

**Biological Inventory
of the
Colorado Canyons National Conservation Area**



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Executive Summary

The Mack ridge and Rabbit valley areas of the Colorado Canyons National Conservation Area (CCNCA) make up an area of arid salt desert hills and eroded sandstone bluffs, benches, and valleys. The vegetation of these areas is often sparse and frequently composed of pinyon juniper woodlands, salt desert shrublands, mixed desert shrublands, and arid grasslands. The Colorado River valley, which forms the southern boundary of the areas, provides a relative oasis in this otherwise xeric environment. Vegetation there, as well as in some of the larger side drainages, is dominated by riparian woodlands and shrublands composed of cottonwoods, willows, tamarisk, and Russian olive.

At approximately 46,000 acres, the Mack Ridge and Rabbit Valley areas provide area for recreation and livestock grazing, habitat for plants, wildlife, and natural plant communities, and many other less tangible amenities. Effective management of the CCNCA requires accurate information on the resources present within the area and their status within the surrounding landscape. This biological inventory documents the Imperiled and Vulnerable plants, animals, and natural communities that are located within the Mack Ridge and Rabbit Valley Areas of the CCNCA.

The methods used by the CNHP to inventory the CCNCA are the same methods developed by NatureServe and the Network of Natural Heritage Programs for the inventory of rare and imperiled plants, animals, and natural communities. In general that method identifies existing data, targets known and possible locations for of concern, documents the status of the element through mapping and ranking of quality, and develops potential conservation boundaries.

Field work for the inventory was conducted during the spring, summer, and fall of 2003. It is based on the systematic methods of the Colorado Natural Heritage Program. The process included the review of existing information in the CNHP database and elsewhere, defining prioritized Targeted Inventory Areas (TIAs), conducting field work to investigate and document element occurrences in the TIAs, and delineating and ranking Potential Conservation Areas (PCAs).

The Mack Ridge and Rabbit Valley areas contain a total of 136 known element occurrences. The occurrences include 64 animal records, 34 plant records, and 38 records for natural communities. The 136 known elements include 39 new element occurrence records identified using the above methods. New element occurrences of note recorded in the Mack Ridge and Rabbit Valley Areas include a Peregrine Falcon observation near Crow Bottom, an occurrence for Eastwood evening primrose (*Camissonia eastwoodiae*), an occurrence for the long-nosed leopard lizard (*Gambelia wislizenii*), and a new occurrence for Gardner's mat saltbush shrubland (*Atriplex gardneri/Leymus salinus* shrubland) among others. New data incorporated into the database also includes several occurrences for the endangered Colorado River fishes.

The Biodiversity Rank and boundaries of four existing PCAs were revised to better represent the element occurrences identified in the area. The PCAs are the Colorado River PCA, the

Six and Fifty Reservoir PCA, the Mack Ridge PCA, and the Rabbit Valley PCA. These PCAs are considered Highly Significant (B3), Very Highly Significant (B2), and Outstanding Significance (B1). The Colorado River PCA is an Outstanding Significance site due to the endangered Colorado River Fishes and the presence of the Peregrine Falcon and Bald Eagle within that PCA. The Six and Fifty Reservoir PCA is a Very High Significance site due primarily to the presence there of the Eastwood evening primrose, Gardner's mat saltbush shrublands, and a western slope grassland community of Indian rice grass. The Mack Ridge and Rabbit Valley PCAs are both considered High Significance sites based on the number of G2 and G3 elements found there.

Included in the report are species characterization abstracts and ecological system descriptions for the elements used to arrive at a Biodiversity Rank for each of the sites. The species characterization abstracts provide brief summaries for a plant or animal species and include the description, taxonomy, habitat, distribution and abundance, and the areas in the CCNCA where the element is supported. Ecological system descriptions provide similar information, but relate to the ecological system within which several similar plant associations might be found.

Acknowledgements

I would like to acknowledge the support and assistance of the following individuals whose help was invaluable in producing this inventory and report. Peggy Lyon, as the primary botanist and ecologist on the project, brought her vast knowledge of the area's flora and fauna to the project. Her knowledge and dedication in the field produced a number of element occurrences that otherwise would have been missed. Joe Lucht who served as the zoologist on the project deserves credit for the great details he recorded on the many days and nights he spent in the field over the course of the summer.

Mr. Tom Nesler of the Colorado Department of Wildlife and Mr. Doug Osmundson of the US Fish and Wildlife Service provided data and interpretation of information on the Endangered Fish species of the Colorado River. The assistance of Renee Rondeau in developing the format for and editing the report was invaluable and without a doubt made this report much more than it would have been otherwise. The information management staff at CNHP gave me guidance on getting the data into the new database system and then getting it back out again for the report. Those folks include Jodie Bell, Jeremy Siemers, Jill Handwerk, and Amy Lavender. Lastly, I would like to thank the Bureau of Land Management for their continued support of the Colorado Natural Heritage Program and commitment to managing the CCNCA to ensure the long-term protection of its biological diversity.

I. Introduction

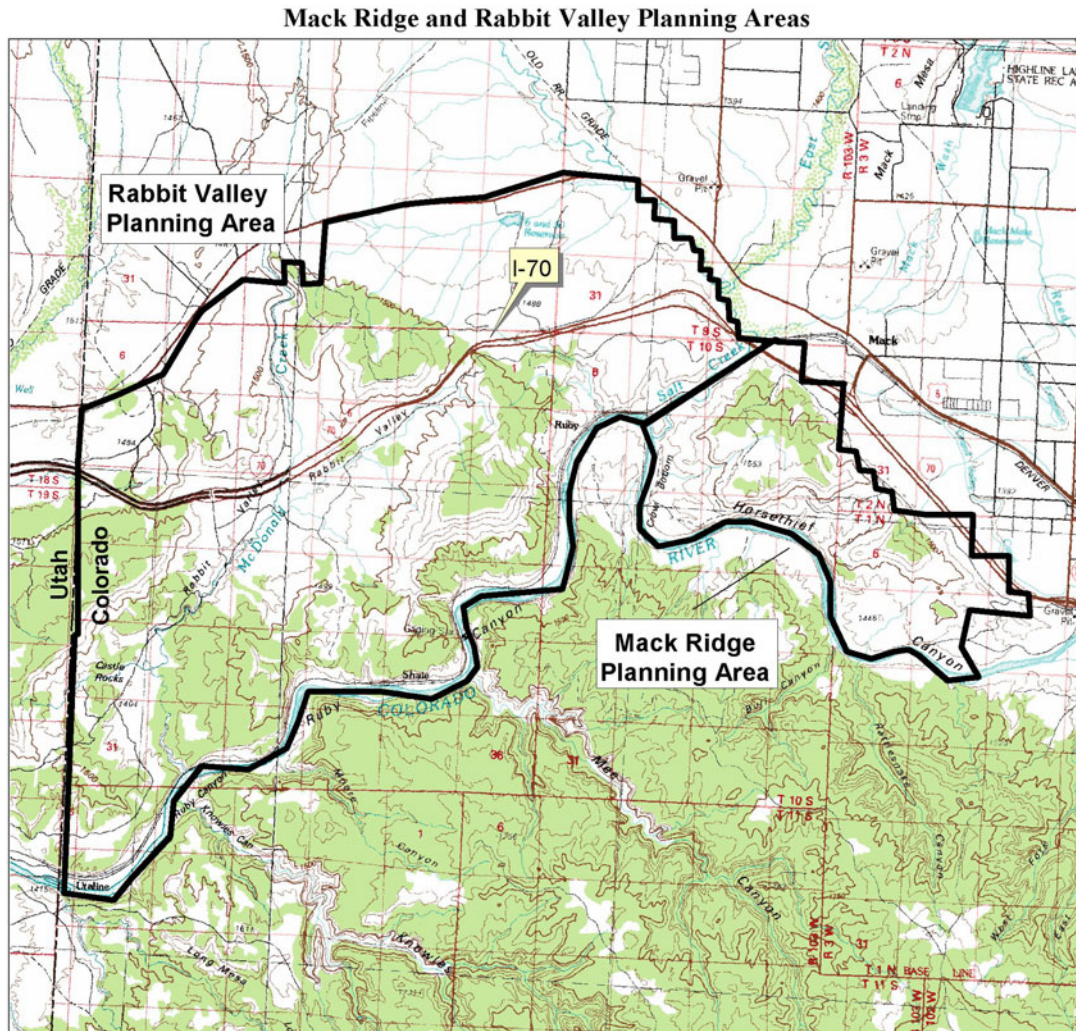
The Colorado Canyons National Conservation Area (CCNCA) was designated in late 2000, when the President signed into law the Colorado Canyons National Conservation Area and Black Ridge Canyons Wilderness Act of 2000 (PL 106-353 106th Congress). The designation was made to "...conserve, protect, and enhance, for the benefit and enjoyment of both present and future generations, the nationally important values of the public lands making up the CCNCA, including the Black Ridge Canyons, Ruby Canyon, and Rabbit Valley" (USDI 2004).


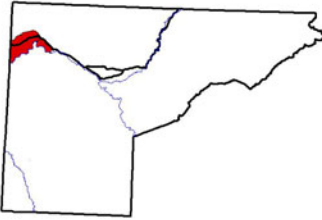
The legislation creating the CCNCA requires the BLM to develop a comprehensive resource management plan that allows for multiple uses of the area while providing for the long-term protection of the resources of the CCNCA. The resource management plan currently being developed for the area will allow the BLM to meet its multiple-use objectives by providing for various recreational and agricultural uses while protecting the area's scenic, cultural, and biological resources for future generations to enjoy (USDI 2004). In support of that effort the Colorado Natural Heritage Program (CNHP) has produced this Biological Inventory of the Colorado Canyons National Conservation Area.

The CCNCA is located approximately 20 miles to the west of Grand Junction, Colorado. It covers 122,300 acres and extends from approximately the Colorado-Utah border on the west, to the area of Loma, Colorado north of the Colorado River, and south of the river extends to the boundary of the Colorado National Monument. The northern boundary approximately follows the 6&50 Road, while the southern boundary extends to about 7 miles south of the Colorado River. The CCNCA includes three separate management areas: North of the river Rabbit Valley occurs on the west side and Mack Ridge on the east side; south of the River is the Black Ridge Wilderness area (Figure 1). The Mack Ridge and Rabbit Valley areas comprise 47,000 acres while the Black Ridge Wilderness encompasses 75,000 acres. This Biological Inventory focused exclusively on the Mack Ridge and Rabbit Valley areas. It does not include any information regarding those portions of the CCNCA that lie south of the Colorado River in the Black Ridge Wilderness area.

The climate of the area is characterized as arid semi-desert. The average maximum summer daytime temperature is 93 (deg F) and night time minimums of 57 (deg F). Summer maxima may be as high as 110 (deg F). Average winter daytime and nighttime temperature extremes are 38 (deg F) and 12 (deg F), respectively. Precipitation averages less than 8.64 inches per year and primarily occurs in the late summer and fall as rain (WRCC 2004).

Figure 1 Location of the Mack Ridge and Rabbit Valley Planning Areas.



