rothrockii</i>	Rothrock townsendia	G2	S2		B
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3		C
<i>Draba crassa</i>	Thick-leaf whitlow-grass	G3	S3		C
<i>Draba fladnizensis</i>	Arctic draba	G4	S2S3		E

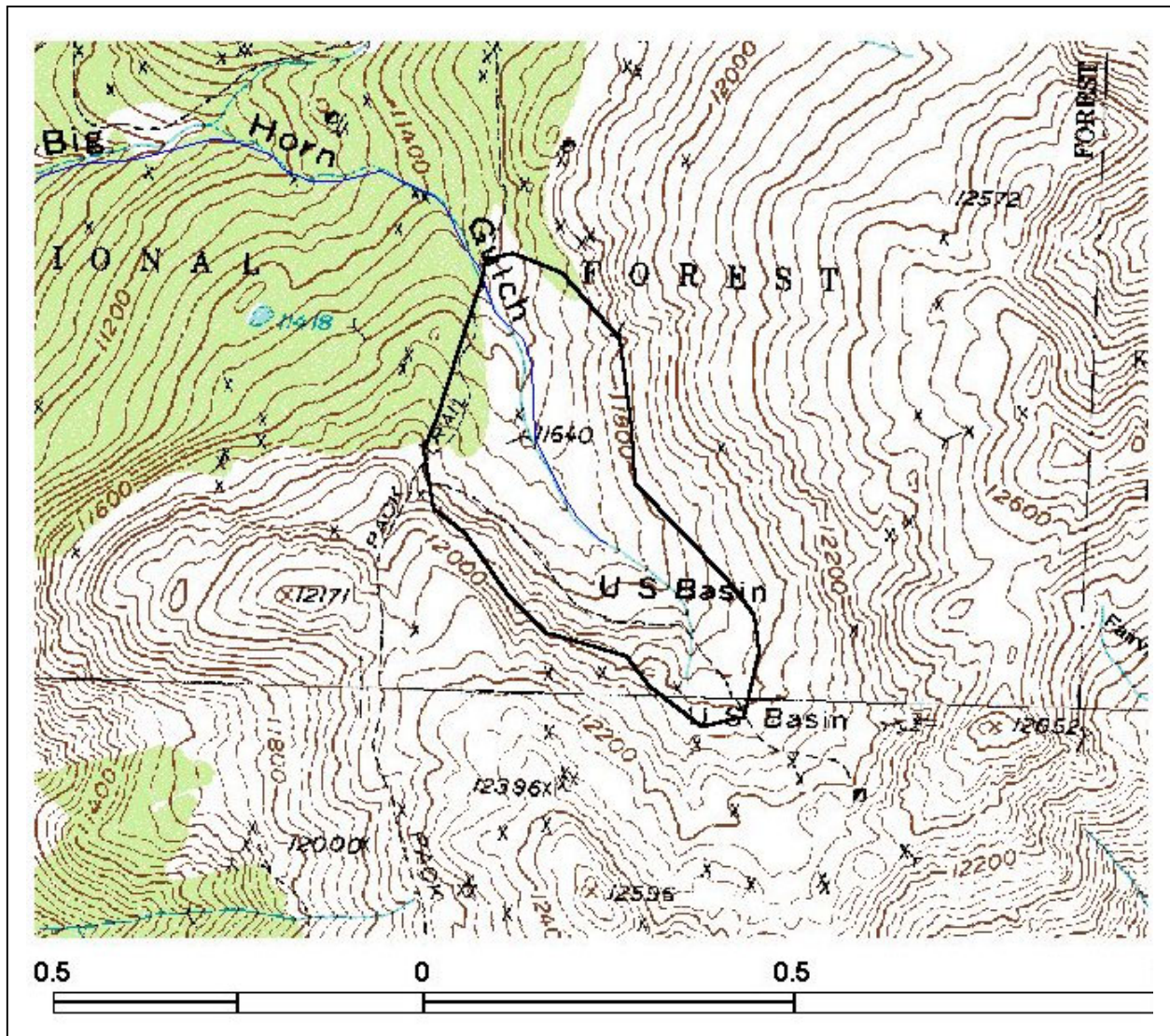
Biodiversity comments: The Stony Pass PCA supports a good (B ranked) occurrence of Rothrock townsendia, and plant that is globally imperiled (G2). There are also fair (C ranked) occurrences of Colorado Divide whitlow-grass and thick-leaf whitlow-grass, both globally vulnerable (G3) species. The occurrence of Arctic draba was reported in 1983 and not ranked (E); however the recollection of the collectors is that it was a small population (Hartman, personal communication). It was not located in 2002.

Boundary Justification: The boundary is drawn to include three rare plant occurrences and the area upslope that provides the moisture from melting snow on which they depend.

Protection Rank Comments: The PCA is primarily on BLM land, with a small amount of private mining claims and Rio Grande National Forest.

Management Rank Comments: The area is a popular stop for 4-wheel drive enthusiasts, and there is some disturbance near the road. However, no exotic species were noted, and the occurrences are located off the well-traveled foot trails.

U. S. Basin Potential Conservation Area



Location in San Juan County

View to west from U. S. Basin PCA, San Juan County Road 14.

U. S. Basin Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P3 Protection actions may be needed, but probably not within the next 5 years. Future plans for private land in the site are not known. There is currently no special protection for the area.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Alpine Loop, County Road 14, about 5 air miles north-northwest of Silverton

Legal Description: U.S.G.S. 7.5 minute quadrangle: Ironton, Silverton. T42N R8W Sections 23-25

Size: 91 acres

Elevation: 11,600 ft. to 12,000 ft.

General Description: This PCA can be accessed from County Road 14, which runs parallel to and east of Highway 550 between Red Mountain Pass and Chattanooga Iron Fen. The PCA is in the northern portion of the Silverton Caldera, composed of andesitic lavas and ashflows from the Tertiary volcanic period. Soils are mapped as Moran very gravelly loam, 10 to 30 percent slopes, a very deep, well drained soil on alpine valley fills and mountain slopes, formed in colluvium and slope alluvium derived from rhyolite (USDA 2003).

The site comprises the headwaters of Big Horn Gulch, and includes grassy tundra and wetland vegetation. A wetland plant community dominated by native sedge (*Carex vernacula*) occurs at the summit of the county road. Associated species are marsh marigold (*Caltha leptosepala*) and tufted hairgrass (*Deschampsia cespitosa*).

Natural Heritage element occurrences at the U. S. Basin PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Carex vernacula</i>	Alpine wetlands	GU	SU		B

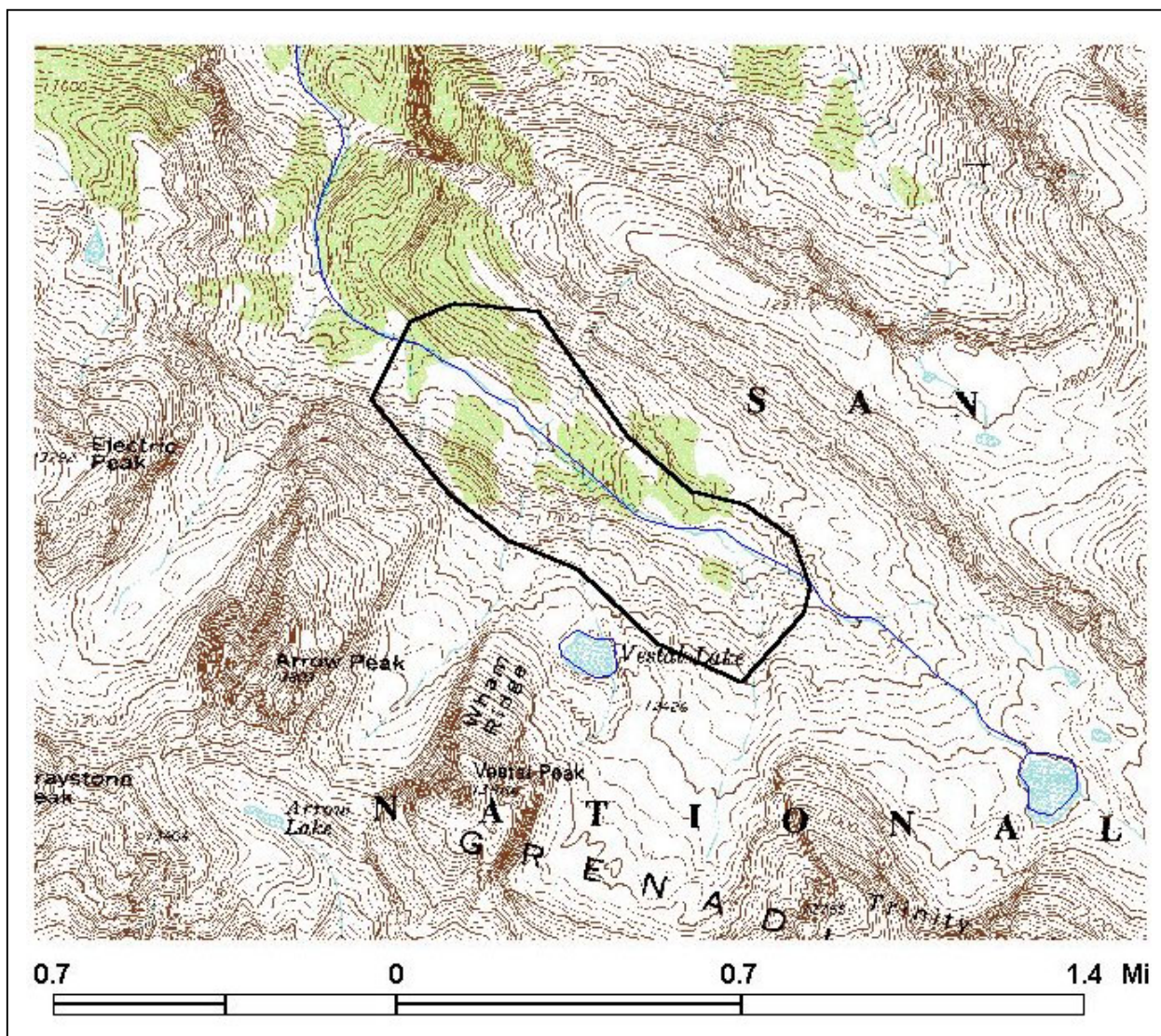
Biodiversity comments: This PCA supports a good (B ranked) occurrence of alpine wetlands (*Carex vernacula*), a plant community for which more information is needed before a rank can be assigned. The community has been documented only five times, all in Colorado. However, more research may prove it to be more common and widespread than is now known.

Boundary Justification: The boundary is drawn to include the alpine wetland community and some upslope area that supplies the moisture to support this community.

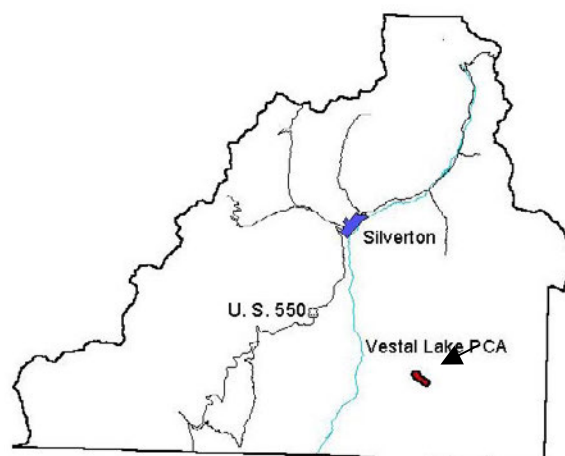
Protection Rank Comments: The PCA is within the San Juan National Forest, and contains one mining claim.