<p>Colorado Natural Heritage Program Colorado State University College of Natural Resources 8002 Campus Delivery Fort Collins, CO 80523-8002</p> <p>Disclaimer Data are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.</p>	<p> Planning Area Boundary</p> <p>39108-A1, Grand Junction 39109-A1, Westwater 30x60 Minute Series</p> <p>Digital Raster Graphics produced by the U.S. Geological Survey map created 21 April 2004 UTM, Zone13, NAD27</p>	<p>Location in Mesa County</p> 
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II. The Natural Heritage Network and Biological Diversity

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 biological diversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that 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 biological diversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country have not been based upon preserving biological diversity; 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 biological diversity, Robert Jenkins, a biologist working with The Nature Conservancy, developed the Natural Heritage Methodology in 1978 (The Nature Conservancy 2000).

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 that 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. For more information on the work of the Natural Heritage Network see www.natureserve.org.

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 multi-cellular 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 natural 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. Once lost, 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 ecological communities within an area that represent the range of species relationships and interdependence. These communities may be characteristic of, or even endemic to, an area. It is within ecological communities that all life dwells.
4. **Landscape Diversity** -- the type, condition, pattern, and connectedness of ecological communities. A landscape consisting of a mosaic of ecological 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. Often overlooked is the reality that humans are also linked to all levels of this hierarchy of diversity. The Colorado Natural Heritage Program believes 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

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 ecological

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 oversee the transcription and mapping of the data and physical locations into the BIOTICS data system. BIOTICS combines a relational database (Oracle) with a geographic information system (ArcView GIS). The data in 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 uses BIOTICS for its data management. 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. CNHP's BIOTICS is a GIS-based system for setting priorities that provides land managers with an effective, proactive land-planning tool. For more information on the work of the Colorado Natural Heritage Program please see www.cnhp.colostate.edu.

The Natural Heritage Ranking System

Each of the plant or animal species and ecological 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. The number of occurrences is weighted more heavily than other criteria because an element found in one place is more imperiled than something found in twenty-one places. Other factors considered in defining the element imperilment rank are 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 indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than 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, vulnerable both globally and in Colorado. Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1S1, critically imperiled both globally and in Colorado. 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 Statute 33-2-105 Article 2. State designations apply to animals only; Colorado has no legal list of threatened and endangered plant species (Buckner and Bunin 1992).

In addition, the U.S. Forest Service and Bureau of Land Management recognize some species as "Sensitive". Table 2 defines the special status designations 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 in Table 2 with a "C".

Table 1. Definition of CNHP 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 some factor of its biology makes 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 throughout 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.

Element Occurrence Ranking

Actual locations of elements, whether they are single organisms, populations, or plant communities, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. 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 the most ecologically 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.

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 listed as potentially 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

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 areas needed for their conservation. These “Potential Conservation Areas” (PCA) focus on capturing the ecological processes that are necessary to support the viable persistence of an element occurrence. A PCA may include a single occurrence of an element or a suite of element occurrences. Not all element occurrences are included in PCAs. PCAs are ordinarily drawn for A to C ranked G1 to G3 and S1 or S2 elements only. Other lower ranked element occurrences may fall geographically within the boundaries of a PCA, and are thus included, but would not warrant a PCA on their own.

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. CNHP PCAs are referred to by the BLM as “Areas of Biological Significance”.

In developing PCA boundaries, CNHP biologists 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 of a PCA does not recommend the exclusion of all activity. It is hypothesized that some activities will prove degrading to the element or the process on which the element depends, while others will not. Specific activities or land use changes proposed within or adjacent to the PCA boundary should be carefully considered and evaluated for their implications to the survival of the elements for which the PCA is primarily defined and the other elements that also fall within the site.

The PCA boundaries presented here are for planning and management purposes. They delineate ecological areas where land-use practices should be carefully planned and managed to ensure compatibility with protection goals for natural heritage elements. Please note that PCA 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 PCA of reasonable size. For instance, while a PCA for Colorado River cutthroat trout may be drawn to include only a portion of the riparian zone of a river or creek, it should be noted that the ecological functions that determine the viability of the occurrence operate at the watershed scale. Activities throughout the entire watershed can affect water quality and hydrology of the river, which in turn may affect the trout's local habitat and population viability. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level planning and conservation efforts are needed. This requires coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies with jurisdictions and interests across the landscape.

Ranking of Potential Conservation Areas

Potential Conservation Areas (sites or PCAs) are ranked based on their Biological Diversity (B rank), their existing level of land use Protection (P rank), and their existing level of land use Management (M rank). These three ranks allow land managers to evaluate a site in terms of both its biodiversity value and its level of potential vulnerability to change.

Biological Diversity Rank

CNHP uses element and element occurrence ranks to assess the biological diversity significance of a site. 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 **Biological Diversity 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 Biological diversity 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 should occur in order to prevent the loss of the element. 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 potential threats that are related to land ownership or designation. The following codes are used to indicate the urgency to protect the area:

- P1** May be immediately threatened by severely destructive forces, within 1 year of rank date,
- 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.

A protection action involves increasing the current level of legal protection accorded one or more tracts of a potential conservation area. Protection strategies on public lands may include special designations such as Wilderness, Research Natural Areas (RNA), 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.

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 grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences in the PCA.

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 at the area:

- M1** Management action may be required immediately or element occurrences could be lost or irretrievably degraded within one year,
- M2** New management action may be needed within 5 years to prevent the loss of element occurrences,

- M3** New management action may 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 comprehensively inventorying the biology of and prioritizing conservation needs over a large area are necessarily diverse. This Biological Inventory of the Colorado Canyons National Conservation Area follows a method that the Colorado Natural Heritage Program has used and continues to develop specifically for this purpose. The Biological Inventory of the Colorado Canyons National Conservation Area was conducted in several steps as summarized below and is explained in the following sections.

- Collect available information
- Identify the Imperiled Elements with potential to occur in the CCNCA
- Identify Targeted Inventory Areas (TIAs)
- Conduct Field Surveys
- Process new and updated Element Occurrence data
- Delineate Potential Conservation Areas (PCAs)

Collect available information

Prior to conducting the inventory, available existing information for the area was collected from a number of sources and entered into the CNHP databases. Information on new occurrences and updates to existing occurrences were included. A variety of information sources were consulted for this information. The plant and animal collections at Colorado State University, University of Colorado, Rocky Mountain Herbarium, Mesa College Herbarium, and local private collections were reviewed. Both general and specific literature sources were checked for either locational information or biological data pertaining to a species in general.

Identify the Imperiled Elements with potential to occur in the CCNCA

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 Mesa and adjacent counties are included in this list. Species or plant communities that prefer habitats not included in the study area were removed from the list.

The inventory effort for each of these elements was prioritized according to the element's Global rank. Globally imperiled to vulnerable (G1-G3) elements were given highest priority, State imperiled to vulnerable (S1-S3) elements were given secondary priority. Globally and State secure elements (G4-G5) were given the least priority.

Identify Targeted Inventory Areas

Inventory areas were targeted based on their likelihood of harboring imperiled species or significant plant communities. Locations of priority elements known from preliminary information were targeted for survey. Additional areas were targeted using a variety of information sources, such as aerial photography, topographic maps, geology maps, and hydrology maps. Precisely known element locations for historic records were included so that they could be verified and updated as possible.

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. In addition, CNHP took care to ensure that all major ecosystems, vegetation types, and elevational zones in the area were included in the field surveys.

This process was used to delineate over 61 TIAs that were believed to have relatively high probability of harboring natural heritage resources. These areas vary in size from less than 10 to several hundred acres and include all major habitat types in the study area. Included in the list are 23 TIAs for seep and spring areas. Figures 2 and 3 show the locations of plant, animal, and natural community TIAs identified in the Mack Ridge and Rabbit Valley Areas.

Surveys for all elements were prioritized by the element's degree of imperilment. For example, all species with Natural Heritage ranks of G1-G3 were the primary targets 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. Likewise, element occurrences with precise locations were prioritized over elements with general or missing location information.

Conduct Field Surveys

Following the delineation of TIAs, field surveys were planned and completed to search for the prioritized list of elements. The TIAs were visited at the appropriate time as dictated by the phenology of the individual elements. It is essential that surveys take place during a time when the targeted elements are detectable. For instance, breeding birds cannot be surveyed outside of the breeding season and plants are often not identifiable without flowers or fruit which are only present during certain times of the season. Many of the plants in the CCNCA have extremely short flowering seasons and all but disappear by mid-summer. In the Rabbit Valley and Mack Ridge areas field surveys for the targeted elements and areas were conducted in April, May, September, and October of 2003.

The methods used in the surveys necessarily vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that attempted to cover the area as thoroughly as possible in the time available.

Some types of organisms require special techniques in order to capture and document their presence. These are summarized below:

Amphibians: visual or with aquatic nets

Mammals: Sherman live traps, pitfall traps

Figure 2. Targeted Inventory Areas (TIAs) for plants and natural communities.