Management Rank Comments: The area is just off a county road that is popular for recreation. A few common dandelions (*Taraxacum officinale*) were found in the site near the road.

Vestal Lake Potential Conservation Area



Marsh marigold (*Caltha leptosepala*) is an important component of wetland communities at the Vestal Lake PCA.



Location in San Juan County

Vestal Lake Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: M5 No serious management needs are known or anticipated.

Location: San Juan County, Elk Creek headwaters, Weminuche Wilderness, San Juan National Forest, about 8 air miles south-southeast of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Storm King Peak. T40N R7W Sections 25, 26, 35 and 36

Size: 195 acres

Elevation: 11,400 ft. to 12,200 ft.

General Description: This PCA is located in the Grenadier Range, north of Vestal Lake along a tributary of Elk Creek (un-named on maps, but could be called South Fork Elk Creek). It lies on Precambrian rocks of the Uncompahgre Formation. To the south of the PCA are several high peaks, including Vestal Peak, Trinity Peaks, Arrow Peak, Electric Peak, and Graystone Peak. The subalpine willow carr was surveyed as part of the CNHP riparian survey of 1994. The drainage from Vestal Lake runs from several small lakes, between very sharp, barren rock with 13,800 ft. peaks on the south and a 12,900 ft. ridge on the north. Lower slopes are clothed with spruce and fir. Wider areas of the valley bottom contain an alpine willow carr community (*Salix planifolia*/*Caltha leptosepala*), with shrub cover of planeleaf willow estimated at 100%. Forb cover was 70%, and included marsh marigold (*Caltha leptosepala*), arrowleaf ragwort (*Senecio triangularis*), chiming bells (*Mertensia ciliata*), larkspur (*Delphinium barbeyi*), and bittercress (*Cardamine cordifolia*). Reedgrass (*Calamagrostis canadensis*) was the major graminoid present with 30% cover. Farther upstream, where the drainage is narrower, the community shifts from willows to sedges and forbs, although some willows are still present at about 20% cover. Here, forbs include marsh marigold as the dominant species, with narrow-leaf cottongrass (*Eriophorum angustifolium*), rock sedge (*Carex saxatilis*), reedgrass, sheepsedge (*Carex illota*), boreal bog sedge (*C. magellanica*) and alpine fescue (*Festuca brachyphylla*). Mosses account for 63% cover beneath the vascular plants.

Natural Heritage element occurrences at the Vestal Lake PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Salix planifolia/Caltha leptosepala</i>	Subalpine riparian willow carr	G4	S4		A
<i>Caltha leptosepala</i>	Montane wet meadows	G4	S4		A

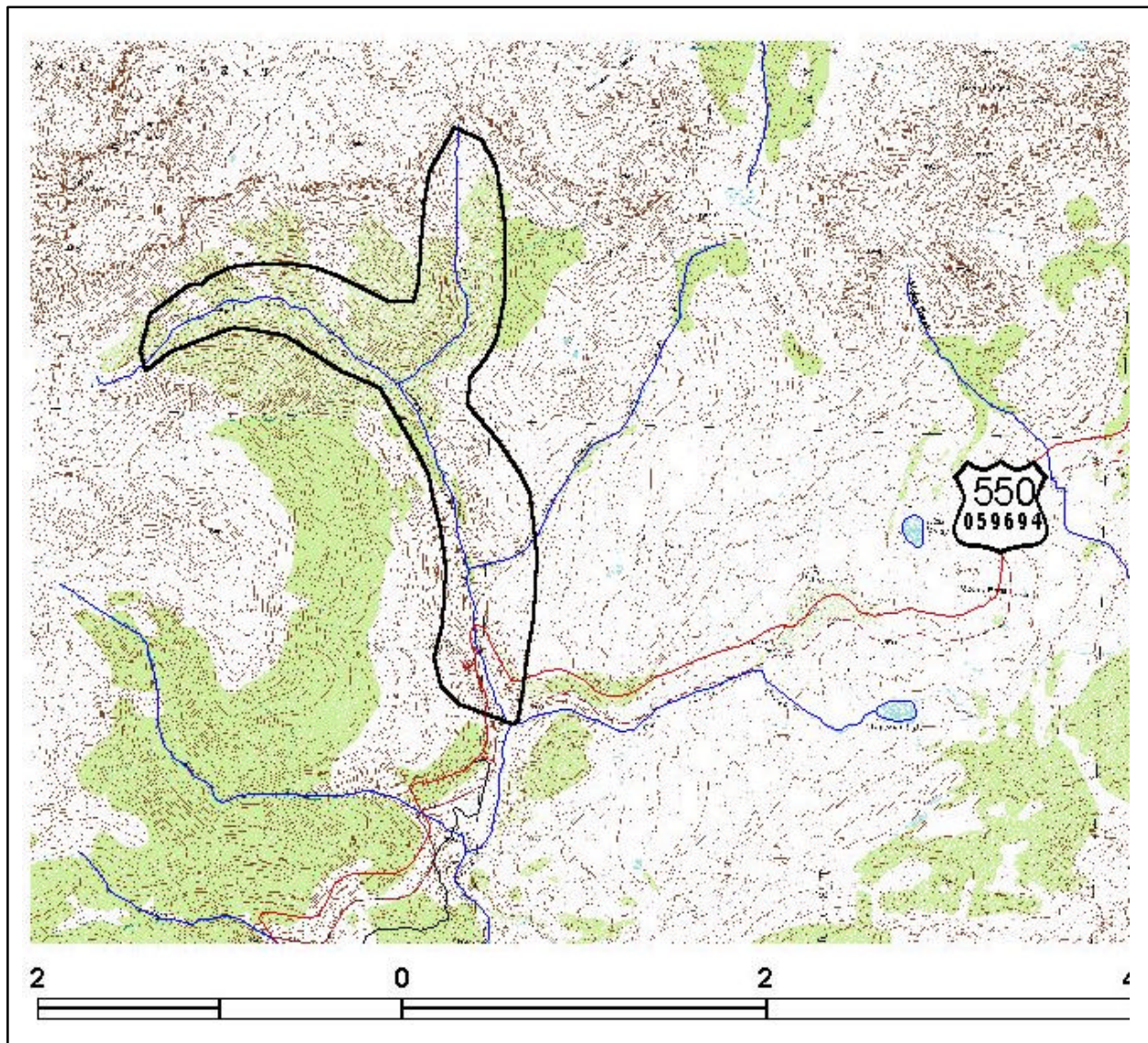
Biodiversity comments: The Vestal Lake PCA supports excellent (A ranked) occurrences of two globally common (G4) wetland plant communities. Both communities are typical of the vegetation along mountain streams in the area. High quality occurrences such as these can provide excellent reference areas.

Boundary Justification: The boundary is drawn to include the two high quality plant communities along the creek, and a small amount of the valley sides that drain into the creek that can affect water quality and siltation.

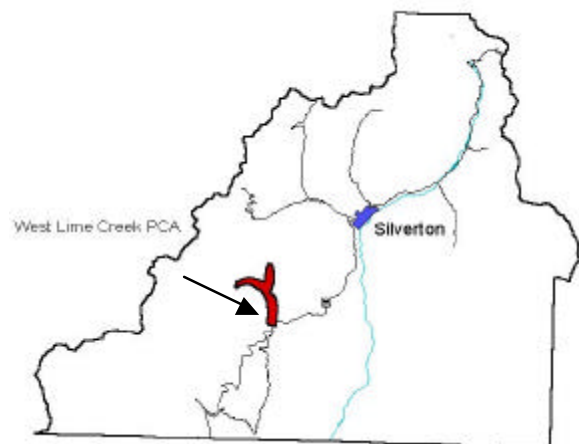
Protection Rank Comments: The PCA is entirely within the Weminuche Wilderness of the San Juan National Forest.

Management Rank Comments: The area was found to be in pristine condition. An unofficial trail receives little use, and impacts are minimal. No exotic species were noted.

West Lime Creek Potential Conservation Area



Steep hillside with Thurber fescue (*Festuca thurberi*) at West Lime Creek



Location in San Juan County

West Lime Creek Potential Conservation Area

Biodiversity Rank: B4 Moderate biodiversity significance

Protection Urgency Rank: P4 No protection actions are needed in the foreseeable future.

Management Urgency Rank: 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 quality of the element occurrences.

Location: San Juan County, Lime Creek drainage, about 6 air miles southwest of Silverton.

Legal Description: U.S.G.S. 7.5 minute quadrangle: Engineer Mountain, Snowdon Peak, Ophir. T40N R8W Sections 5, 7, 9, 16 and 21

Size: 610 acres

Elevation: 10,000 ft. to 11,400 ft.

General Description: The West Lime Creek PCA is located northwest of Highway 550 at the first major switchback south of Molas Pass. The creek is in excellent condition, with a series of small waterfalls and beautiful pools. The valley bottom is lined with montane forests of spruce and aspen, with a shrubby understory of twinberry honeysuckle (*Lonicera involucrata*), cow parsnip (*Heracleum lanatum*) and gooseberry currant (*Ribes montigenum*). More open riparian areas are dominated by mountain willow (*Salix monticola*) and Drummond willow (*Salix drummondiana*). South and west facing hillsides above the creek have an excellent example of montane grassland dominated by Thurber fescue (*Festuca thurburi*). This community is the major grass-dominated type in San Juan County, and occurs in a mosaic with aspen and mixed conifer forests throughout much of the county. Associated species here include fringed brome (*Bromus ciliatus*), cinquefoil (*Potentilla pulcherrima*), strawberry (*Fragaria virginiana*), tall fleabane (*Erigeron elatior*), Richardson's geranium (*Geranium richardsonii*), valerian (*Valeriana edulis*), and meadowrue (*Thalictrum fendleri*). Kittentails (*Besseyia ritteriana*), a San Juan endemic rare plant was found at the base of these grassy slopes as well as in more moist areas upstream. Seeps in the south facing hillside support another rare plant, variegated scouring rush (*Hippochaete variegata*), along with shortfruit willow (*Salix brachycarpa*), grass-of-Parnassus (*Parnassia fimbriata*), fringed gentian (*Gentianopsis thermalis*), star gentian (*Swertia perenne*), shrubby cinquefoil (*Potentilla fruticosa*), subalpine rush (*Juncus mertensianus*), golden sedge (*Carex aurea*), rush (*Juncus longistylis*), and nodding bluegrass (*Poa reflexa*).

Natural Heritage element occurrences at the West Lime Creek PCA

Scientific Name	Common name	Global rank	State rank	State/Federal status	Element occurrence rank
<i>Besseyia ritteriana</i>	Kittentails	G3	S3		C
<i>Hippochaete variegata</i>	Variegated scouring rush	G5	S1		B
<i>Festuca thurberi-Lathyrus leucanthus</i>	Montane grasslands	G4	S4		A
<i>Eriophorum altaicum</i> var. <i>noeageum</i>	Altai cottongrass	G4?T3T4	S3		E
<i>Cryptogramma stelleri</i>	Slender rock-brake	G5	S2	S-FS	E

Biodiversity comments: The West Lime Creek PCA supports a fair (C ranked) occurrence of kittentails, a San Juan endemic plant that is globally vulnerable (G3). Other occurrences included in the site are a good (B ranked) population of variegated scouring rush, a species that is globally secure (G5) but extremely rare (S1) in Colorado; a globally common but state imperiled (S2) population of slender rock-brake (*Cryptogramma stelleri*); and an unranked (E) occurrence of Altai cottongrass, a species that is listed as sensitive by the U.S. Forest Service.

Boundary Justification: The boundary is drawn to include a variety of occurrences of plant species and communities in the riparian zone and adjacent hillsides of West Lime Creek. The integrity of all of these occurrences is tied to the supply of moisture from upslope areas.