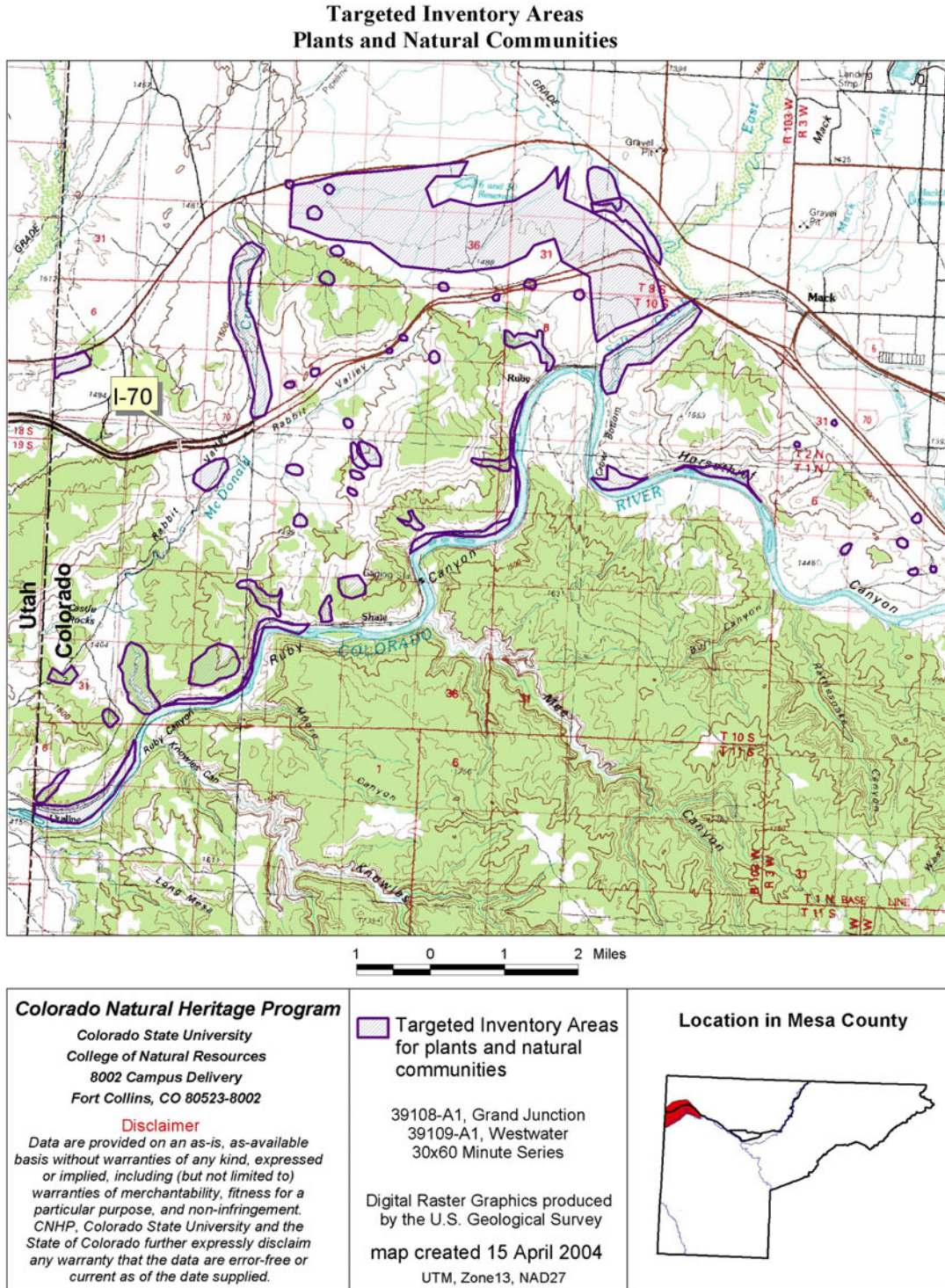
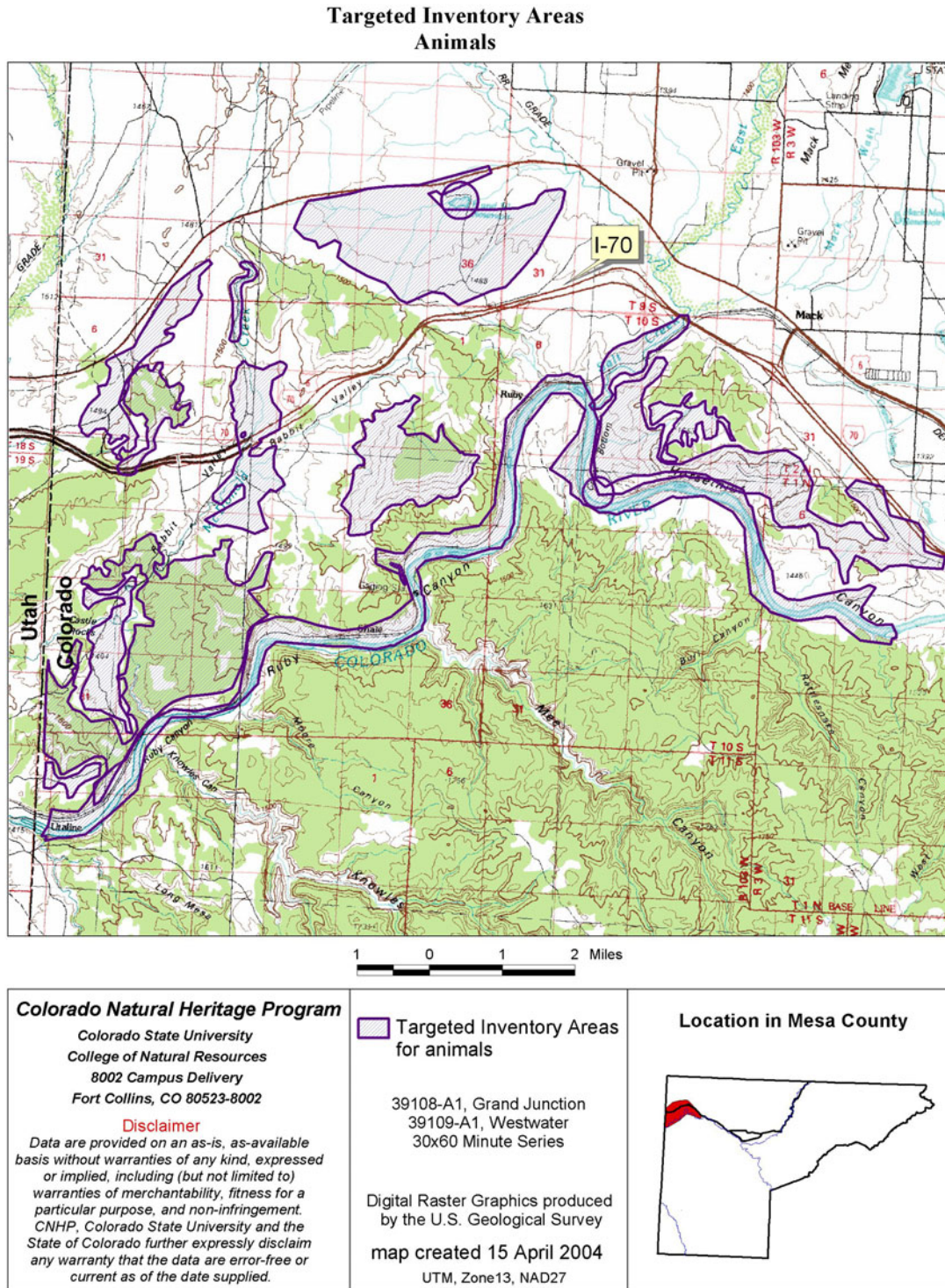


Figure 3. Targeted Inventory Areas (TIAs) for animal species.



Birds: visual or by song/call, evidence of breeding sought
Insects: aerial net, pit fall traps, moth lighting
Plant communities: visual, collect qualitative or quantitative composition data
Wetland plant communities: visual, collect qualitative or quantitative composition, soil, and hydrological function and value data
Fishes: electroshocking, seining, barbless fly-fishing, observation

When a species or community element was discovered, its precise location and known extent was recorded with GPS and marked on 1:24,000 scale topographic maps. Other data recorded at each occurrence includes numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs and other descriptive information. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the viability of the population, based on its size, condition and landscape context. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See Section II on Natural Heritage Methodology for more about element occurrence ranking.

It should be noted that observations made in any one year may not represent the range of conditions over the long term. The current drought conditions that have existed for approximately 5 years have likely reduced the presence of many plant species. The unusually dry weather has shortened growing seasons and made it difficult to verify the continued presence of some plant species which we had identified in 1996. Continued observations over several years may prove useful to document the continued presence of targeted elements that were not encountered during this 2003 survey.

Process updated and new Element Occurrence data

Before it can be useful, field data collected during the summer inventory is processed and added to the CNHP database. Processing includes review of the element data and review of the occurrence data to assign an appropriate occurrence rank. Element occurrence data for new and updated EORs is transcribed from the field notes and entered into a database template. Prior to being loaded into the database, the field data undergoes a rigorous quality assurance process. Locations for elements and polygons representing the occurrences on the ground are digitized and integrated with the field data in the database. As necessary, Global and State element ranks may be modified to reflect the new data. These new and updated element occurrences represent the raw product of the inventory project.

Delineate Potential Conservation Area Boundaries

To aid in the conservation of the identified elements, CNHP delineates specific areas needed for potential conservation efforts that may be undertaken. These “Potential Conservation Areas” (Sites or PCAs) are equivalent to the BLM’s Areas of Biological Significance. The area of land delineated by CNHP as a PCA is an estimate of the minimum area needed to ensure the viable persistence of the elements for which the PCA was drawn. PCAs do not convey, nor should they be interpreted as having, any legal status. They are simply a recommendation of the minimum area of land that may be necessary to conserve if the elements are to be preserved.

The PCA boundary is based on the ecological processes of the element occurrences attached to it. Therefore the ecological scale of the elements attached to the PCA, in part, determines the scale of the PCA. Elements with dissimilar ecological scales are typically attached to separate PCAs. In general, elements that operate at very large scales require a larger PCA, while those that operate at a very local scale may be drawn much smaller and still capture the essential ecological factors.

The rank of the PCA is based on the global and state ranks of the elements for which the PCA is drawn. For a detailed discussion of the PCA ranking process see “Potential Conservation Areas” in Section II above.

Data collected in the field are essential to delineating PCA boundaries, but other sources of information such as aerial photography are also used. PCA boundaries should be considered as preliminary and should be adapted over time in response to changing information about site conditions or the status or understanding of the elements attached to the site. There is a continuing need for additional research, both to delineate PCAs for new occurrences and to update PCAs for known occurrences.

III. Results

The Mack Ridge and Rabbit Valley areas contain a total of 136 known element occurrences. The occurrences include 64 animal records, 34 plant records, and 38 records for natural communities. The Biological Inventory of the Colorado Canyons National Conservation Area identified 39 new element occurrence records for the Mack Ridge and Rabbit Valley Planning Areas. New element occurrences of note recorded in the Mack Ridge and Rabbit Valley Planning Areas include a Peregrine Falcon observation near Crow Bottom, an occurrence for Eastwood evening primrose (*Camissonia eastwoodiae*), an occurrence for the long-nosed leopard lizard (*Gambelia wislizenii*), and a new occurrence for Gardner's mat saltbush shrubland (*Atriplex gardneri*/*Leymus salinus* shrubland) among others.

The following sections present four Potential Conservation Areas (PCAs) and a series of Species Abstracts and Ecological System descriptions. The PCAs were drawn and defined to ensure the long-term viability of the elements identified in the CCNCA. Species Abstracts and Ecological System descriptions are provided for the element occurrences that define site Biodiversity Ranks. They are included to provide land and resource managers with information important to decision making regarding the conservation of the elements.

Species characterization abstracts provide specific information on the biology and habitat of an individual plant or animal species. Ecological system descriptions apply to several plant associations with similar ecological requirements. The descriptions characterize those ecological requirements, including the processes, distribution, vegetation, environment, and other factors that support the plant associations in that system. The broader perspective that ecological systems provide can be applied to any of the several associations that occur within the system.

Potential Conservation Areas within the CCNCA

Potential Conservation Areas (PCAs) define our best estimate of the minimum area necessary to ensure successful long-term conservation of the elements attached to it. PCAs do not possess any legal basis or requirements, but are simply recommendations based on our best estimate of what area of land is necessary to support the elements biological requirements. The BLM recognizes PCAs as Areas of Biological Significance and uses this terminology to present and describe these areas in BLM planning and management documents

Prior to this study, CNHP had defined four PCAs in the Mack Ridge and Rabbit Valley Planning Areas: Colorado River PCA, the Six and Fifty Reservoir PCA, the Mack Ridge PCA, and the Rabbit Valley PCA. Based on the new and updated element occurrence records, those four PCAs have been revised to best reflect the conservation status and needs of the elements. Revisions included making additions to the list of elements attached to or driving the PCA rank, review and adjustment of the Biodiversity rank (B rank) of the PCA, and making changes to the shape and placement of the PCA boundaries.

The following pages provide descriptions and maps for each of the four PCAs included in the Mack Ridge and Rabbit Valley Planning Areas.

Colorado River Site – Ruby & Horsethief Canyon Reaches

Biodiversity Rank: B1 (Outstanding significance)

The Ruby and Horsethief reaches of the Colorado River Site support fair (C ranked) occurrences for the globally critically imperiled (G1) and federally endangered Colorado pikeminnow (*Ptychocheilus lucius*) and the globally critically imperiled (G1) humpback chub (*Gila cypha*), and several good and fair (B-C ranked) occurrences for the globally vulnerable (G4T3) American Peregrine Falcon (*Falco peregrines anatum*).

The site also supports historic (H ranked) occurrences for the globally critically imperiled (G1) and federally endangered razorback sucker (*Xyrauchen texanus*), the globally vulnerable (G3) roundtail chub (*Gila robusta*), and the globally apparently secure (G4) bald eagle (*Haliaeetus leucocephalus*). An extirpated (X ranked) occurrence for the globally critically imperiled bonytail chub (*Gila elegans*) also occurs within the site.

The Colorado River site is a very large site extending along the Colorado River from the Colorado-Utah border to just above the town of Rifle. The Ruby and Horsethief Canyon reaches of the Colorado River Site are within the CCNCA and are the focus of this Site Report. While the Biodiversity Rank is based on the entire site, the Horsethief and Ruby Canyon reaches are of critical importance to the primary elements driving the site rank.

Protection Urgency Rank: P5

In Ruby and Horsethief Canyons, the BLM land on either side of the river has been designated as part of the CCNCA and will be managed for multiple use in accordance with the final management plan for the area. Most floodplain areas of Ruby and Horsethief Canyons are also publicly owned and managed by the BLM, with a few small parcels of private land. Although the Colorado River is excluded from the CCNCA, the USFWS has designated these reaches of the Colorado River as critical habitat for the endangered Colorado River fishes. The state and federal governments provide protection for the Bald Eagle, razorback sucker, Colorado pikeminnow, and humpback chub under the Endangered Species Act. The Peregrine Falcon and the roundtail chub are managed under the BLM Special Status Species Policy.

Management Urgency Rank: M3

BLM management for Ruby and Horsethief Canyons will be defined by the management plans established for the CCNCA. Existing management for the area generally emphasizes recreational uses, calls for managing wildlife habitat primarily for endangered and special concern species, and strives to improve land health. In the river corridor this places an emphasis on improving the quality and increasing the area of cottonwood stands on the riparian bottoms. Management to protect and increase the quality of cottonwood stands in the riparian zone is important in protecting these species (USDI 1987). Habitat for Peregrine Falcons and Bald Eagles is actively managed and protected from surface-disturbing activities. Camping and boating activities must be managed to minimize impacts to the habitat and populations of the endangered Colorado River fishes.

Location: Located along the main channel of the Colorado River, beginning approximately at the Utah – Colorado border and extending upstream to approximately twenty miles west of Grand Junction or where the river enters Horsethief Canyon below the Loma boat launch.

U.S.G.S. quadrangles:	Bitter Creek Well, Ruby Canyon, Westwater, Mack Quadrangles
Legal Description:	T1N R3W Sections 7, 8, 9, 10 T10S R103W Sections 5, 7, 8, 15, 16, 17, 18, 19 T10S R104W Sections 23, 24, 25, 26, 27, 28, 32, 33 T11S R104W Sections 4, 5, 8
Size:	Approx. 3,300 acres (1,300 ha)
Elevation:	4,440 to 5,689 feet (1,350 to 1,734)

General Description: The Colorado River Site is a very large linear site that extends from just above the Town of Rifle to the Colorado-Utah border. The Ruby and Horsethief Canyon reaches of the Colorado River Site are within the CCNCA and are the focus of this site report. It should be noted that the information provided here, applies specifically to the section of the river corridor that extends from the Colorado – Utah border to area of the Loma boat launch. Other portions of the site upstream from this reach are fully described in the CNHP database and other CNHP reports.

This section of the river corridor winds through a wide canyon containing narrow floodplains which are frequently backed by a series of sandstone cliffs and benches. There are no diversions or dam structures in this reach of the river. The Union Pacific Railroad line enters the canyon at the confluence with West Salt Creek and parallels the river as it flows into Utah.

The river and its primary floodplains are critical to ensuring the survival and viability of the endangered Colorado River fishes for which this site is primarily drawn. Floodplain areas with back water areas and slack water shorelines are important habitat characteristics for the endangered fishes. Floodplain vegetation in many areas is dominated by the non-native invasive species tamarisk (*Tamarisk racemosa*). River flows through this reach of the river are characterized as flat water, without the presence of any rapids. Although during spring when snowmelt induced flows occur river velocities increase significantly.

River flows in this reach are a function of the regulated nature of the river, which along its course is frequently diverted to provide water for urban and agricultural uses on the east and west slopes of the continental divide. Diversions along the Colorado River reduce total flow and peak discharges. Water quality in this reach is likewise a function of basinwide water and land uses which tend to increase sediment and contaminant loads over natural conditions (Osmundson et.al. 2002).

The canyon walls provide numerous nesting and perch sites for the Peregrine Falcon. Some of the floodplains in the canyon support large cottonwood trees that provide important nesting sites for the Bald Eagle.

The canyon is also an important recreational area. While there are no established trails on most of the floodplain areas, the river is very popular for boating and camping.

Biodiversity Rank Justification: The Ruby and Horsethief Canyon reaches of the Colorado River Site are very important habitat areas for the once common, but now endangered Colorado River fishes (Osmundson 2002). This reach supports good (C ranked) and historic (H ranked)

occurrences of the globally critically imperiled (G1) Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*), and fair (C ranked) occurrence of the globally vulnerable (G3) roundtail chub (*Gila robusta*). The site also supports occurrences of the globally vulnerable (G3) American Peregrine Falcon (*Falco peregrines anatum*), and the globally apparently secure (G4) Bald Eagle (*Haliaeetus leucocephalus*). The CNHP database also indicates an historic (H ranked) occurrence for the extirpated bonytail chub (*Gila elegans*) from this reach of the river. Table 3 lists the elements supported by the Ruby and Horsethief Canyon reaches of the Colorado River Site.

Recent surveys conducted by the U.S. Fish and Wildlife Service (USFWS) have documented the status of the Colorado pikeminnow population in the reach of the river that includes Ruby and Horsethief Canyons (Osmundson 2003). Based on the multi-year studies conducted, the reach including the Ruby and Horsethief canyons was estimated to support a total population of 420 fish. The estimate for the most recent study was not significantly different from the first study period. The studies also identified a significant decrease in the number of native roundtail chub (*Gila robusta*) present in the reach, as well as a significant increase in the number of non-native species over the ten year sampling period (Osmundson 2003).

Table 3. Natural Heritage elements of the Horsethief and Ruby Canyon Reaches of the Colorado River Site (all elements were used to establish site rank).

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	*EO Rank
<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	E	ST	C
<i>Gila cypha</i>	Humpback Chub	G1	S1	E	ST	C
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B	BLM Sens	SC	C
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B	BLM Sens	SC	C
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B	BLM Sens	SC	B
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B	BLM Sens	SC	C
<i>Gila cypha</i>	Humpback Chub	G1	S1	E	ST	H
<i>Gila cypha</i>	Humpback Chub	G1	S1	E	ST	H
<i>Gila cypha</i>	Humpback Chub	G1	S1	E	ST	H
<i>Gila cypha</i>	Humpback Chub	G1	S1	E	ST	H
<i>Xyrauchen texanus</i>	Razorback Sucker	G1	S1	E	SE	H
<i>Xyrauchen texanus</i>	Razorback Sucker	G1	S1	E	SE	H
<i>Gila elegans</i>	Bonytail Chub	G1	SX	E	SE	X
<i>Gila robusta</i>	Roundtail Chub	G3	S2	BLM Sens	SC	C
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B, S3N	T	ST	C
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B, S3N	T	ST	C

*EO = Element Occurrence

The gallery forests occupying the floodplains nearest the river were historically dominated by an overstory of Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*) with an open shrub canopy of skunkbrush sumac (*Rhus trilobata*) and a sparse herbaceous understory of mesic graminoid species. However, alteration of the river's natural hydrology has negatively impacted cottonwood regeneration and promoted a dense cover of non-native species such as tamarisk (*Tamarix ramosissima*), Russian olive (*Elaeagnus angustifolia*), and Russian knapweed (*Acroptilon repens*) on the floodplains. As a result, the cover of native riparian vegetation remaining along the river has been diminished.

The gallery forests within the Ruby and Horsethief Canyons are small and of poor quality, but do have the potential to support nesting Bald Eagles. Protecting habitat for nesting Bald Eagles in Crow Bottom and other riparian forest areas of the river corridor will require maintaining the quality of these areas in the near-term and improving the quality and quantity over the long-term. Because riparian cottonwood gallery forests depend on periodic flooding and high water tables for regeneration, recruitment of young cottonwood trees on Crow Bottom and other floodplain areas is lower than it would be otherwise due to changes in the natural hydrologic regime of the river and competition from invasive species.

Boundary Justification: The Colorado River Site is a large site that passes through the CCNCA and extends far upstream of the Mack Ridge and Rabbit Valley areas. This portion of the site provides important habitat for the endangered Colorado River fishes and the Bald Eagles and Peregrine Falcons that nest in the canyon. The boundary for the Ruby and Horsethief Canyon reaches of the Colorado River site encompasses the main stem of the river, its floodplains, and the cliff walls adjacent to the river and floodplain (Figure 4). The boundaries incorporate an area that will allow natural hydrological processes such as seasonal flooding, sediment deposition, and new channel formation to maintain habitat for viable populations of the fish elements. It should be noted that the hydrological processes necessary to the elements are not fully contained by the site boundaries. Given that the endangered fish elements are affected by hydrologic and water quality processes associated with the Colorado River, upstream activities such as diversions, impoundments, and development could potentially be detrimental to the elements. This boundary indicates the minimum area that should be considered for any conservation management plan.

Protection Rank Justification: In Ruby and Horsethief Canyons, the BLM land on either side of the river has been designated as part of the CCNCA. Most floodplain areas of Ruby and Horsethief Canyons are publicly owned and managed by the BLM, with a few small parcels of private land. Crow Bottom is an important parcel of riparian habitat that remains in private ownership. As available, private parcels in the riparian zone should be purchased and managed by the BLM in concert with the other lands in the canyon.