Protection Rank Comments: The PCA is in the San Juan National Forest and on State Land Board property.

Management Rank Comments: The PCA receives minimal use. The only non-native plants observed were some common dandelion (*Taraxacum officinale*).

References

- Alexander, Robert R.; Shearer, Raymond C.; Shepperd, Wayne D. 1984. Silvical characteristics of subalpine fir. Gen. Tech. Rep. RM-115. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 29 p. [7479]
- American Ornithologists' Union (AOU), Committee on Classification and Nomenclature. 1983. Check-list of North American Birds. Sixth Edition. American Ornithologists' Union, Allen Press, Inc., Lawrence, Kansas.
- Aplet, G.H., R.D. Laven, and F.W. Smith. 1988. Patterns of community dynamics in Colorado Engelmann spruce-subalpine fir forests. *Ecology* 69:312-319.
- Bailey, R. G., P. E. Avers, T. King, and W. H. McNab. 1994. Ecoregions and Subregions of the United States. Prepared for the USDA Forest Service by the U. S. Geological Survey, Fort Collins, CO.
- Baker, William L. 1984. A preliminary classification of the natural vegetation of Colorado. *The Great Basin Naturalist*. 44(4): 647-676. [380]
- Baker, W.L. 1989. Classification of the riparian vegetation of the montane and subalpine zones in western Colorado. *Great Basin Naturalist* 49(2):214-228.
- Beetle, Alan A. 1961. Range survey in Teton County, Wyoming. Part 1. Ecology of range resources. Bull. 376. Laramie, WY: University of Wyoming, Agricultural Experiment Station. 42 p. [417]
- Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6. xx + 275 pp.
- Blair, Rob, (ed.), with Tom Ann Casey, William H. Romme and Richard N. Ellis, technical editors. 1996. The Western San Juan Mountains, Their Geology, Ecology, and Human History. University Press of Colorado, Fort Lewis College Foundation.
- Bourgeron, P.S. and L.D. Engelking, eds. 1994. A preliminary vegetation classification of the western United States. Western Heritage Task Force, The Nature Conservancy, Boulder, CO.
- Boyle, S. 1998. Black Swift. In Colorado Breeding Bird Atlas, H. E. Kingery ed. Colorado Bird Atlas Partnership; co-published by Colorado Division of Wildlife.
- Bridges, D. 1992. Relative abundance of owls in Colorado. *Journal of Colorado Field Ornithology* 26: 27-28.

- Carsey, K., J. Coles, K. Decker, and R. Fenwick. 1999. Identification and evaluation of wetlands of statewide significance in Colorado. Report prepared for the Department of Natural Resources, Denver, CO. by Colorado Natural Areas Program, Denver, CO.
- Chronic, H. 1980. Roadside Geology of Colorado. Mountain Press Publ., Missoula, MT. 344 pp.
- Church, S.E., B.A. Kimball, D.L. Fey, D.A. Ferdener. T.J. Yager, and R.B. Vaughn. 1997. Source, Transport, and Partitioning of metals between Water, Colloids, and Bed Sediments of the Animas River, Colorado, U.S. Geological Survey Open File Report 97-151.
- Colorado Counties online. 2003. <http://www.ccionline.org/counties/sanjuan.html>
- Colorado Division of Wildlife. 1986. Colorado Stream Data Bank, Second Edition. December 1986. Colorado Division of Wildlife, Denver.
- Colorado Division of Wildlife, U. S. Forest Service, National Park Service, U. S. Fish and Wildlife Service, New Mexico Game and Fish Department, and Wyoming Game and Fish Department. 1997. Draft Strategy for the Conservation and Reestablishment of Lynx and Wolverine in the Southern Rocky Mountains.
- Colorado Natural Areas Program. 1999. See Carsey *et al.* above.
- Colorado Natural Heritage Program (CNHP). 2003. Biological and Conservation Data (BCD) System. Colorado Natural Heritage Program, CSU, Fort Collins, CO.
- Cooper, D.J. 1986. Ecological studies of wetland vegetation, Cross Creek Valley, Holy Cross Wilderness Area, Sawatch Range, Colorado. Holy Cross Wilderness Defense Fund, Technical Report No. 2. 24 pp.
- Cooper, D.J. 1993. Wetlands of the Crested Butte region: mapping, functional evaluation, and hydrological regime. Report submitted to the town of Crested Butte and the Environmental Protection Agency, Region VIII, Denver, CO.
- Cooper, D.J. and T.R. Cottrell. 1990. Classification of riparian vegetation in the northern Colorado Front Range. Unpublished report to The Nature Conservancy, Colorado Field Office, Boulder, CO. 115 pp.
- Cooper, S.V., P. Lesica, and D. Page-Dumroese. 1997. Plant Community Classification for Alpine Vegetation on the Beaverhead National Forest, Montana. USDA Forest Service General Technical Report INT-362. Intermountain Research Station, Ogden, UT.
- Cronquist, A., A. H. Holmgren, N. H. Holmgren, and J. L. Reveal. 1972. Intermountain Flora; Vascular Plants of the Intermountain West, U.S.A., Volume 1. Hafner Publishing Co., Inc., New York.

- Cronquist, A., A. H. Holmgren, N. H. Holmgren, and J. L. Reveal. 1972. Intermountain Flora; Vascular Plants of the Intermountain West, U.S.A., Volume 1. Hafner Publishing Co., Inc., New York.
- Cronquist, A., A. H. Holmgren, N. H. Holmgren, J. L. Reveal, and P. K. Holmgren. 1977. Intermountain Flora; Vascular Plants of the Intermountain West, U.S.A., Volume 6. Hafner Publishing Co., Inc., New York.
- Cronquist, A., A. H. Holmgren, N. H. Holmgren, J. L. Reveal, and P. K. Holmgren. 1984. Intermountain Flora; Vascular Plants of the Intermountain West, U.S.A., Volume 4. Hafner Publishing Co., Inc., New York.
- Cronquist, A., A. H. Holmgren, N. H. Holmgren, J. L. Reveal, and P. K. Holmgren. 1989. Intermountain Flora; Vascular Plants of the Intermountain West, U.S.A., Volume 3. Hafner Publishing Co., Inc., New York.
- Durkin, P., M. Bradley, E. Muldavin, and P. Mehlhop. 1994. A riparian/wetland vegetation community classification of New Mexico: Pecos River Basin, Volume I. Report to the New Mexico Environment Department, Surface Water Quality Bureau. NM.
- Ellingson, Aaron. Colorado State University. Personal communication.
- FEIS. Fire Effects Information Services. Fire Effects Information System [Online] (2003). Prescribed Fire and Fire Effects Research Work Unit, Rocky Mountain Research Station (producer). Available: www.FEIS.
- Foerster, K. S. and C. T. Collins. 1990. Breeding distribution of the black swift in southern California. W. Birds 21:1-9.
- Glick, Barry. <http://www.gardenweb.com/cyberplt/plants/trautvet.html>
- Girard, M., D.L. Wheeler, and S.B. Mills. 1995. Classification of riparian communities on the Bighorn National Forest. USDA Forest Service draft manuscript. Rocky Mountain Region, Lakewood, CO.
- Hale, Alan. 2003. Mosses and Liverworts in Wales. <http://home.clara.net/adhale/bryos/index.htm>
- Hansen, P.L., R.D. Pfister, K. Boggs, B.J. Cook, J. Joy, and D.K. Hinckley. 1995. Classification and Management of Montana's Riparian and Wetland Sites. Montana Forest and Conservation Experiment Station Miscellaneous Publication No. 54. The University of Montana, Missoula, MT. 646 pp. + Posters
- Hansen, P.L., S.W. Chadde, and R.D. Pfister. 1988. Riparian dominance types of Montana. University of Montana Miscellaneous Publication 49. Montana Forest and Conservation Experiment Station. Missoula, MT. 411 pp.

- Hartman, Emily. Personal communication.
- Hayward, G. D. and P. H. Hayward. 1993. Boreal Owl (*Aegolius funereus*). In, The Birds of North America, No. 63, A. Poole and F. Gill, (eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.
- Henderson, Jan A. 1982. Ecology of subalpine fir. In: Oliver, Chadwick Dearing; Kenady, Reid M., eds. Proceedings of the biology and management of true fir in the Pacific Northwest symposium; 1981 February 24-26; Seattle-Tacoma, WA. Contribution No. 45. Seattle, WA: University of Washington, College of Forest Resources: 53-58. [6759]
- Hermann, F.J. 1970. Manual of the Carices of the Rocky Mountains and Colorado Basin. Agriculture Handbook No. 374. USDA Forest Service, Washington, DC.
- Hitchcock, C. Leo; Cronquist, Arthur. 1973. Flora of the Pacific Northwest. Seattle, WA: University of Washington Press. 730 p. [1168]
- Hitchcock, C. Leo; Cronquist, Arthur; Ownbey, Marion. 1969. Vascular plants of the Pacific Northwest. Part 1: Vascular cryptograms, gymnosperms, and monocotyledons. Seattle, WA: University of Washington Press. 914 p. [1169]
- Hogan, Tim. Personal communication.
- . 1997. Draft Ecological Evaluation for the Needle Mountains.
- Johnston, B.C. 1987. Plant Associations of Region Two. 4th ed. USDA Forest Service R2-ECOL-87-02. Rocky Mountain Region, Lakewood, CO. 429 pp.
- Jones, G.P. and G.M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Report submitted to the Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database (The Nature Conservancy), Laramie, WY.
- Kettler, S. and A. McMullen. 1996. Routt National Forest riparian vegetation classification. Report submitted to Routt National Forest. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Kittel, G.M, E. VanWie and M. Damm. 1997. A classification of the riparian vegetation of the South Platte River Basin (and part of Republican River Basin), Colorado. Report by Colorado Natural Heritage Program, Fort Collins, CO to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Denver, CO.

- Kittel, G.M. 1994. Montane riparian vegetation in relation to elevation and geomorphology along the Cache la Poudre River, Colorado. Thesis. University of Wyoming, Laramie, WY.
- Kittel, Gwen and Susan Spackman. 1994. Riparian Field Survey of the Colorado Basin.
- Knorr, O. A., and M. S. Knorr. 1990. The black swift in the Chiricahua Mountains of Arizona. *Southwest Nat.* 35:559-560.
- Knorr, O. A. 1961. The Geographical and Ecological Distribution of the Black Swift in Colorado. *The Wilson Bulletin*, 73(2):155-170. Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder, CO. 655 pp.
- Komarkova, Vera. 1986. Habitat types on selected parts of the Gunnison and Uncompahgre National Forests. Final Report Contract No. 28-K2-234. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 270 p. [1369]
- Koterba, Wayne D. 1967. An analysis of the North Fork valley grasslands in Glacier National Park, Montana. Missoula, MT: University of Montana. 81 p. Thesis. [29855]
- Koterba, Wayne D.; Habeck, James R. 1971. Grasslands of the North Fork Valley, Glacier National Park, Montana. *Canadian Journal of Botany*. 49: 1627-1636. [6401]
- Kovalchik, B.L. 1987. Riparian Zone Associations, Deschutes, Ochoco, Fremont, and Winema National Forests. USDA Forest Service Technical Paper R6 ECOL-TP-279-87. Pacific Northwest Region, Bend, OR. 171 pp.
- Kovalchik, B.L. and W. Elmore. 1992. Effects of cattle grazing systems on willow-dominated plant associations in central Oregon. In W.P. Clary, E.D. McArthur, D. Bedunah, and C.L. Wambolt, compilers. *Proceedings-Symposium on Ecology and Management of Riparian Shrub Communities*, May 29-31, 1991, Sun Valley, ID. USDA Forest Service General Technical Report INT-289. Intermountain Forest & Range Experiment Station. Ogden, UT. 232 pp.
- Manning, M.E. and W.G. Padgett. 1995. Riparian Community Type Classification for Humboldt and Toiyabe National Forests, Nevada and Eastern California. USDA Forest Service R4-ECOL-95-01. Intermountain Region, Ogden, UT. 306 pp.
- Michael, C. M. 1927. Black Swift nesting in Yosemite National Park. *Condor* 29:89-97.
- Michener-Foote, Joan and Tim Hogan. 1997. The Flora and Vegetation of the Needle Mountains, San Juan Range, southwestern Colorado. *Natural History Inventory of Colorado*, No. 18. University of Colorado Museum, Boulder, Colorado.