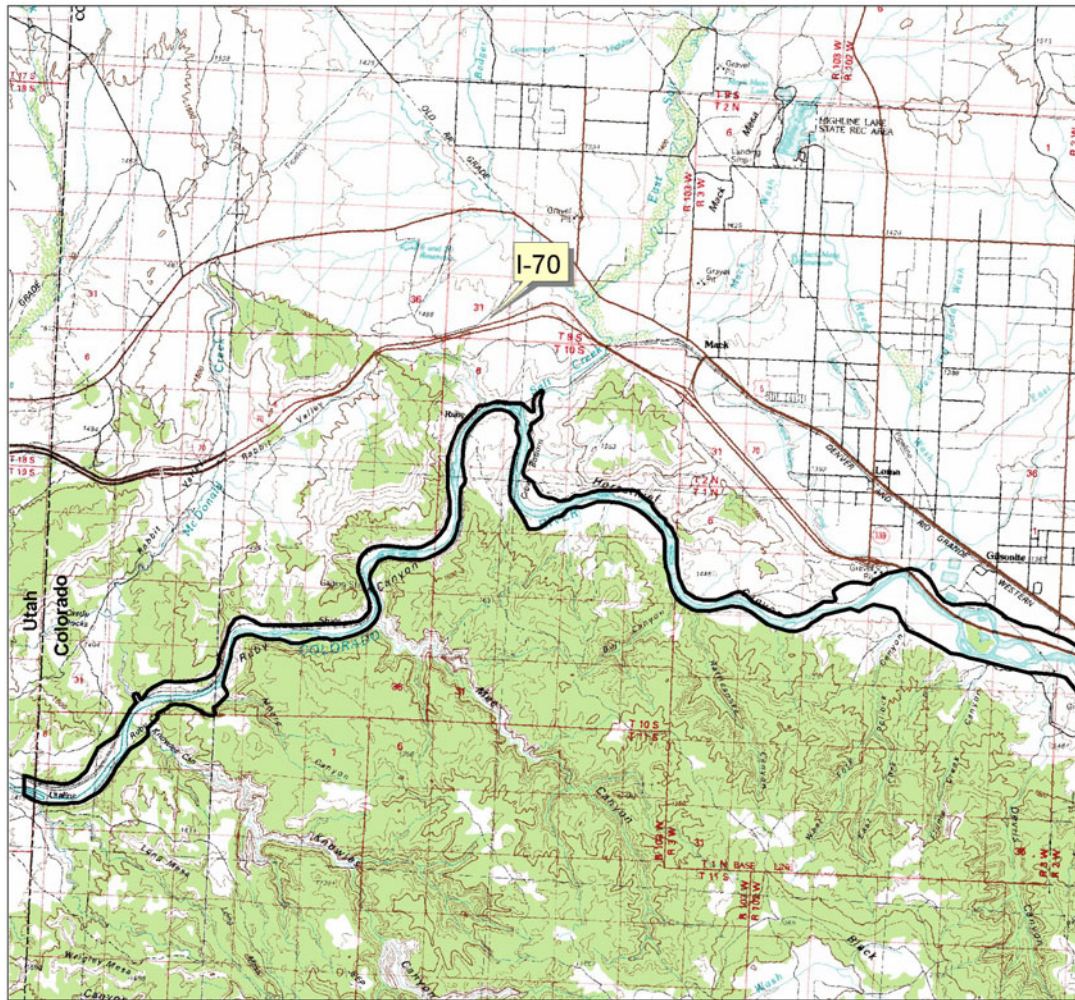
Management Rank Justification: BLM management for Ruby and Horsethief Canyons will be defined by the management plans established for the CCNCA. Existing management for the area generally emphasizes recreational uses, calls for managing wildlife habitat primarily for endangered and special concern species, and strives to improve land health. The state and federal governments provide protection for the Bald Eagle, razorback sucker, Colorado pikeminnow, and humpback chub under the Endangered Species Act. The peregrine falcon and the roundtail chub are managed under the BLM Species of Special Concern Policy.

In the river corridor, management should place an emphasis on improving the quality and increasing the area of cottonwood stands on the riparian bottoms. Management to protect and increase the quality of backwater areas in the riparian zone is important in protecting the fish species (USDI 1987). Monitoring of federally listed species is under the authority of the USFWS. Current efforts by the Colorado Division of Wildlife (CDOW) to control competition and predation by the non-native fish also inhabiting the reach should be encouraged and continued (Nesler 2004). The cliff face habitat important for Peregrine Falcons and Bald Eagles is actively managed and protected from surface-disturbing activities.

Monitoring and control of non-native plant species is important to improving the quality of the elements and ensuring their long-term viability. Elements should be monitored to determine if their status is stable, increasing, or decreasing.

Figure 4. Colorado River PCA

Ruby and Horsethief Canyon Reaches, Colorado River Potential Conservation Area
 B1: Outstanding Biodiversity Significance



1 0 1 2 Miles

Colorado Natural Heritage Program

Colorado State University
 College of Natural Resources
 8002 Campus Delivery
 Fort Collins, CO 80523-8002

Disclaimer

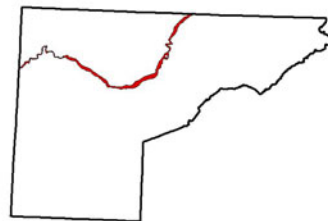
Data are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

 PCA Boundary

39108-A1, Grand Junction
 39109-A1, Westwater
 30x60 Minute Series

Digital Raster Graphics produced
 by the U.S. Geological Survey
 map created 2 March 2004
 UTM, Zone13, NAD27

Location in Mesa County



Six and Fifty Reservoir

Biodiversity Rank: B2 (Very High Significance)

The Six and Fifty Site supports an excellent (A ranked) occurrence of the globally imperiled (G2S1) Eastwood evening primrose (*Camissonia eastwoodiae*), a good (B ranked) occurrence of the globally imperiled (G2S2) Western Slope Grassland (*Achnatherum hymenoides* shale barren) community, and a good (B ranked) and a fair (C ranked) occurrence of the globally imperiled (G2?S2?) Gardner's mat saltbush shrubland (*Atriplex gardneri*/*Leymus salinus* shrubland) plant community. Other elements included in the site are several fair (C ranked) occurrences of globally vulnerable plant communities and good (B ranked) occurrences of globally vulnerable plant and animal species.

Protection Urgency Rank: P5

The site is contained within the Colorado Canyons National Conservation Area. Protection for the CCNCA is afforded by the public ownership and defined by the multiple use policies inherent in the NCA legislation.

Management Urgency Rank: M3

Much of this site's area is impacted by invasive species, notably Cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola tragus*). West salt creek and other drainages on the site have been invaded by Tamarisk (*Tamarisk racemosa*). An active program of weed management is needed to prevent the further spread of exotic species and reclaim the areas already infested. To determine if recreational and grazing activities and the presence of invasive species are impacting the rare plants and natural communities, monitoring should be undertaken. This would allow BLM to determine if their populations are stable or whether they exhibit a declining or increasing trend.

Location: This site is located west of Mack along Highway 6 and 50. The site extends north from the I-70 corridor to approximately 1 mile north of 6 & 50 highway. The eastern site boundary begins at West Salt Creek and extends west for about 7 km.

U.S.G.S. quadrangle:	Badger Wash, Ruby Canyon, and Bitter Creek Well Quadrangles
Legal Description:	T9S R103W Sections 19, 29, 30, 31, 32 T9S R104W Sections 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, 36
Size:	6,273 acres (2,538 ha)
Elevation:	4,900 to 5,400 feet (1,500 to 1,650 meters)

General Description: The Six and Fifty Reservoir Site, which straddles Highway 6 and 50 west of Mack, is an area of low, rolling, shale hills, and salt-desert shrub vegetation. Depending on steepness and aspect, the slopes are dominated by shrublands of shadscale, mat saltbush, or Gardner saltbush (*Atriplex* sp.). Associated native grasses include galleta (*Pleuraphis jamesii*), Indian rice grass (*Achnatherum hymenoides*), and Salina wild rye (*Leymus salinus*). Common forbs are poison aster (*Xylorhiza* sp.) and prince's plume (*Stanleya pinnata*). The Ridges and small drainages often contain the vulnerable Grand buckwheat (*Eriogonum contortum*). It is often associated with Gardner saltbush (*Atriplex gardneri*) and poison aster (*Xylorhiza* sp.). Similar habitats support the

less abundant tall cryptanth (*Cryptantha elata*). The flat bottomlands are degraded and covered by a combination of greasewood (*Sarcobatus vermiculatus*) or mat saltbush (*Atriplex corrugata*), usually with an understory of cheatgrass (*Bromus tectorum*) or barren shale. The drainages of intermittent and perennial streams have been invaded by tamarisk (*Tamarisk racemosa*). Other common species are rabbitbrush (*Chrysothamnus* sp.), spiny horsebrush (*Tetradymia spinosa*), budsage (*Picrothamnus desertorum*), and winterfat (*Krascheninnikovia lanata*). Recently disturbed areas are invaded by Russian thistle (*Salsola australis*). There are some remnant patches of Indian rice grass (*Achnatherum hymenoides*) in good condition, with few exotic species, that are indicative of the potential natural community.

The key ecological factors of this site are the convergence of climatic and edaphic factors. The soils are derived primarily from sandstone and shale parent materials and range from fine clayey to sandy to very rocky. Together with the dry arid climate the geology of the site provides conditions which support several imperiled plant species and salt-desert plant associations.

Biodiversity Rank Justification: The Six and Fifty Site contains an excellent (A ranked) occurrence of a globally imperiled plant species (*Camissonia eastwoodiae*), a good (B ranked) occurrence of a globally imperiled plant community (*Achnatherum hymenoides* shale barrens) and good (B ranked) and fair (C ranked) occurrences of a globally imperiled (G2S2) plant community (*Atriplex gardneri/ leymus salinus* Shrubland).

Other elements included in the site are several occurrences of fair (C ranked) globally vulnerable plant communities and good (B ranked) occurrences of globally vulnerable plant species (Table 4).

Table 4. Natural Heritage elements at the Six and Fifty Reservoir Site (elements at top of list in bold type are used to establish site rank).

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	*EO Rank
<i>Camissonia eastwoodiae</i>	Eastwood evening-primrose	G2	S1			A
<i>Achnatherum hymenoides</i> Shale Barrens	western slope grasslands	G2	S2			B
<i>Atriplex gardneri/ leymus salinus</i> Shrubland	Gardner's mat saltbush shrublands	G2?	S2?			B
<i>Atriplex gardneri/ leymus salinus</i> Shrubland	Gardner's mat saltbush shrublands	G2?	S2?			C
<i>Eriogonum contortum</i>	Grand buckwheat	G3	S2	BLM Sens		B
<i>Cryptantha elata</i>	cliffdweller's candlestick catseye	G3	S2			B
<i>Atriplex gardneri/Pleuraphis jamesii</i> Shrubland	Gardner's mat saltbush shrublands	G3G5	S1?			C
<i>Atriplex confertifolia/Leymus salinus</i> Shrubland	Cold desert shrublands	G3G5	S3			B
<i>Vireo vicinior</i>	Gray vireo	G4	S2B			E
<i>Gambelia wislizenii</i>	longnose leopard lizard	G5	S1	BLM Sens		H
<i>Atriplex corrugata</i> Shale Barren Shrubland	alkali mat saltbush shrublands	G5	S2?			C
<i>Plegadis chihi</i>	White-faced ibis	G5	S2B	BLM Sens		E
<i>Himantopus mexicanus</i>	Black-necked stilt	G5	S3B			E
<i>Mustela nigripes</i>	Black-footed ferret	G1	S1	FE		H

*EO = Element Occurrence

Additional noteworthy elements attached to the site include Grand buckwheat (*Eriogonum contortum*), cliffdweller's candlestick catseye (*Cryptantha elata*), Gardner's mat saltbush shrublands (*Atriplex gardneri/Pleuraphis jamesii*), cold desert shrublands (*Atriplex confertifolia/Leymus salinus*), Gray Vireo (*Vireo vicinior*), and longnose leopard lizard (*Gambelia wislizenii*). While several of these are globally secure or apparently secure, they are imperiled or critically imperiled in Colorado. They include the White-faced Ibis (*Plegadis chihi*) (G5S2B), the longnose leopard lizard (*Gambelia wislizenii*) (G5S2), and the Gray Vireo (*Vireo vicinior*) (G4S2B).