- Moseley, Robert K.; Bernatas, Susan. 1992. Vascular flora of Kane Lake Cirque, Pioneer Mountains, Idaho. *The Great Basin Naturalist*. 52(4): 335-343. [20212]
- NatureServe: An online encyclopedia of life [web application]. 2000. Version 1.1 . Arlington, Virginia, USA: Association for Biodiversity Information. Available: <http://www.natureserve.org/>.
- Neely, B., P. Comer, C. Moritz, M. Lammert, R. Rondeau, C. Pague, G. Bell, H. Copeland, J. Humke, S. Spackman, T. Schulz, D. Theobald, and L. Valutis. 2001 Southern Rocky Mountains ecoregion: an ecoregional assessment and conservation blueprint. The Nature Conservancy of Colorado, Boulder CO.
- NVC 2001. National Vegetation Classification in NatureServe: An online encyclopedia of life [web application version 1.4]. Arlington, Virginia, USA: Association for Biodiversity Information. <http://www.natureserve.org/> . (Accessed after March 2001 data update).
- Padgett, W.G., A.P. Youngblood, and A.H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region, Report R4-ECOL-89-01. Ogden, UT. 191 pp.
- Peet, R.K. 1981. Forest vegetation of the Colorado Front Range: composition and dynamics. *Vegetatio* 45:3-75.
- Proebstel, D. S. 1994. Taxonomic Identification of Colorado River Cutthroat Trout (*Onocorhynchus clarki pleuriticus*) in Colorado--Draft report. Progress Report October 1994.
- Redders, Jeff. San Juan National Forest Ecologist. 2002. Personal communication.
- Richard, C., G. Kittel, and S. Kettler. 1996. A classification of the riparian vegetation of the San Juan National Forest. Draft 1 report to be submitted to the San Juan National Forest. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Rinne, J. R. 1995. Rio Grande cutthroat trout. Pages 24-27 in M. K. Young, technical editor. USDA Forest Service Gen. Tech. Rep. RM-GTR-256. iv + 61 pp.
- Rollins, Reed. 1993. *The Cruciferae of Continental North America*. Stanford University Press.
- Rondeau, Renee. 2001. Ecological System Viability Specifications for Southern Rocky Mountain Ecoregion. Colorado Natural Heritage Program, Fort Collins, CO

- Root, Robert A.; Habeck, James R. 1972. A study of high elevational grassland communities in western Montana. *The American Midland Naturalist*. 87(1): 109-121. [4005]
- Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski. 1994. The Scientific Basis for Conserving Forest Carnivores in the western United States. General technical report RM-254. U.S. Forest Service, Rocky Mountain Forest and Range Experimental Station, Fort Collins. 184 pp.
- Ryder, R. A. 1998. Boreal Owl. In, *Colorado Breeding Bird Atlas*, H.E. Kingery ed. Colorado Bird Atlas Partnership; co-published by Colorado Division of Wildlife.
- Sanderson, J. and S. Kettler. 1996. A preliminary wetland vegetation classification for a portion of Colorado's west slope. Report prepared for Colorado Department of Natural Resources, Denver, CO. and U.S. Environmental Protection Agency, Region VIII, Denver, CO. Colorado Natural Heritage Program, Fort Collins, CO. 243 pp.
- Schultz, Chris. 2002. San Juan National Forest. Unpublished research on black swift locations.
- personal communication, 2002.
- Simon, Bill. 2003. Animas River Stakeholders Group. Personal communication.
- Singer, Francis James. 1975. Wildfire and ungulates in the Glacier National Park area, northwestern Montana. Moscow, ID: University of Idaho. 53 p. Thesis.
- Spahr, R., L. Armstrong, D. Atwood, and M. Rath. 1991. Threatened, endangered, and sensitive species of the Intermountain Region. U.S. Forest Service, Ogden, Utah.
- Stiles, F. G., and A. J. Negret. 1994. The nonbreeding distribution of the black swift: a clue from Colombia and unsolved problems. *Condor* 96:1091-1094.
- Stubbendieck, James, S. Hatch and C. Butterfield. 1992. *North American Range Plants*, fourth edition. University of Nebraska Press, Lincoln NB and London.
- Stutz, Howard C.; Carlson, J.R. 1985. Genetic improvement of saltbush (*Atriplex*) and other chenopods. In: Carlson, Jack R.; McArthur, E. Durant, chairmen. *Range plant improvement in western North America: Proceedings of a symposium at the annual meeting of the Society for Range Management; 1985 February 14; Salt Lake City, UT. Denver, CO: Society for Range Management: 89-92. [2287]*
- Sublette, J. E., M. D Hatch, and M. Sublette. 1990. *The fishes of New Mexico*. University New Mexico Press, Albuquerque, New Mexico. 393 pp.

- The Nature Conservancy (TNC). 1992. Upper Colorado River Basin Bioreserve Strategic Plan. Unpublished report. Colorado Field Office, The Nature Conservancy, Boulder, CO.
- Uresk, Daniel W.; Lowrey, Dennis G. 1984. Cattle diets in the central Black Hills of South Dakota. In: Noble, Daniel L.; Winokur, Robert P., eds. Wooded draws: characteristics and values for the Northern Great Plains: Symposium proceedings; 1984 June 12-13; Rapid City, SD. Great Plains Agricultural Council Pub. No. 111. Rapid City, SD: South Dakota School of Mines and Technology: 50-52. [2400]
- USDA Soil Conservation Service. 2003. Soil Survey of San Juan National Forest. In progress.
- USDA, NRCS. 2003. The PLANTS database (<http://plants.usda.gov/plants>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA (for common names, distributions)
- USDI Bureau of Land Management. 2000. Abandoned Mine Lands-Upper Animas River Watershed. www.co.blm.gov/mines/upperanimas
- U. S. Fish and Wildlife Service. 14 September 1998. 90-day finding for a petition to list the Rio Grande cutthroat trout. Federal Register 63(177):49062-49063.
- USGS. 2000. Interim report on the scientific investigations in the Animas river watershed, Colorado, to facilitate remediation decisions by the U. S. Bureau of Land Management and the U.S. Forest Service, March 29, 2000 Meeting, Denver, Colo. Available at <http://pubs.usgs.gov/of/2000/ofr-00-0245/ofr-00-0245.pdf>.
- Vallentine, John F. 1961. Important Utah range grasses. Extension Circular
- Vander Kloet, S. P. 1988. The genus *Vaccinium* in North America. Publication 1828. Ottawa: Research Branch, Agriculture Canada. 201 p. [11436]
- Volland, Leonard A.; Dell, John D. 1981. Fire effects on Pacific Northwest forest and range vegetation. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Range Management and Aviation and Fire Management. 23 p. [2434]
- Young, M. K. 1995. Colorado River cutthroat trout. Pages 16-23 in M. K. Young, technical editor. Conservation assessment for inland cutthroat trout. USDA Forest Service Gen. Tech. Re. RM-GTR-256. iv + 61 pp.
- Young, M.K., Schmal, R. N., Kohley, T. W. and V.G. Leonard. 1996. Conservation status of Colorado River cutthroat trout. General Technical Report RM-GTR-

282. U.S. Forest Service, Rocky Mountain Forest and Range Experimental Station, Fort Collins. 32 pp.
- Weber, W. A. and R. C. Wittmann. 1992. Catalog of the Colorado Flora: A Biodiversity Baseline. University Press of Colorado, Niwot, Colorado.
- Weber, W.A. and R.C.Wittman. 1996. Colorado Flora: Western Slope. University Press of Colorado, Niwot, CO.
- Weber, William A., 2001. Rare Cryptogams in Colorado. Colorado Native Plant Society, unpublished document.
- Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. 1987. A Utah Flora. Brigham Young University, Provo UT
- Wilson, E. O. 1988. Biodiversity. National Academy Press, Washington D.C. 520 pp.
- Youngblood, A.P., W.G. Padgett, and A.H. Winward. 1985a. Riparian community type classification of eastern Idaho-western Wyoming. USDA Forest Service, Intermountain Region, R4-Ecol-85-01. Ogden, UT. 78 pp.

Appendix I. Species lists for selected areas in San Juan County. Note: Species tracked by CNHP are in bold type; non-native species are in italics.

Location List:

1. Coal Bank Pass
2. Red Mountain Pass
3. West Lime Creek
4. South Fork Mineral Creek at Rico-Silverton trailhead
5. South Fork Mineral Creek at beaver ponds below Bandora Mine
6. Clear Creek, at waterfall by South Mineral Creek Campground
7. Alpine Loop, CR 2, west of Silverton. (Species observed from road)
8. Placer Gulch, County Road 9, above Gold Prince Mine
9. Mineral Basin, Black Bear Road summit
10. Ophir Pass
11. South Mineral Creek at Porcupine Creek
12. Lime Creek, County Road 1, north end
13. Lake southeast of Scout Lake
14. Andrews Lake
15. Lower Ice Lake Basin
16. Upper Ice Lake Basin
17. Andrews Lake wetlands
18. Grand Turk
19. Coal Bank Pass
20. Andrews Lake West
21. Kendall Mountain
22. Stony Pass
23. Christ of the Mines Shrine
24. California Gulch
25. South Fork Cement Creek
26. Maggie Gulch
27. Chattanooga Fen
28. Lime Creek Rest Area
29. Hermosa Creek
30. Lake Hope Trail
31. Picayune Gulch
32. Red Mountain Number One
33. Little Green Falls
34. Relay Creek Road
35. Burns Gulch
36. Clear Lake

1. Coal Bank Pass

Moist east facing hillside, opening in spruce-fir forest, *Veratrum tenuipetalum* and *Ligusticum porteri* dominant.

USGS quadrangle: Engineer Mountain.

T40N R8W Sections 29, 30, 31, 32

Achillea lanulosa

Aconitum columbianum

Agoseris glauca

Arnica parryi

Astragalus alpinus

Besseyia ritteriana

Boechera drummondii

Bromus anomalus

Carex geyeri

Carex sp. coll

Castilleja miniata

Cirsium parryi

Dactylis glomerata

Descurainia incisa

Distegia involucrata

Draba spectabilis* var. *oxyloba

Dugaldia hoopsii

Elymus glaucus

Elymus trachycaulus

Epilobium angustifolium

Equisetum arvense

Erigeron coulteri

Erigeron elatior

Festuca thurberi

Fragaria virginiana

Frasera speciosa

Geranium richardsonii

Helianthella quinquenervis

Heliomeris multiflora

Heracleum lanatum

Heterotheca villosa

Ligularia amplexans

Ligularia bigelovii

Luzula parviflora

Mertensia ciliata

Nocca montana

Oxypholis fendleri

Pedicularis racemosa

Penstemon whippleanus
Phleum commutatum
Picea engelmannii
Poa alpina
Poa arctica
Polemonium pulcherrimum
Potentilla hippiana
Pseudocymopterus montanus
Ranunculus sp. coll
Rhodiola integrifolia
Ribes montigenum
Rumex sp.
Salix monticola
Senecio triangularis
Symphoricarpos oreophilus
Taraxacum officinale
Thalictrum fendleri
Trifolium repens

2. Red Mountain Pass

Wet meadow with *Salix planifolia* and *Caltha leptosepala*
USGS quadrangle: Ironton.
T42N R8W Section 14

Achillea lanulosa
Aconitum columbianum
Agoseris aurantiaca
Agrostis scabra
Allium geeyeri
Amerosedum (Sedum) lanceolatum
Anemone multifida
Angelica pinnata
Antennaria media
Anticlea elegans
Aquilegia coerulea
Arnica mollis
Besseyia ritteriana
Bistorta bistortoides
Boechera (Arabis) drummondii
Bromopsis (Bromus) lanatipes
Bromus inermis (along road only)
Caltha leptosepala
Cardamine cordifolia
Carex aquatilis

Carex microptera
Carex sp. coll
Carex utriculata
Castilleja miniata
Castilleja rhexifolia
Cirsium arvense (disturbance from irrigation ditch)
Clementsia (Sedum) rhodantha
Delphinium barbeyi
Deschampsia cespitosa
Descurainia incisa
Draba sp.
Draba streptocarpa
Dugaldia hoopsii
Elymus trachycaulus
Epilobium angustifolium
Epilobium hornemannii
Erigeron coulteri
Erigeron elatior
Erigeron peregrinus
Erigeron sp. coll.
Festuca brachyphylla
Festuca thurberi
Fragaria virginiana
Geranium richardsonii
Geum alpinum
Habeneria hyperborea
Helianthella quinquenervis
Heterotheca villosa
Heuchera parvifolia
Hydrophyllum fendleri
Juncus balticus
Juncus sp. coll (black)
Ligularia amplexans
Ligusticum porteri
Luzula parvifolia
Maianthemum stellatum
Mertensia ciliata
Micranthes odontoloma
Mimulus guttatus
Nocca montana
Oenothera sp.
Oreochrysum parryi
Oxypolis fendleri
Pedicularis bracteosa
Pedicularis groenlandica
Pedicularis racemosa

Penstemon whippleanus
Phacelia sericea
Picea engelmannii
Poa alpina
Polemonium pulcherrimum
Potentilla sp.
Primula parryi
Pseudocymopterus montanus
Ranunculus sp.
Rhodiola (Tolmachevia, Sedum) integrifolia
Ribes lacustre
Salix brachycarpa
Salix planifolia
Sambucus racemosa
Senecio crassulus
Senecio triangularis
Sibbaldia procumbens
Stellaria sp.
Taraxacum officinale
Thalictrum fendleri
Vaccinium myrtillus
Valerian capitata
Valeriana edulis
Veronica nutans
Vicia americana

2. West Lime Creek

Riparian woodland
U.S.G.S. Quadrangle: Engineer Mountain.
T40N R8W Sections 9 and 16.

Abies lasiocarpa
Agoseris aurantiaca
Anemone multifida
Aquilegia coerulea
Arnica cordifolia
Besseyia ritteriana
Bromus ciliatus
Carex aurea
Carex geyeri
Castilleja miniata
Cirsium parryi
Cystopteris fragilis
Distegia involucrata

Dugaldia hoopsii
Epilobium angustifolium
Erigeron coulteri
Erigeron elatior
Erigeron eximius
Erigeron subtrinervis
Festuca thurberi
Fragaria virginiana
Fraseria speciosa
Gentianella heterosepala
Gentianopsis thermalis
Geranium richardsonii
Heuchera parviflora
Hippochaete variegata
Juncus longistylis
Juncus mertensianus
Juniperus communis
Koeleria macrantha
Maianthemum stellatum
Oreochrysum parryi
Parnassia fimbriata
Picea engelmannii
Pneumonanthe parryi
Poa retrorsa
Polemonium pulcherrimum
Potentilla fruticosa
Potentilla pulcherrima
Pseudocymopterus montanus
Ribes montigenum
Ribes wolfii
Rubus ideaeus
Salix brachycarpa
Salix drummondiana
Salix monticola
Solidago simplex
Swertia perennis
Symphoricarpos oreophilus
Taraxacum officinale
Thalictrum fendleri
Valeriana edulis

4. South Fork Mineral Creek at Rico-Silverton trailhead

Wetland with Salix planifolia-Salix brachycarpa, Caltha leptosepala
U.S.G.S. Quadrangle: Ophir
T41N R9W Section 25

Achillea lanulosa
Acomastylis rossii
Allium geayeri
Angelica pinnata
Aquilegia coerulea
Arabis drummondii
Caltha leptosepala
Cardamine cordifolia
Castilleja rhexifolia
Clementsia rhodantha
Descurainia incisa
Distegia involucrata
Dugaldia hoopsii
Erigeron peregrinus
Erigeron sp. coll
Fragaria virginiana
Geranium richardsonii
Luzula parviflora
Mertensia ciliata
Oxypolis fendleri
Pedicularis groenlandica
Picea engelmannii
Polemonium pulcherrimum
Potentilla sp.
Pseudocymopterus montanus
Rhodiola integrifolia
Ribes sp.
Salix drummondiana
Salix monticola
Sibbaldia procumbens
Taraxacum officinale
Thalictrum fendleri
Trifolium salictorum
Valerian capitata
Valeriana edulis
Veronica nutans

5. South Fork Mineral Creek at beaver ponds below Bandora Mine

U.S.G.S. Quadrangle: Ophir
T41N R8W Section 30

Aconitum columbianum
Allium geayeri
Calamagrostis canadensis

Caltha leptosepala
Campanula rotundifolia
Cardamine cordifolia
Carex utriculata
Deschampsia cespitosa
Dugaldia hoopsii
Epilobium hornemannii
Erigeron coulteri
Erigeron flagellaris
Geum triflorum
Mertensia ciliata
Mimulus guttatus
Oxypholis fendleri
Phleum commutatum
Salix brachycarpa
Salix planifolia
Senecio triangularis
Valeriana edulis
Veratrum tenuipetalum

-

6. Clear Creek, at waterfall by South Mineral Campground

U.S.G.S. Quadrangle: Ophir
T41N R8W Section 17

Arnica cordifolia
Carex geyeri
Cilaria austromontana
Distegia involucrata
Mertensia ciliata
Osmorhiza depauperata
Populus tremuloides
Rhodiola integrifolia
Saxifraga cernua
Senecio atratus

Boggy spruce forest above waterfall, with lots of moss:

Carex sp.
Goodyera oblongifolia
Herbaria hyperborea
Mitella sp.
Orthilia secunda
Oxypholis fendleri
Parnassia fimbriata
Pyrola rotundifolia

7. Alpine Loop, CR 2, west of Silverton. (Species observed from road)

Achillea lanulosa
Betula glandulosa
Calamagrostis canadensis
Cardamine cordifolia
Carex utriculata
Cirsium scariosum
Epilobium angustifolia
Festuca thurberi
Picea engelmannii
Polemonium foliosissimum
Populus tremuloides
Potentilla fruticosa
Rosa woodsii
Salix exigua
Salix monticola

8. Placer Gulch, County Road 9, above Gold Prince Mine

Alpine tundra dominated by *Geum rossii*
U.S.G.S. Quadrangle: Handies Peak
T42N R7W Section 11

Achillea lanulosa
Agoseris aurantiaca
Allium geayeri
Amerosedum lanceolatum
Androsace septentrionalis
Antennaria media
Antennaria rosea
Aquilegia coerulea
Arnica mollis
Artemisia scopulorum
Bistorta bistortoides
Bistorta vivipara
Caltha leptosepala
Carex microptera
Castilleja occidentalis
Castilleja rhexifolia
Cirsium scopulorum
Deschampsia cespitosa
Draba spectabilis var. *oxyloba*

Draba streptocarpa
Elymus trachycaulus
Epilobium hornemannii
Erigeron melanocephalus
Erigeron peregrinus
Erigeron pinnatisectus
Geranium richardsonii
Juncus drummondii
Lidia obtusiloba
Ligusticum porteri
Mertensia ciliata
Noccaea montana
Pedicularis groenlandica
Phacelia sericea
Poa alpina
Poa fendleriana
Podistera eastwoodiae
Polemonium pulcherrimum
Polemonium viscosum
Potentilla diversifolia
Potentilla uniflora
Pseudocymopterus montanus
Rhodiola integrifolia
Ribes sp.
Rydbergia grandiflora
Salix arctica
Selaginella sp. coll
Senecio crassulus
Senecio dimorphophyllus
Senecio triangularis
Sibbaldia procumbens
Trifolium parryi
Trisetum spicatum
Vaccinium sp.
Veronica nutans

9. Mineral Basin, Black Bear Road summit

Tundra and wet meadow, Geum rossii dominant
U.S.G.S. quadrangle: Ironton.
T42N R8W Sections 15 and 16

Androsace septentrionalis
Antennaria media
Artemisia scopulorum
Bistorta bistortoides

Caltha (*Psychrophila*) *leptosepala*
Carex sp. coll
Castilleja occidentalis
Castilleja rhexifolia
Cerastium beeringianum
Deschampsia cespitosa
Draba crassifolia
Draba graminea
Draba streptobrachia
Erigeron coulteri
Erigeron melanocephalus
Erigeron peregrinus
Geum (*Acomastylis*) *rossii*
Juncus drummondii
Micranthes odontoloma
Oxyria digyna
Pedicularis groenlandica
Pedicularis scopulorum
Phleum commutatum
Podistera eastwoodiae
Potentilla diversifolia
Potentilla uniflora
Primula parryi
Rhodiola integrifolia
Salix arctica
Salix reticulata
Senecio dimorphophylla
Sibbaldia procumbens
Silene acaulis
Tonestus pygmaea
Trifolium salictorum
Trollius albiflorus
Vaccinium cespitosum
Veronica nutans

10. Ophir Pass

South side of road, just east of summit, in scree, small patches of soil

U.S.G.S. 7.5 minute quadrangle: Ophir.

T42N R8W Sections 31, 32

Acomastylis rossii
Angelica pinnata
Antennaria media
Aquilegia coerulea
Arnica mollis

Artemisia scopulorum
Cardamine cordifolia
Carex ebenea
Cerastium beeringianum
Chionophila jamesii
Cystopteris fragilis
Deschampsia cespitosa
Erigeron melanocephalus
Erigeron peregrinus
Erysimum capitatum
Festuca brachyphylla
Juncus drummondii
Ligularia soldanella
Luzula parvifolia
Mertensia ciliata
Oreobrama pygmaea
Oxyria digyna
Pedicularis parryi
Penstemon whippleanus
Phlox condensata
Pseudocymopterus montanus
Rhodiola integrifolia
Salix reticulata
Senecio fremontii
Sibbaldia procumbens
Silene acaulis
Stellaria umbellata
Thalictrum fendleri
Vaccinium cespitosum
Veronica nutans

11. South Mineral Creek at Porcupine Creek

(about 1 mile south of campground; along creek, small waterfalls, and seep areas above creek)

U.S.G.S. 7.5 minute quadrangle: Ophir.