The site is also the location of a historic occurrence for the federally endangered black footed ferret (*Mustela nigrapes*). That record in the CNHP database was recorded for an observation of a ferret in a prairie dog town in 1986. The prairie dog towns within this site could at some future date be valuable for reintroduction of the black footed ferret.

Boundary Justification: The boundary was drawn to identify the minimum area recommended for protection of the primary elements located in the area. The elements primarily driving the site design are the Eastwood evening-primrose (*Camissonia eastwoodiae*), western slope grasslands (*Achnatherum hymenoides shale barren*), and Gardner's mat saltbush shrublands (*Atriplex gardneri/Leymus salinus*).

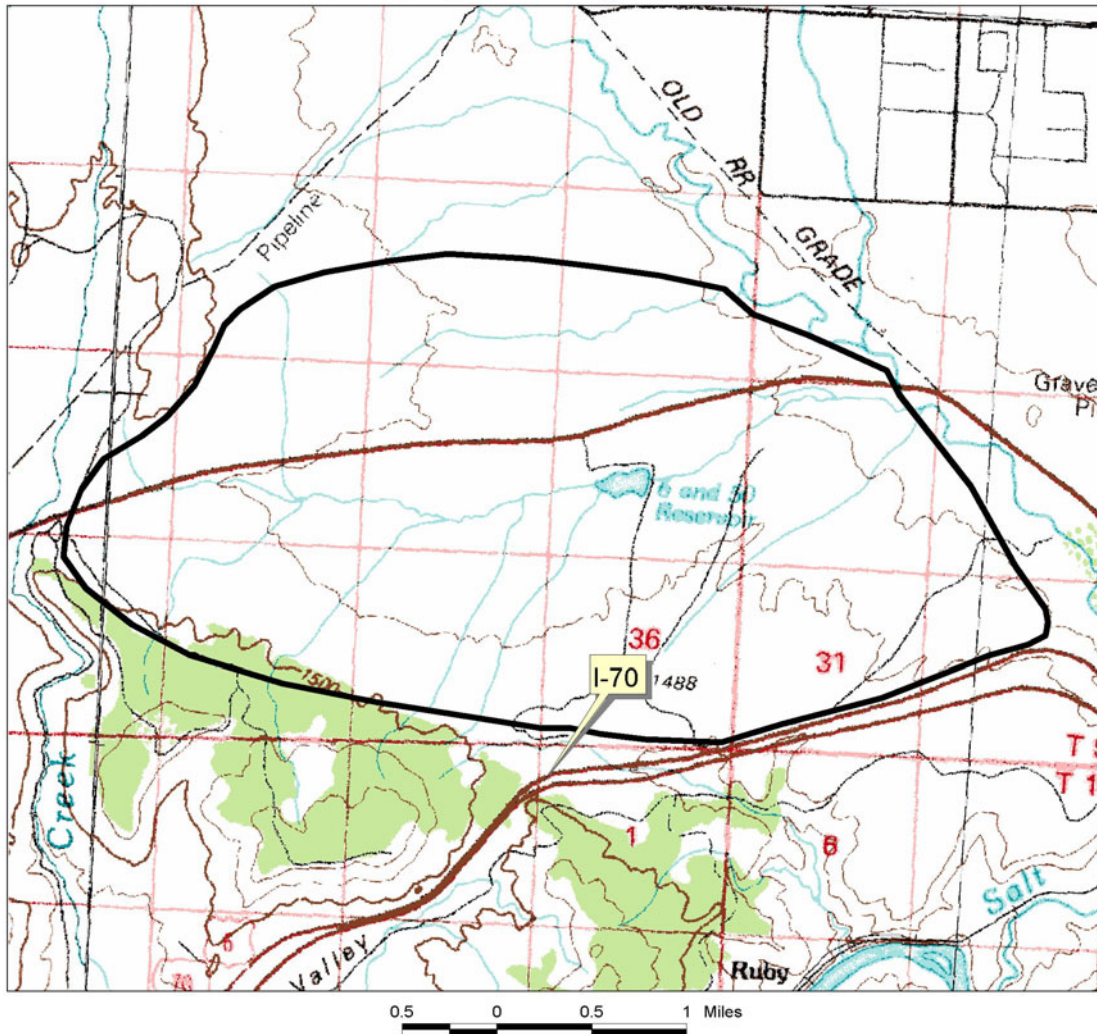
The site boundaries include the element occurrences and adjacent habitat for the plant and animal species and significant plant communities of the area (Figure 5). While the entire site is located on BLM lands, the majority of the site is within the CCNCA. The Six and Fifty Reservoir which is included in the site provides an important source of water for migratory and resident wildlife in this arid desert environment.


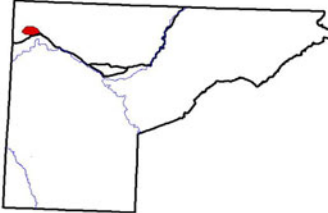
Protection Rank Justification: The site is entirely on BLM property and is contained largely within the Colorado Canyons National Conservation Area. Protection for the CCNCA is afforded by the public ownership and defined by the multiple use policies inherent in the NCA legislation.

Management Rank Justification: Grazing and weed management are the most critical management needs at this site. Because a large portion of this site is within the CCNCA, management of off-road vehicle use, and extractive uses are limited. However, weed infestation and cattle grazing remain the leading threats to the quality and continued existence of the elements on the site. Monitoring is needed to determine if the status for the primary elements on the site is stable or in an increasing, decreasing trend.

Figure 5. Six and Fifty Reservoir PCA.

Six and Fifty Reservoir Potential Conservation Area
 B2: Very High Biodiversity Significance



<p>Colorado Natural Heritage Program Colorado State University College of Natural Resources 8002 Campus Delivery Fort Collins, CO 80523-8002</p> <p>Disclaimer Data are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.</p>	<p> PCA Boundary</p> <p>39108-A1, Grand Junction 39109-A1, Westwater 30x60 Minute Series</p> <p>Digital Raster Graphics produced by the U.S. Geological Survey map created 2 March 2004 UTM, Zone13, NAD27</p>	<p>Location in Mesa County</p> 
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Mack Ridge

Biodiversity Rank: B3 (High significance)

The Mack Ridge site supports an Extant (E ranked) occurrence of the globally imperiled (G2) Ferron milkvetch (*Astragalus musiniensis*) and a Good (B ranked) occurrence of the globally imperiled (G2Q) Utah juniper/mountain mahogany woodland community (*Juniperus osteosperma/Cercocarpus montanus* woodland). Other occurrences supported by the site include two Good (B ranked) occurrences of the Utah juniper/Utah greasewood woodland community (*Juniperus osteosperma/Forsellesia meionandra* woodland) whose global and state ranks are unknown at this time, and good and fair (B and C ranked) occurrences of the globally vulnerable (G3) Westwater buckwheat (*Eriogonum scabrellum*) plant species and the western slope needle and thread grassland (*Hesperostipa comata* Great Basin Herbaceous Vegetation) natural community.

Protection Urgency Rank: P5

This site is on land publicly owned and managed by the BLM in accordance with the guidelines established for the CCNCA. Those guidelines for the NCA and the CCNCA management plan recognize the importance of protecting and conserving the biological resources of the area.

Management Urgency Rank: M3

Current management of the CCNCA recognizes this Site and its Elements. Grazing management and weed control activities compatible with the rare elements are important to ensure the long-term viability of the elements attached to this site.

Location: The Mack Ridge Site is located south of Interstate 70 approximately 30 km west of Grand Junction. Traveling west on I-70, take the Loma Exit and turn south onto county road and continue westerly for approximately 5 km. Turn south onto small unmarked BLM access road and follow up and over hill to arrive at the northwestern end of the site.

U.S.G.S. quadrangle: Mack , Rabbit Valley Quadrangles

Legal Description: T1N R3W Sections 4, 5, 6, 7, 8, 9;

T2N R3W Section 30, 31, 32;

T10S R103W Section 3, 4, 5, 8, 9, 10, 15, 16, 17

Size: 4,796 acres (2,013 ha)

Elevation: 4,600 to 5,400 feet (1,402 to 1,646 m)

General Description: This site, south of the town of Mack and north of the Colorado River, supports a mosaic of arid desert shrub and juniper woodland communities as well as several imperiled or vulnerable plant and animal species. The site encompasses about 5,000 acres of rugged and eroded sandstone and shale benches, talus slopes, bluffs, and plateaus. Soils are derived from the Morrison and Dakota sandstones and Mancos shale formations.

Primary uses of this site are for livestock grazing and public recreation. The site is entirely within the Mack portion of the Colorado Canyons National Conservation Area. There are two

existing grazing allotments in the area and numerous trails dedicated to non-motorized recreation (primarily mountain biking).

Elements driving the site design include the Ferron milkvetch (*Astragalus musiniensis*) and the Utah juniper/mountain mahogany woodland (*Juniperus osteosperma/Cercocarpus montanus* woodland). Other species and communities supported by the site include the Utah juniper/Utah greasewood woodland community (*Juniperus osteosperma/Forsellesia meionandra* woodland), the Westwater buckwheat (*Eriogonum scabrellum*) plant species, and the western slope needle and thread grassland (*Hesperostipa comata* Great Basin Herbaceous Vegetation). The BLM Sensitive Jones blue star (*Amsonia jonesii*) plant species and the BLM Sensitive midget faded rattlesnake (*Crotalus viridis concolor*) animal species are also supported by this site.

Biodiversity Rank Justification: The biodiversity rank for the Mack Ridge Site is based on the Extant (E-ranked) occurrence of the globally imperiled (G2) Ferron milkvetch (*Astragalus musiniensis*), a Good (B ranked) occurrence of the globally imperiled (G2Q) Utah juniper/mountain mahogany woodland community (*Juniperus utahensis/Cercocarpus montanus* woodland), and a Good (B ranked) occurrence of the globally vulnerable (G3) Westwater buckwheat (*Eriogonum scabrellum*) that is critically imperiled in Colorado (S1). The Ferron milkvetch is known from only four locations in Colorado, all within twenty miles of this site. The Utah juniper/mountain mahogany woodland is known from three Colorado locations. This type does occur in Utah, although the total number of occurrences there is unknown. The westwater buckwheat is known in Colorado from three occurrences.