T41N R8W Section 19

Aconitum columbianum

Besseyia ritteriana

Bistorta vivipara

Cardamine cordifolia

Carex norvegica

Castilleja rhexifolia

Cystopteris fragilis

Descurainia incisa

Draba spectabilis* var. *oxyloba

Dugaldia hoopsii

Erigeron coulteri

Erigeron elatior

Erigeron peregrinus

Festuca thurberi

Frasera speciosa

Geranium richardsonii

Habeneria hyperborea

Heracleum lanatum

Ligusticum porteri

Listera cordata

Luzula parvifolia

Mertensia ciliata

Micranthes odontoloma

Mimulus guttatus

Mitella pentandra

Oxypolis fendleri

Parnassia fimbriata

Pedicularis groenlandica

Primula parryi

Pseudocymopterus montanus

Rhodiola integrifolia

Salix brachycarpa

Salix drummondiana

Salix planifolia

Stellaria sp. coll

Thalictrum fendleri

Urtica dioeca

Valeriana edulis,

Veratrum tenuipetalum

12. Lime Creek

County Road 1, north end

Spruce-lodgepole-aspen forest and riparian with *Populus angustifolia*

U.S.G.S. Quadrangle: Snowdon Peak

T40N R8W Section 21

Abies lasiocarpa
Acer glabrum
Aconitum columbianum
Actaea rubra
Agrostis scabra
Alnus incana
Anaphalis margaritacea
Antennaria rosea
Anticlea elegans
Aquilegia coerulea
Arnica cordifolia
Astragalus alpinus
Bistorta vivipara
Cardamine cordifolia
Carex geyeri
Castilleja linariifolia
Castilleja miniata
Cerastium beeringianum
Chamerion subdentatum
Cirsium parryi
Cryptogramma acrostichoides
Delphinium barbeyi
Deschampsia cespitosa
Distegia involucrata
Dugaldia hoopsii
Epilobium angustifolium
Equisetum arvense
Erigeron coulteri
Erigeron speciosus
Fragaria vesca
Fragaria virginiana
Galium septentrionalis
Galium triflorum
Geranium richardsonii
Herbaria hyperborea
Hedysarum occidentale
Heracleum lanatum
Heterotheca villosa

Juncus mertensianus
Juniperus communis
Leucanthemum vulgare
Lithospermum multiflorum
Maianthemum stellatum
Mertensia ciliata
Mitella stauropetala
Osmorhiza depauperata
Oxypolis fendleri
Parnassia fimbriata
Paxistima myrsinites
Pedicularis groenlandica
Pedicularis procera
Penstemon whippleanus
Pinus contorta
Pneumonanthe parryi
Poa pratensis
Potentilla hippiana
Potentilla pulcherrima
Prunus virginiana
Pseudocymopterus montanus
Rhodiola integrifolia
Ribes cereum
Rubacer parviflorum
Rubus idaeus
Rumex sp.,
Salix drummondiana
Salix geyeriana
Salix monticola
Selaginella densa
Senecio atrata
Shepherdia canadensis
Solidago simplex
Taraxacum officinale
Thalictrum fendleri
Trautvetteria caroliniensis
Vaccinium myrtillus
Valeriana edulis

13. Lake southeast of Scout Lake
U.S.G.S. Quadrangle: Engineer Mountain
T39N R8W Section 17

Abies lasiocarpa
Achillea lanulosa

Alopecurus alpinus
Amelanchier alnifolia
Arctostaphylos uva-ursi
Carex geyeri
Carex utriculata
Eleocharis aciculata
Eleocharis palustris
Epilobium hornemannii
Galium trifidum ssp. *Brevipes*
Heterotheca villosa
Juniperus communis
Leucanthemum vulgare
Mahonia repens
Myrophyllum sp.
Nuphar lutea ssp. *polycephala*
Paxistima myrsinites
Sparganium angustifolium I
Veronica serpyllifolia var. *humifusa*
Zigadenus sp.

14. Andrews Lake

Around lake and on lower part of Crater Lake trail to ponds
U.S.G.S. Quadrangle: Snowdon Peak
T48N R8W Section 24

Abies lasiocarpa
Agoseris aurantiaca
Agoseris glauca
Anemone multifida
Angelica grayi
Antennaria rosea
Anticlea elegans
Aquilegia coerulea
Aquilegia elegantula
Arnica cordifolia
Arnica mollis
Arnica parryi
Arnica rydbergii
Artemisia franserioides
Artemisia scopulorum
Bistorta bistortoides
Bromus anomalus
Calamagrostis canadensis
Caltha leptosepala

Campanula rotundifolia
Carex aquatilis
Carex bella
Carex ebenea
Carex microptera
Carex norvegica
Carex praegracilis
Carex utriculata
Castilleja miniata
Castilleja rhexifolia
Castilleja sulphurea
Cystopteris fragilis
Dactylis glomerata
Danthonia intermedia
Delphinium barbeyi
Distegia involucrata
Elymus trachycaulus
Epilobium angustifolium
Epilobium angustifolium
Epilobium hornemannii
Eremogone fendleri
Erigeron coulteri
Erigeron elatior
Erigeron flagellaris
Erigeron peregrinus
Erigeron pinnatisectus
Festuca saximontana
Festuca thurberi
Fragaria virginiana
Geranium richardsonii
Geum macrophyllum
Heracleum lanatum
Heterotheca villosa
Juniperus communis
Leucanthemum vulgare
Ligularia bigelovii
Luzula parviflora
Mertensia ciliata
Noccaea montana
Oreochrysum parryi
Osmorhiza depauperata
Oxypolis fendleri
Pedicularis racemosa
Penstemon whippleanus
Phleum commutatum

Phleum pratensis
Picea engelmannii
Pinus contorta
Poa alpina
Poa pratensis
Polemonium pulcherrimum
Potentilla fruticosa
Potentilla hippiana
Potentilla pulcherrima
Rhodiola integrifolia
Ribes montigenum
Salix brachycarpa
Salix planifolia
Sambucus racemosa
Senecio amplexans
Senecio crassulus
Senecio triangularis
Senecio wernerifolia
Sibbaldia procumbens
Solidago simplex
Sparganium angustifolium
Spergulastrum lanuginosum
Taraxacum officinale
Thalictrum fendleri
Trifolium pratense
Trifolium repens
Vaccinium myrtillus
Veratrum tenuipetalum
Veronica nutans

15. Lower Ice Lake Basin wetlands

U.S.G.S. Quadrangle: Ophir
T41N R8W Section 18

Aconitum columbianum
Angelica grayi
Caltha leptosepala
Cardamine cordifolia
Castilleja sulphurea
Cirsium scariosum
Delphinium barbeyi
Deschampsia cespitosa
Ligusticum porteri
Mertensia ciliata
Parnassia fimbriata

Picea engelmannii
Ranunculus escholtzii
Salix brachycarpa
Salix planifolia
Senecio triangularis
Veratrum tenuipetalum

16. Upper Ice Lake Basin

Rock outcrops by inlet, Draba graminea site
U.S.G.S. Quadrangle: Ophir
T41N R9W Section 13

Carex ebenea
Castilleja sulphurea
Chondrosum prostratum
Claytonia megarhiza
Draba crassifolia.
Draba graminea
Erigeron melanocephalus
Geum rossii
Hirculus platysepalus
Micranthes oregana
Poa alpina
Podistera eastwoodiae
Ranunculus macauleyi
Salix reticulata
Saxifraga cernuua
Sedum rhodanthum

17. Andrews Lake wetlands

U.S.G.S. Quadrangle: Snowdon Peak
T40N R8W Section 13

Allium geayeri
Antennaria luzuloides
Astragalus alpina
Bistorta vivipara
Caltha leptosepala
Carex aquatilis
Carex aurea
Carex buxbaumii
Carex capillaris
Carex ebenea
Carex eleocharis

Carex interior
Carex lachenalii
Carex microglochin
Carex neurophora
Carex utriculata
Carex viridula
Ceratocephala orthoceras
Danthonia intermedia
Deschampsia cespitosa
Eriophorum angustifolium
Gentianopsis thermalis
Habeneria hyperborea
Juncus mertensianus
Ligusticum porteri
Myrophyllum sp.
Nuphar lutea ssp. polycephala
Parnassia fimbriata
Pedicularis groenlandica
Pneumonanthe parryi
Potentilla fruticosa
Potamogeton pusillus
Salix brachycarpa
Salix planifolia
Senecio dimorphophylla
Sparganium angustifolium
Sphagnum sp.
Swertia perennis
Triglochin palustris
Veratrum tenuipetalum

18. Grand Turk

Colorado Trail from Little Molas Lake
U.S.G.S. Quadrangle: Silverton
T40N R8W Sections 2 and 11

Besseyia ritteriana

Cardamine cordifolia
Carex elynoides
Carex nova
Cilaria austromontana
Danthonia intermedia
Draba aurea
Draba sp.

Draba streptobrachia

Dugaldia hoopsii

Erigeron pinnatisectus

Festuca saximontana.

Fragaria virginiana

Gentianoides thermalis

Geum rossii:

Habeneria hyperborea

Heterotheca villosa

Hieracium gracile

Koeleria macrantha

Lidia obtusiloba

Machaeranthera coloradoensis

Noccaea montana

Oxypolis fendleri

Parnassia fimbriata

Phacelia sericea

Phleum commutatum

Picea engelmannii

Poa arctica

Polemonium viscosum

Potentilla pulcherrima

Rydbergia grandiflora

Senecio triangularis

Sibbaldia procumbens

Silene acaulis

Taraxacum officinale

Trifolium nanum

Trifolium parryi

19. Coal Bank Pass

Wet east facing slope above Highway 550, dominated by *Veratrum tenuipetalum*, with sub-dominants of *Ligusticum porteri* and *Thalictrum fendleri*

U.S.G.S. Quadrangle: Engineer Mt.

T40N R8W Sections 29 and 30

Achillea lanulosa

Aconitum columbianum

Agoseris glauca

Arnica parryi

Astragalus alpinus

Besseyia ritteriana

Boechera drummondii

Bromus anomalus

Carex geyeri

Carex sp.
Castilleja miniata
Cirsium parryi
Dactylis glomerata
Descurainia incisa
Distegia involucrata
Draba spectabilis var. oxyloba
Dugaldia hoopsii
Elymus glaucus
Elymus trachycaulus
Epilobium angustifolium
Equisetum arvense
Erigeron coulteri
Erigeron elatior
Festuca thurberi
Fragaria virginiana
Fraseria speciosa
Geranium richardsonii
Helianthella quinquenervis
Heliomeris multiflora
Heracleum lanatum
Heterotheca villosa
Ligularia amplexans
Ligularia bigelovii
Ligusticum porteri
Luzula parviflora
Mertensia ciliata
Noccaea montana
Oxypolis fendleri
Pedicularis racemosa
Penstemon whippleanus
Phleum commutatum
Picea engelmannii
Poa alpina
Poa arctica
Polemonium pulcherrimum
Potentilla hippiana
Pseudocymopterus montanus
Ranunculus sp.
Rhodiola integrifolia
Ribes montigenum
Rumex sp.
Salix monticola
Senecio triangularis
Symphoricarpos oreophilus

Taraxacum officinale
Thalictrum fendleri
Trifolium repens
Veratrum tenuipetalum

20. Andrews Lake West

Wetlands at west end below dam and along stream
U.S.G.S. Quadrangle: Snowdon Peak
T40N R8W Sections 14 and 23

Achillea lanulosa
Aconitum columbianum
Agoseris glauca
Allium geayeri
Anaphalis margaritacea
Anticlea elegans
Arnica mollis
Astragalus alpinus
Bromus anomalus
Calamagrostis canadensis
Caltha leptosepala
Carex aquatilis
Carex aurea
Carex buxbaumii
Carex capillaris
Carex haydenii
Carex microglochin
Carex sp.
Carex utriculata
Carex viridula
Castilleja sulphurea
Cerastium beeringianum
Danthonia intermedia
Dugaldia hoopsii
Epilobium angustifolium
Epilobium hornemannii
Erigeron coulteri
Erigeron peregrinus
Erigeron subtrinervis
Eriophorum angustifolium
Festuca thurberi
Fragaria virginiana
Frasera speciosa
Galium triflorum
Geranium richardsonii

Geum macrophyllum
Habeneria hyperborea
Heterotheca villosa
Juncus mertensianus
Koeleria macrantha
Ligularia bigelovii
Ligusticum porteri
Mertensia ciliata
Oxypolis fendleri
Parnassia fimbriata
Pedicularis groenlandica
Phleum commutatum
Pinus contorta
Potentilla fruticosa
Potentilla hippiana
Pseudocymopterus montanus
Rhodiola integrifolia
Salix brachycarpa
Salix monticola
Salix planifolia
Sedum rhodanthum
Senecio atratus
Senecio triangularis
Solidago simplex
Sphagnum sp.
Taraxacum officinale
Vaccinium myrtillus
Veronica nutans
Viola canadensis

21. Kendall Mountain

County Road 33 from Silverton, to lookout

U.S.G.S. Quadrangle: Silverton

T41N R7W Sections 21 and 22

Achillea lanulosa
Angelica grayi
Artemisia scopulorum
Besseya ritteriana
Bistorta bistortoides
Carex bella
Carex ebenea
Carex elynoides
Castilleja rhexifolia
Castilleja sulphurea

Cerastium beeringianum
Cirsium arvense
Cirsium parryi.
Claytonia megarhiza
Deschampsia cespitosa
Dugaldia hoopsii
Elymus trachycaulus
Epilobium hornemannii
Festuca brachyphylla
Festuca thurberi
Hirculus platysepalus
Juncus drummondii
Lidia obtusiloba
Ligularia holmii
Ligularia soldanella
Linaria vulgaris
Micranthes oregana
Noccaea montana
Oreobrama pygmaea
Oxyria digyna
Penstemon harbouri
Penstemon whippleanus
Picea engelmannii
Poa alpina
Poa arctica
Polemonium viscosum
Populus tremuloides
Potentilla diversifolia
Potentilla pulcherrima
Rhodiola integrifolia
Rubus idaeus
Rydbergia grandiflora
Salix arctica
Salix drummondiana
Salix monticola
Salix planifolia
Salix reticulata (not much)
Sambucus racemosa
Sedum lanceolatum
Senecio atratus
Senecio eremophilus
Senecio oodes
Senecio taraxacoides
Senecio wernerifolia.
Sibbaldia procumbens
Silene acaulis

Stellaria umbellata
Tonestus pygmaeus
Trifolium nanum
Trisetum spicatum
Veronica nutans

22. Stony Pass

Dry tundra, rock outcrops and wetlands. Elev. 12,650
U.S.G.S. Quadrangle: Howardsville
T41N R6W Section 20

Angelica grayi
Antennaria media
Aquilegia coerulea
Arnica rydbergii
Artemisia scopulorum
Boechera lemonii
Campanula uniflora
Carex elynoides
Carex nova
Castilleja sulphurea
Chondrosium prostratum
Cirsium hesperium
Claytonia megarhiza
Draba crassa
Draba crassifolia
Draba streptobrachia
Epilobium anagalladifolium
Erigeron melanocephalus
Erigeron pinnatisectus
Erigeron simplex
Erysimum capitatum
Festuca brachyphylla
Gentianodes algida
Geum rossii
Ligularia holmii
Mertensia lanceolata
Noccaea montana
Packera streptanthifolia
Pedicularis scopulorum
Phacelia sericea
Poa alpina
Podistera eastwoodiae
Polemonium viscosum
Potentilla pulcherrima
Ranunculus macauleyi

Rydbergia grandiflora
Salix arctica
Salix reticulata
Saxifraga cernua
Senecio holmii
Senecio taraxacoides
Trifolium nanum
Sibbaldia procumbens
Silene acaulis
Smelowskia calycina
Townsendia rothrockii
Trifolium nanum
Trifolium salictorum
Veronica nutans

23. Christ of the Mines Shrine, Silverton

Disturbed areas along road and trail to shrine with *Potentilla hippiana* dominant

U.S.G.S. Quadrangle: Silverton

T41N R7W Section 17 and 18

Achillea lanulosa
Antennaria sp.
Dactylis glomerata
Elymus elymoides
Epilobium angustifolium
Geranium richardsonii
Heterotheca villosa
Linaria vulgaris
Maianthemum stellatum
Oligosporus dracunculus
Picea engelmannii
Picea pungens
Pinus contorta
Populus tremuloides
Potentilla hippiana
Ribes aureum
Ribes montigenum
Rumex utahensis
Salix drummondiana
Salix monticola
Solidago simplex
Taraxacum officinale
Thalictrum fendleri
Valeriana edulis

24. California Gulch

Wetland with some rock outcrops. *Deschampsia cespitosa*, *Caltha leptosepala*, *Carex aquatilis* and *Calamagrostis canadensis* dominant.

U.S.G.S. Quadrangle: Handies Peak

T42N R7W Sections 1 and 2

Achillea lanulosa
Aconitum columbianum
Agrostis scabra
Allium rubrum
Antennaria rosea
Aquilegia coerulea
Arnica mollis
Artemisia scopulorum
Bistorta bistortoides
Calamagrostis canadensis
Caltha leptosepala
Cardamine cordifolia
Carex aquatilis
Carex microglochin
Carex microptera
Carex nova
Castilleja rhexifolia
Castilleja sulphurea
Chondrophylla prostrata
Cystopteris fragilis
Danthonia intermedia
Delphinium barbeyi
Deschampsia cespitosa
Draba spectabilis* var. *oxyloba
Dugaldia hoopsii
Elymus trachycaulus
Erigeron coulteri
Erigeron melanocephalus
Erigeron peregrinus
Erigeron pinnatisectus
Gentianella heterosepala
Gentianella thermalis
Geum rossii
Juncus balticus
Juncus drummondii
Juncus mertensianus

Ligularia amplexans
Ligusticum porteri
Mertensia ciliata
Micranthes odontoloma
Micranthes oregana
Noccaea montana
Oreochrysum parryi
Oxypolis fendleri
Oxyria digyna
Pedicularis groenlandica
Penstemon whippleanus
Phleum commutatum
Poa alpina
Podistera eastwoodiae
Potentilla pulcherrima
Primula parryi
Ranunculus alismaefolius
Rhodiola integrifolia
Salix planifolia
Sedum lanceolatum
Sedum rhodanthum
Senecio dimorphophylla
Senecio triangularis
Sibbaldia procumbens
Silene acaulis
Smelowskia calycina
Swertia perennis
Trisetum spicatum
Trollius albicaulis
Vaccinium sp.
Veratrum tenuipetalum
Veronica serpyllifolia var. humifusa
Zygadenus elegans

Mosses collected:

Aulacomnium palustre
Philonotis fontana
Straminergon stramineum
Warnstorfia exannulata

25. South Fork Cement Creek

Headwaters of south fork at cirque below Storm Mt, lake, wetland and meadow
Beautiful big bowl, lots of talus, wetland and lake below.
U.S.G.S. Quadrangle: Silverton
T42N R7W Section 28

Achillea lanulosa
Allium geayeri
Aquilegia coerulea
Arnica mollis
Arnica parryi
Besseyia ritteriana
Calamagrostis canadensis
Caltha leptosepala
Cardamine cordifolia
Carex aquatilis
Carex microptera
Chamerion subdentatum
Danthonia intermedia
Deschampsia cespitosa
Draba spectabilis var. oxyloba
Erigeron coulteri
Erigeron peregrinus
Gentianella heterosepala
Geranium richardsonii
Geum rossii
Juncus drummondii
Juncus mertensianus
Ligularia amplexans
Ligularia bigelovii
Ligularia holmii
Mertensia ciliata
Micranthes oregana
Oreobrama pygmaea
Oxyria digyna
Pedicularis groenlandica
Poa alpina
Potentilla sp.
Pseudocymopterus montanus
Rhodiola integrifolia
Ribes sp.
Sedum rhodanthum
Senecio fremontii var. blitoides
Senecio triangularis
Sibbaldia procumbens
Stellaria umbellata
Swertia perennis
Trollius albicaulis
Vaccinium myrtillus

26. Maggie Gulch

CR23. Waterfalls, and upper basin with talus, wet meadows, trail to Continental Divide

U.S.G.S. Quadrangle: Howardsville

T41N R6W Sections 5, 8, 9 and 17

Agrostis thurberi

Antennaria media

Arabis lemonii

Arnica mollis

Artemisia scopulorum

Bistorta bistortoides

Bistorta vivipara

Calamagrostis canadensis

Caltha leptosepala

Carex aquatilis

Carex atrata

Carex canescens

Carex elynoides

Carex microglochin

Carex microptera

Carex nova

Carex vernacula

Castilleja sulphurea

Chamerion subdentatum

Chondrophylla prostrata

Cilaria austromontana

Cirsium hesperium

Claytonia megarhiza

Delphinium barbeyi

Deschampsia cespitosa

Draba crassa

Draba spectabilis* var. *oxyloba

Draba streptobrachia

Dugaldia hoopsii

Elymus trachycaulus

Erigeron coulteri

Erigeron elatior

Festuca thurberi

Gentianella heterosepala

Gentianodes algida

Gentianopsis thermalis

Geum rossii

Hirculus platysepalus
Ligularia bigelovii
Micranthes odontoloma
Micranthes oregana
Noccaea montana
Pedicularis groenlandica
Penstemon harbourii
Phacelia sericea
Phleum commutatum
Pneumonanthe parryi
Polemonium viscosum
Potentilla pulcherrima
Rhodiola integrifolia
Rydbergia grandiflora
Salix arctica
Salix brachycarpa
Salix planifolia
Salix reticulata
Sedum rhodanthum
Senecio atratus
Senecio holmii
Sibbaldia procumbens
Stipa lettermannii
Swertia perennis
Veronica nutans

27. Chattanooga Iron Fen

Wetland and ponds north of Highway 550.
U.S.G.S. Quadrangle: Silverton
T42N R8W Sections 26 and 27

Aster lanceolatus ssp. hesperius
Betula glandulosa
Calamagrostis canadensis
Caltha leptosepala
Cardamine cordifolia
Carex aquatilis
Carex utriculata
Conioselinum scopulorum
Deschampsia cespitosa
Gentianopsis thermalis
Juncus balticus
Pedicularis groenlandica
Polemonium caeruleum ssp. amygdalinum
Potentilla fruticosa

Salix planifolia
Sedum rhodanthum
Swertia perennis
Veronica nutans

Mosses collected:

Aulacomnium palustre
Brachythecium oedipodium
Ceratodon purpureus
Gymnocolea inflata
Hypnum cupressiforme
Jungermannia rubra
Lophozia incisa
Palustriella falcata (green, falcate lvs)
Philonotis marchica
Pohlia nutans
Polytrichastrum alpinum
Polytrichum juniperinum
Racomitrium canescens
Scorpidium cossonii
Sphagnum sp.
Sphagnum angustifolium
Sphagnum fuscum
Sphagnum russowii
Tomentypnum nitens
Warnstorfia exannulata

28. Lime Creek Rest Area

West of Highway 550, south of Molas Pass.
U.S.G.S. Quadrangle: Snowdon Peak
T40N R8W Section 14

Achillea lanulosa
Aconitum columbianum
Anemone multifida
Antennaria marginata
Bromus ciliatus
Campanula rotundifolia
Carex geyeri
Castilleja sulphurea
Cerastium strictus
Convolvulus arvensis
Dactylis glomerata
Distegia involucrata
Erigeron coulteri

Erigeron eximius
Erigeron glabella
Festuca thurberi
Fragaria virginiana
Frasera speciosa
Gentianella acuta
Gentianopsis thermalis
Geranium richardsonii
Heterotheca villosa
Ligularia bigelovii
Ligusticum porteri
Maianthemum stellatum
Oreochrysum parryi
Oxypolis fendleri
Parnassia fimbriata
Picea engelmannii
Pinus contorta
Pneumonanthe parryi
Polemonium pulcherrimum
Potentilla pulcherrima X hippiana
Pseudocymopterus montanus
Ribes montigenum
Salix drummondiana
Salix monticola
Solidago simplex
Symphoricarpos oreophilus
Taraxacum officinale
Thalictrum fendleri
Vaccinium myrtillus
Valeriana edulis

29. Hermosa Creek

Alnus incana
Geranium richardsonii
Habeneria hyperborea
Phleum pratense
Picea engelmannii
Picea pungens
Prunus virginiana var. melanocarpa
Ribes sp.
Salix drummondiana
Salix monticola
Sambucus racemosa

Shepherdia canadensis
Taraxacum officinale
Thalictrum fendleri

30. Lake Hope Trail

Small wetland with Eriophorum angustifolium, Veronica nutans, Sedum rhodanthum, Carex magellanica (not Limosa). Carex aquatilis dominant. Moist forest west of fen, along creek:

252913; 4184601; 10,481 ft. waypoint 9.