The site also supports several other important occurrences including: Good (B ranked) occurrences of two natural communities (*Juniperus utahensis/Forsellesia meionandra*, *Artemisia nova/Leymus salinus*) whose global and state ranks are unknown at this time (GU/SU); a concentration of good and fair (B and C ranked) occurrences of globally vulnerable (G3) and apparently secure (G4) species and natural communities including Eastwood’s milkvetch (*Astragalus eastwoodiae*), midget faced rattlesnake (*Crotalus viridis concolor*), Jones blue star (*Amsonia jonesii*), Utah juniper/Salina wild rye Woodlands (*Juniperus osteosperma/Leymus salinus* woodland), and western slope needle and thread grassland (*Hesperostipa comata* Great Basin Herbaceous Vegetation). Elements of concern that are dependent on the Mack Ridge site are listed in Table 5.

Table 5. Natural Heritage elements at the Mack Ridge site (elements at top of list in bold type are used to establish site rank).

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	*EO Rank
<i>Astragalus musiniensis</i>	Ferron Milkvetch	G2	S1	BLM Sens		E
<i>Juniperus osteosperma/Cercocarpus montanus</i>	Utah Juniper/Mountain-mahogany Woodland	G2Q	S2?			C
<i>Eriogonum scabrellum</i>	Westwater Buckwheat	G3	S1			B
<i>Hesperostipa comata</i> Great Basin Herbaceous Vegetation	Western Slope Grasslands	G2G4	S2			C
<i>Juniperus osteosperma/ Leymus salinus</i>	Mesic Western Slope Pinyon-Juniper Woodlands	G3	S3			B
<i>Juniperus osteosperma/ Leymus salinus</i>	Mesic Western Slope Pinyon-Juniper Woodlands	G3	S3			B
<i>Juniperus osteosperma/ Leymus salinus</i>	Mesic Western Slope Pinyon-Juniper Woodlands	G3	S3			B

<i>Astragalus eastwoodiae</i>	Eastwood Milkvetch	G3?	S3			C
<i>Atriplex confertifolia/ Pleuraphis jamesii</i>	Cold Desert Shrublands	G3G5	S2			D
<i>Atriplex confertifolia/ Leymus salinus</i>	Cold Desert Shrublands	G3G5	S3			B
<i>Atriplex confertifolia/ Leymus salinus</i>	Cold Desert Shrublands	G3G5	S3			B
<i>Amsonia jonesii</i>	Jones Blue Star	G4	S1	BLM Sens		B
<i>Cynomys leucurus</i>	White-tailed Prairie Dog	G4	S4			
<i>Juniperus osteosperma/ Amelanchier utahensis- Philadelphia microphyllus/ Leymus salinus</i>	Mesic Western Slope Pinyon-Juniper Woodlands	G5	SU			B
<i>Juniperus osteosperma/ Artemisia nova/ rock woodland</i>	Utah Juniper/Black Sagebrush/Rock Woodlands	G5	SU			B
<i>Juniperus osteosperma/ Artemisia nova/ rock woodland</i>	Utah Juniper/Black Sagebrush/Rock Woodlands	G5	SU			B
<i>Crotalus viridis concolor</i>	Midget Faded Rattlesnake	G5T3	S3?	BLM Sens	SC	E
<i>Coluber constrictor mormon</i>	Western Yellowbelly Racer	G5T5	S3			H
<i>Artemisia nova/ Leymus salinus</i>	West Slope Shrubland	GU	SU			B
<i>Juniperus osteosperma/ Forsellesia meionandra</i>	Utah Juniper/Utah Greasebush	GU	SU			B
<i>Juniperus osteosperma/ Forsellesia meionandra</i>	Utah Juniper/Utah Greasebush	GU	SU			B

*EO = Element Occurrence

The BLM lists three species supported by the site as federally sensitive. These include Ferron milkvetch (*Astragalus musiniensis*), Jones blue star (*Amsonia jonesii*), and the midget faced rattlesnake (*Crotalus viridis concolor*).

The EO rank of the Ferron milkvetch is given as “extant” (E). Although the previously known habitat location was searched, the species was not found, and it is assumed that the plants may not have been identifiable or were not present this year due to the drought conditions.

Boundary Justification: The Mack Ridge site is primarily drawn to support two imperiled plant species and an imperiled salt-desert woodland community. The site encompasses a mosaic of desert grassland, shrubland, and woodland communities within which other vulnerable plant and animal species are found. The boundary was defined to encompass the element occurrences as well as much of the surrounding suitable habitat with similar soils, topography, and hydrology. This includes the more densely wooded north facing slopes on the north side of the site as well as the south facing cliffs, benches, and scree slopes that tend toward the southern side of the site. These areas are critical to the viability of the plant species and natural community elements which, based on their ecological scale, may require an area of anywhere from 1,000 to 20,000 acres to be viable. As drawn, the site provides an area of about 5,000 acres within which management of fire, herbivory, and other important ecological processes may ensure viability of the elements. The boundary for the Mack Ridge site is shown in Figure 6.

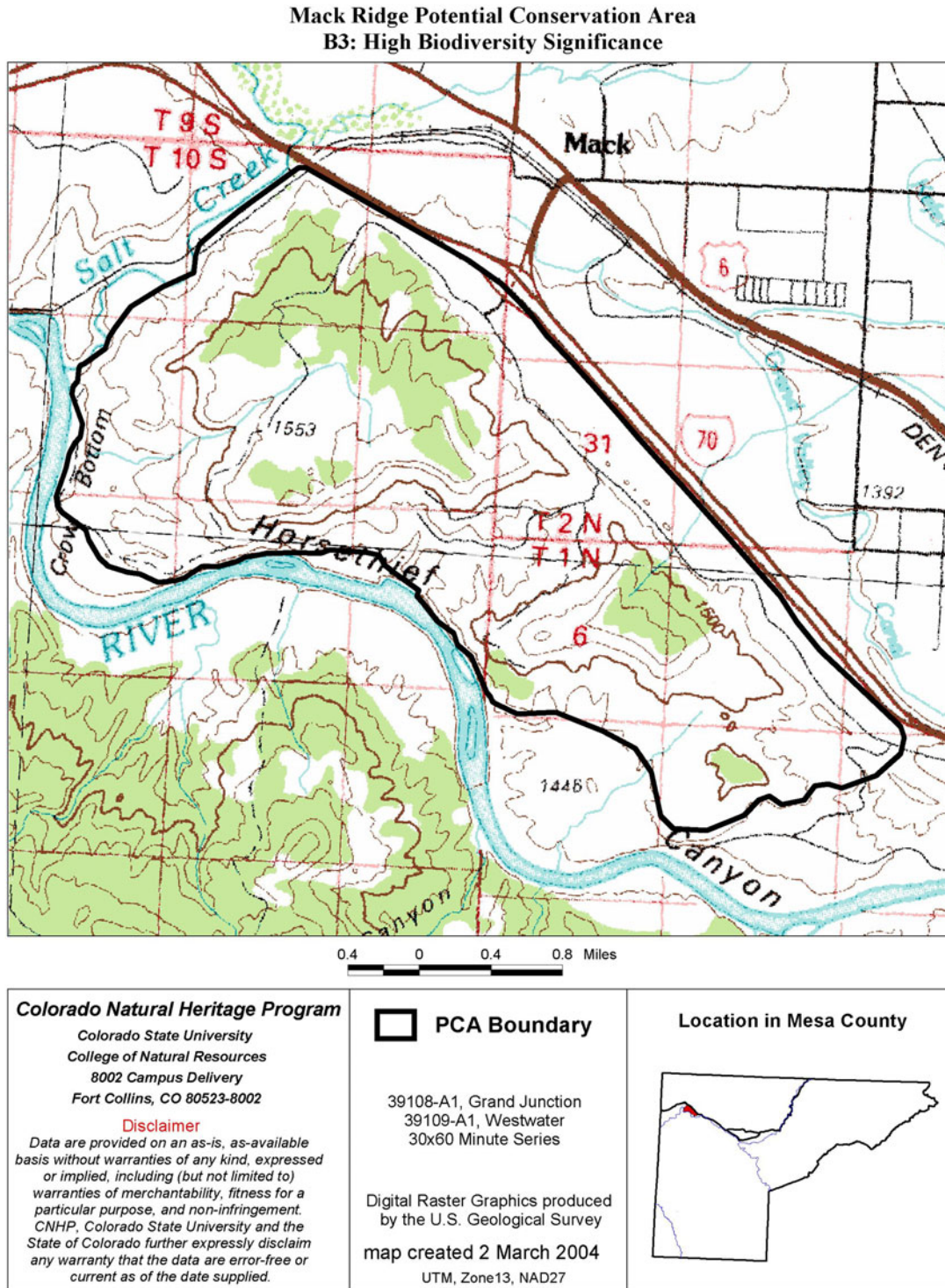
Protection Rank Justification: The Mack Ridge site is publicly owned and managed by the BLM in accordance with the guidelines for the CCNCA. Urgency for land protection may change if management status changes in the future.

Management Rank Justification: Current management planning for the CCNCA recognizes the site and its elements. The management rank is justified on the need to maintain or reestablish

natural ecological processes and to control the spread of invasive species, specifically cheatgrass. The role and effects of fire and livestock grazing in managing the site should be evaluated carefully to ensure compatibility with the ecological requirements of the elements. Cheatgrass has invaded and degraded the quality of many areas within the site. The EO for *Hesperostipa comata* Great Basin Herbaceous Vegetation occurs on the rolling mesa top and is surrounded on all sides and threatened by dense stands of cheatgrass. The EO is currently C ranked because of its small size, however, control of cheatgrass and expansion of the community to a larger area would permit the EO rank to increase. Management to control the further spread of cheatgrass and to restore existing areas of cheatgrass is essential to the long-term viability of the site elements.

Fire, as a natural ecological process, can have beneficial or detrimental effects on the elements depending on such factors as timing, intensity, and existing vegetation type. Historical fire suppression efforts have tended to increase the extent and density of shrub and woodland types and may result in destructive high intensity fires. Fire may increase cover and density of cheatgrass in those areas where it is present. In other areas, fire can be a beneficial factor in maintaining herbaceous community types.

Figure 6. Mack Ridge PCA.



Rabbit Valley

Biodiversity Rank: B3 (High significance)

The Rabbit Valley Site is a high significance site (B3) that supports several critically imperiled, imperiled, and vulnerable endemic plant species and natural plant communities. Included in the site design are an unranked occurrence of the Dolores skeleton plant (*Lygodesmia doloresensis*) a globally critically imperiled (G1QS1) plant, an unranked occurrence of Eastwood evening primrose (*Camissonia eastwoodiae*) a globally imperiled (G2S1) plant, excellent occurrences of two globally imperiled (G2S2) woodland communities (*Pinus edulis/Hesperostipa comata* and *Juniperus osteosperma*), a good (B ranked) occurrence of Osterhout cat's-eye (*Cryptantha osterhoutii*) a globally imperiled (G2G3S2) plant, and fair (C ranked) occurrences of two western slope grassland communities (*Pleuraphis jamesii* Herbaceous Vegetation and *Hesperostipa comata* Great Basin herbaceous vegetation) that are both globally imperiled (G2G4).