Abies lasiocarpa
Aconitum columbianum
Actaea rubra
Angelica pinnata
Arnica cordifolia
Arnica mollis
Arnica parryi
Bistorta bistortoides
Bistorta vivipara
Bromus ciliatus
Calamagrostis canadensis
Caltha leptosepala
Cardamine cordifolia
Carex aquatilis
Carex illota
Carex magellanica
Carex microglochin
Carex nova
Carex utriculata
Conioselinum scopulorum
Distegia involucrata
Epilobium angustifolium
Erigeron coulteri
Erigeron peregrinus
Eriophorum altaicum
Eriophorum angustifolium
Gentianella acuta
Geranium richardsonii
Geranium viscosum
Ligularia amplexans
Ligusticum porteri
Luzula parvifolia
Lycopodium sp.
Maianthemum racemosum

Mertensia ciliata
Micranthes odontoloma
Noccaea montana
Oxypolis fendleri
Osmorhiza depauperata
Pedicularis groenlandica
Pedicularis procera
Picea engelmannii
Poa reflexa
Polemonium pulcherrimum
Ribes montigenum
Ribes wolfii
Salix brachycarpa
Salix planifolia
Sedum rhodanthum
Senecio triangularis
Sibbaldia procumbens
Sphagnum sp.
Stellaria umbellata
Swertia perennis
Trifolium salictorum
Trollius albicaulis
Vaccinium myrtillus
Valeriana edulis
Veronica nutans

31. Picayune Gulch

Calamagrostis canadensis
Caltha leptosepala
Carex aquatilis
Carex illota
Carex microptera
Carex nova
Carex utriculata
Cystopteris fragilis
Draba crassa
Draba streptobrachia
Geum rossii
Hymenoxys grandiflora
Juncus drummondii
Pedicularis groenlandica
Potentilla sp.
Salix planifolia

Salix reticulata
Sedum rhodanthum
Sibbaldia procumbens
Smelowskia calycina
Thalictrum fendleri

32. Red Mountain Number One

Dry rocky tundra at summit of County Road 11.
GPS 266103; 4198552; 12,135 ft. waypt 32.
U.S.G.S. Quadrangle: Ironton
T42N R7W Section 8

Claytonia megarhiza
Draba streptobrachia
Erigeron pinnatisectus
Festuca brachyphylla
Ligularia holmii
Picea engelmannii
Salix arctica
Salix reticulata
Selaginella densa
Senecio neomexicana
Silene acaulis
Smelowskia calycina
Tonestus pygmaea
Vaccinium cespitosum

33. Little Green Falls

Dry, south facing hillside below falls, north of South Mineral Creek, above road (some on edge of drainage). *Potentilla hippiana* dominant.
U.S.G.S. Quadrangle: Silverton
T41N R8W Section 15

Agrostis scabra
Arctostaphylos uva-ursi
Artemisia ludoviciana
Betula glandulosa
Caltha leptosepala
Campanula rotundifolia
Carex sp.
Cystopteris fragilis
Danthonia intermedia
Deschampsia cespitosa
Distegia involucrata

Epilobium angustifolium
Erigeron flagellaris
Erigeron glabellus
Erigeron speciosus
Festuca arizonica
Festuca thurberi
Fragaria virginiana
Geranium cespitosum
Geranium richardsonii
Heracleum lanatum
Heterotheca villosa
Heuchera parviflora
Juncus drummondii
Juniperus communis
Ligusticum porteri
Phalaris arundinacea
Pneumonanthe parryi
Potentilla fruticosa
Potentilla hippiana
Pseudocymopterus montanus
Rhodiola integrifolia
Ribes sp.
Rosa woodsii
Rubus idaeus
Salix brachycarpa
Salix drummondiana
Salix monticola
Sambucus racemosa
Senecio eremophilus
Solidago simplex
Taraxacum officinale
Thalictrum fendleri
Tragopogon dubius
Vaccinium myrtillus

34. Relay Creek Road. (FR 580)

Forest Road 580, spruce-aspen forest
U.S.G.S. Quadrangle: Hermosa Creek
T39N R9W Section 9

Achillea lanulosa
Agrostis sp.
Anaphalis margaritacea
Bromus inermis
Anthemis sp.

Cirsium parryi
Dactylis glomerata
Epilobium angustifolium
Erigeron coulteri
Erigeron speciosus
Festuca thurberi
Fragaria virginiana
Frasera speciosa
Heterotheca villosa
Phleum pratense
Picea engelmannii
Pinus contorta
Populus tremuloides
Prunus virginiana
Ribes wolfii
Rosa sayi
Rubus idaeus.
Salix monticola
Salix scouleriana
Sambucus racemosa
Senecio atratus
Symphoricarpos oreophilus
Urtica gracilis

35. Burns Gulch

(not all common alpine species were recorded; Geum rossii and Salix reticulata dominant)

U.S.G.S. Quadrangle: Handies Peak
T42N R6W Section 16 and 17

Androsace septentrionalis
Angelica grayi
Antennaria sp. (umbrinella?)
Anticlea elegans
Aquilegia coerulea
Bistorta bistortoides
Carex microglochin
Castilleja rhexifolia
Castilleja sulphurea
Cilaria austromontana
Cirsium scopulorum
Draba albertina
Draba aurea
Draba crassa
Draba crassifolia

Draba fladnizensis

Draba streptobrachia

Erigeron melanocephalus

Erigeron pinnatisectus

Erigeron simplex

Erysimum capitatum (violet)

Gastrolychnis apetala

Lidia obtusiloba

Ligularia holmii

Ligularia soldanella

Micranthes oregana

Muscaria delicatula

Oreobrama pygmaea

Oxyria digyna

Packera wernerifolia

Pedicularis parryi

Pedicularis scopulorum

Poa alpina

Podistera eastwoodiae

Rydbergia grandiflora

Salix arctica

Saxifraga hyperborea

Sedum lanceolatum

Silene acaulis

Smelowskia calycina

Stellaria umbellata

Taraxacum eriophorum

Tonestus pygmaea

Trifolium salictorum

Veronica nutans

Mosses collected:

Myurella julacea

Tortella tortuosa

36. Clear Lake

Turf areas with typical alpine species, dominated by *Salix reticulata*, *Geum rossii*, *Sibbaldia procumbens*, *Artemisia scopulorum*, *Vaccinium cespitosum*; with wetter areas dominated by *Castilleja rhexifolia*, *Cardamine cordifolia*, *Bistorta bistortoides* (*Besseyia* habitat); and very wet areas by *Caltha leptosepala*. Talus with *Penstemon harboursii*, *Aquilegia coerulea*, *Senecio soldanella*.

U.S.G.S. Quadrangle: Ophir

T41N R8W Section 7

Aquilegia coerulea
Artemisia scopulorum
Besseyia ritteriana
Bistorta bistortoides
Bistorta vivipara
Caltha leptosepala
Cardamine cordifolia
Castilleja occidentalis
Castilleja rhexifolia
Cerastium beeringianum
Chondrophylla prostrata
Deschampsia cespitosa
Draba sp.
Dugaldia hoopsii
Erigeron elatior
Erigeron melanocephalus
Erigeron peregrinus
Erigeron pinnatisectus
Geum rossii
Lidia obtusiloba
Oxyria digyna
Penstemon harbouri
Penstemon whippleanus
Phacelia sericea
Polemonium viscosum
Salix brachycarpa
Salix planifolia
Salix reticulata
Senecio holmii
Senecio oodes
Senecio soldanella
Sibbaldia procumbens
Silene acaulis
Smelowskia calycina
Taraxacum sp.
Trifolium parryi
Vaccinium cespitosum
Valeriana capitatum
Valeriana edulis
Viola adunca

South Mineral Creek

Falls in canyon above campground and adjacent spruce-fir forest

U.S.G.S. Quadrangle: Ophir

T41N R8W Sections 17 and 18

Aquilegia coerulea

Arnica cordifolia

Bromopsis ciliatus

Carex geeyeri

Cilaria austromontana

Cryptogramma stelleri

Cystopteris fragilis

Cystopteris montana

Delphinium barbeyi

Distegia involucrata

Epilobium angustifolium

Erigeron coulteri

Erigeron eximius

Geranium richardsonii

Heliomeris multiflora

Heracleum lanatum

Juniperus communis

Lichens

Ligusticum porteri

Linnaea borealis

Luzula parviflora

Lycopodium annotinum

Maianthemum racemosum

Mertensia ciliata

Micranthes odontoloma

Moneses uniflora

Oreochrysum parryi

Orthelia secunda

Poa pratensis

Polemonium pulcherrimum

Rhodiola integrifolia

Ribes sp.

Ribes wolfii

Senecio triangularis

Streptopus fassettii

Thalictrum fendleri

Trisetum spicatum

Vaccinium scoparium

Apendix II.

Potential Conservation Areas listed by ownership. PCAs listed are all or partially in ownership indicated.

U. S. Bureau of Land Management:	page
Burns Gulch	100
Burrows Creek-Mineral Creek Headwaters	107
Burrows Creek Uplands	110
Cement Creek Iron Fen	121
Cinnamon Pass	130
Howardsville	161
Kendall Mountain	168
Lake Como	174
Maggie Gulch	180
Middleton	184
Mineral Point	193
Molas Pass	196
Picayune Gulch	204
Placer Gulch	207
Red Mountain Number One	213
Ross Basin	221
South Fork Cement Creek	224
Spencer Basin	234
Stony Pass	237
 U. S. Forest Service (San Juan NF, unless otherwise noted)	
Animas River Canyon	93
Balsam Lake	97
Burro Bridge Iron Fen	103
California Gulch at Animas River	113
Cascade Creek at Purgatory	117
Chattanooga Iron Fen	125
Clear Lake	133
Coal Bank Hill	136
Coal Bank Pass	139
Coal Creek at Highway 550	142
Crater Lake	145
East Fork Hermosa Creek	147
Elk Creek Headwaters	151
Grand Turk South	154
Hermosa Creek	157
Ice Lake Basin	164
Kite Lake (Rio Grande NF)	171
Lime Creek	177
Mill Creek at Chattanooga	187

Mineral Basin	190
Mineral Point	193
Molas Pass	196
Ophir Pass	201
Pole Creek (Rio Grande NF)	210
Red Mountain Number One	213
Red Mountain Pass	216
Rolling Mountain	219
South Fork Mineral Creek	227
South Twilight Peak	231
U. S. Basin	240
Vestal Lake	243
West Lime Creek	246

Private (mostly small mining claims surrounded by public land)

Animas River Canyon	93
Burns Gulch	100
Burrows Creek-Mineral Creek Headwaters	107
Burrows Creek Uplands	110
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