Other noteworthy elements within the site include an unranked occurrence of the State Critically Imperiled Jones blue star (*Amsonia jonesii*), a fair (C ranked) occurrence for the longnose leopard lizard (*Gambella wislizenii*), and two good occurrences of the State critically imperiled Palmer buckwheat (*Eriogonum palmerianum*).

Protection Urgency Rank: P5

The site is contained within the Colorado Canyons National Conservation Area. Protection for the CCNCA is afforded by the public ownership and defined by the multiple use policies inherent in the NCA legislation. Specific areas within the site have added designations as a BLM ACEC and a State designated Natural Area.

Management Urgency Rank: M3

This site is within a heavily used recreational area, especially attractive to bicyclists and ORV users. Kokopelli's Trail, a popular bicycle trail, runs through the site and numerous historic and contemporary ORV routes are also present. Management of ORVs and bicycles is being addressed, resulting in well signed trails and closure of many former roads and trails. It appears that these efforts have succeeded in reducing opportunistic off-road travel.

Many years of intensive grazing and fire suppression have altered natural communities, and the prevalence of exotic species, especially *Bromus tectorum* and *Halogeton glomeratus*, which tend to dominate the valley floor. Enhanced management efforts to reduce the cover of invasive species would do much to encourage the expansion and improvement of natural communities from the remnants of it that currently remain in the area. Control, and where possible eradication, of exotic species is likely the most important factor inhibiting the number and quality of element occurrences in the area.

Location: The Rabbit Valley site is located approximately 20 miles northwest of Grand Junction. The eastern boundary of the site begins at West Salt Creek and extends westerly to

the Colorado - Utah border. The northern boundary of the site is approximately 6&50 Road, while the Colorado River forms the southern boundary of the site.

U.S.G.S. quadrangle:	Bitter Creek Well, Ruby Canyon, Westwater quadrangles
Legal Description:	T9S R104W Section 33 T10S R104W Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 38, 39, 30, 31, 32, 33 T10S R103W Sections 6, 7, 18, 19 T11S R104W Sections 4, 5, 6, 7, 8
Size:	18, 341 acres (7,422 ha)
Elevation:	4,500 to 5,700 ft (1,372 to 1,737 m)

General Description: The Rabbit Valley site is a large site located on the north side of the Colorado River at the northern end of the Uncompahgre Uplift. It is characterized as an arid salt desert on soils derived from shales and sandstones. It supports a mosaic of xeric grasslands, salt desert shrublands, and sparse pinyon-juniper woodlands. It adjoins the Ruby and Horsethief Canyon reaches of the Colorado River site on the south and the Mack Ridge site on the east. The 6&50 site is located just to the north.

The site is within a popular recreation area, especially attractive to bicyclists and ORV users. Kokopelli's Trail is a popular bicycle trail that runs through the site. BLM has recently closed many trails to ORV use, and signed approved routes. The site includes a BLM Area of Critical Environmental Concern (ACEC) and a state designated Natural Area. These designated areas protect important paleological, cultural, and natural features contained in the site. BLM and the Museum of Western Colorado have developed the site for interpretive use, and the Museum directs ongoing fossil digs in some areas.

Vegetation of the area is primarily a mosaic of pinyon-juniper (*Pinus edulis-Juniperus utahensis*), sagebrush (*Artemisia* spp.), saltbush (*Atriplex* spp.), black grease bush (*Forsellesia meionandra*) and other desert shrubs. Indian rice grass (*Achnatherum hymenoides*), needle and thread grass (*Hesperostipa comata*), or galleta grass (*Pleuraphis jamesii*) are the typical dominant understory species in undisturbed areas. However, most areas of the site have been severely disturbed by years of intense grazing, fire suppression, and the introduction of non-native weedy species. Many areas that previously would have supported varied assemblages of the above grass species are now dominated by a dense cover of cheatgrass. Small remnant patches of native bunchgrasses attest to the natural communities which would be extensive over the area in the absence of cheatgrass.

The key environmental factors of this site are the convergence of climatic and edaphic factors. The soils are derived primarily from sandstone and shale parent material and range from sandy to very rocky. Together with the dry arid climate the geology of the site provides conditions which support several imperiled plant species and cold-desert plant associations.

Biodiversity Rank Justification: The Rabbit Valley Site is a High Significance site (B3) that supports several critically imperiled, imperiled, and vulnerable plant species and natural plant

communities. The elements included in the site design are an unranked occurrence of a globally critically imperiled (G1QS1) plant, an unranked occurrence of a globally imperiled (G2S2) plant, an excellent occurrence of a globally imperiled (G2?S2) plant community, an excellent occurrence of a globally imperiled (G2QS2?) plant community, good (B ranked) and poor (D ranked) occurrences for a globally imperiled (G2G3S2) plant, and several fair (C ranked) occurrences of two vulnerable (G2G4S1,G2G4S2) plant communities. Other elements within the site include good (B ranked), fair (C ranked), and poor (D ranked) occurrences of G2G3 and G2G4 plant species and plant communities (Table 6).

Several of the EORs within this site are ranked as historic (H ranked), extant, or are un-ranked. Historic occurrences were not able to be updated recently, extant occurrences were verified recently but do not contain adequate information to assign a rank, un-ranked occurrences, are not old enough to be classified as historic, but have not been verified recently.

Several elements attached to this site are globally secure or apparently secure, but are imperiled or critically imperiled within Colorado. These include the kit fox (*Vulpes macrotis*) (G4S1), Palmer buckwheat (*Eriogonum palmerianum*) (G4S1), Jones blue star (*Amsonia jonesii*) (G4S1), the long-nosed leopard lizard (*Gambelia wislizenii*) (G5S1), and the Gray Vireo (*Vireo vicinior*) (G4S2B). Of these, the Dolores skeleton plant (*Lygodesmia doloresensis*), Osterhout's catseye (*Cryptantha osterhoutii*), Jones blue star (*Amsonia jonesii*), and the long-nosed leopard lizard (*Gambelia wislizenii*) are listed as BLM Sensitive. The Unita Basin hookless cactus (*Sclerocactus glaucus*) is federally listed as threatened, and the kit fox (*Vulpes macrotis*) is state listed as endangered.

Boundary Justification: The boundary was drawn to identify the minimum area recommended for protection of the primary elements located in the site. The specific elements primarily driving the site design are the Dolores skeleton plant (*Lygodesmia doloresensis*), Eastwood evening-primrose (*Camissonia eastwoodiae*), xeric western slope pinyon-juniper woodlands (*Pinus edulis/Hesperostipa comata* Woodlands), Utah juniper/mountain-mahogany woodland (*Juniperus osteosperma/Cercocarpus montanus* Woodland), Osterhout cat's-eye (*Cryptantha osterhoutii*), western slope grasslands (*Pleuraphis jamesii* Herbaceous Vegetation and *Hesperostipa comata* Great Basin Herbaceous Vegetation). Additional noteworthy elements attached to the site include longnose leopard lizard (*Gambelia wislizenii*), Great Basin spadefoot (*Spea intermontana*), Uinta basin hookless cactus (*Sclerocactus glaucus*), Jones blue star (*Amsonia jonesii*), and Eastwood milk-vetch (*Astragalus eastwoodiae*).

The site boundaries include the element occurrences and adjacent habitat for the plant and animal species and plant communities of the area. It includes the BLM ACEC and the State designated Natural Area. Much of the Rabbit Valley area where these elements occur consists of deep sandy soils favored by the plant and natural community elements. The Rabbit Valley site was drawn to encompass a large area of those sandy soils (Figure 7).

Protection Rank Justification: The site is contained within the Colorado Canyons National Conservation Area. Protection for the CCNCA is defined by the multiple use policies inherent in the NCA legislation. Management planning presently underway will define the level of

protection afforded the attached elements. Specific areas within the site have added designations as a BLM ACEC and a State designated Natural Area.

Table 6. Natural Heritage elements at the Rabbit Valley Site (elements at top of list in bold type are used to establish site rank).

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	*EO Rank
<i>Lygodesmia doloresensis</i>	Dolores skeleton plant	G1Q	S1	BLM Sens.		
<i>Camissonia eastwoodiae</i>	Eastwood evening-primrose	G2	S1			
<i>Pinus edulis/ Hesperostipa comata</i>	xeric western slope pinyon-juniper woodlands	G2?	S2			A
<i>Juniperus osteosperma/ cercocarpus montanus</i>	Utah juniper/mountain-mahogany woodland	G2Q	S2?			A
<i>Cryptantha osterhoutii</i>	Osterhout cat's-eye	G2G3	S2	BLM Sens.		B
<i>Cryptantha osterhoutii</i>	Osterhout cat's-eye	G2G3	S2	BLM Sens.		D
<i>Pleuraphis jamesii</i> Herbaceous Vegetation	western slope grasslands	G2G4	S1			C
<i>Pleuraphis jamesii</i> Herbaceous Vegetation	western slope grasslands	G2G4	S1			C
<i>Hesperostipa comata</i> Great Basin Herbaceous	western slope grasslands	G2G4	S2			C
<i>Hesperostipa comata</i> Great Basin Herbaceous	western slope grasslands	G2G4	S2			C
<i>Hesperostipa comata</i> Great Basin Herbaceous	western slope grasslands	G2G4	S2			C
<i>Juniperus osteosperma/ Leymus salinus</i>	mesic western slope pinyon-juniper woodlands	G3	S3			BC
<i>Sclerocactus glaucus</i>	Uinta basin hookless cactus	G3	S3	T		
<i>Astragalus eastwoodiae</i>	Eastwood milk-vetch	G3?	S3			C
<i>Atriplex confertifolia/ Leymus salinus</i>	cold desert shrublands	G3G5	S3			B
<i>Vulpes macrotis</i>	kit fox	G4	S1		SE	H
<i>Vulpes macrotis</i>	kit fox	G4	S1		SE	H
<i>Eriogonum palmerianum</i>	Palmer buckwheat	G4	S1			
<i>Eriogonum palmerianum</i>	Palmer buckwheat	G4	S1			B
<i>Amsonia jonesii</i>	Jones blue star	G4	S1	BLM Sens		B
<i>Amsonia jonesii</i>	Jones blue star	G4	S1	BLM Sens		
<i>Vireo vicinior</i>	gray vireo	G4	S2B			H
<i>Vireo vicinior</i>	gray vireo	G4	S2B			E
<i>Vireo vicinior</i>	gray vireo	G4	S2B			E
<i>Vireo vicinior</i>	gray vireo	G4	S2B			E
<i>Cynomys leucurus</i>	white-tailed prairie dog	G4	S4		Pending	E
<i>Gambelia wislizenii</i>	longnose leopard lizard	G5	S1	BLM Sens		H
<i>Gambelia wislizenii</i>	longnose leopard lizard	G5	S1	BLM Sens		E
<i>Spea intermontana</i>	Great Basin spadefoot	G5	S3	BLM Sens		
<i>Spea intermontana</i>	Great Basin spadefoot	G5	S3	BLM Sens		E

*EO = Element Occurrence

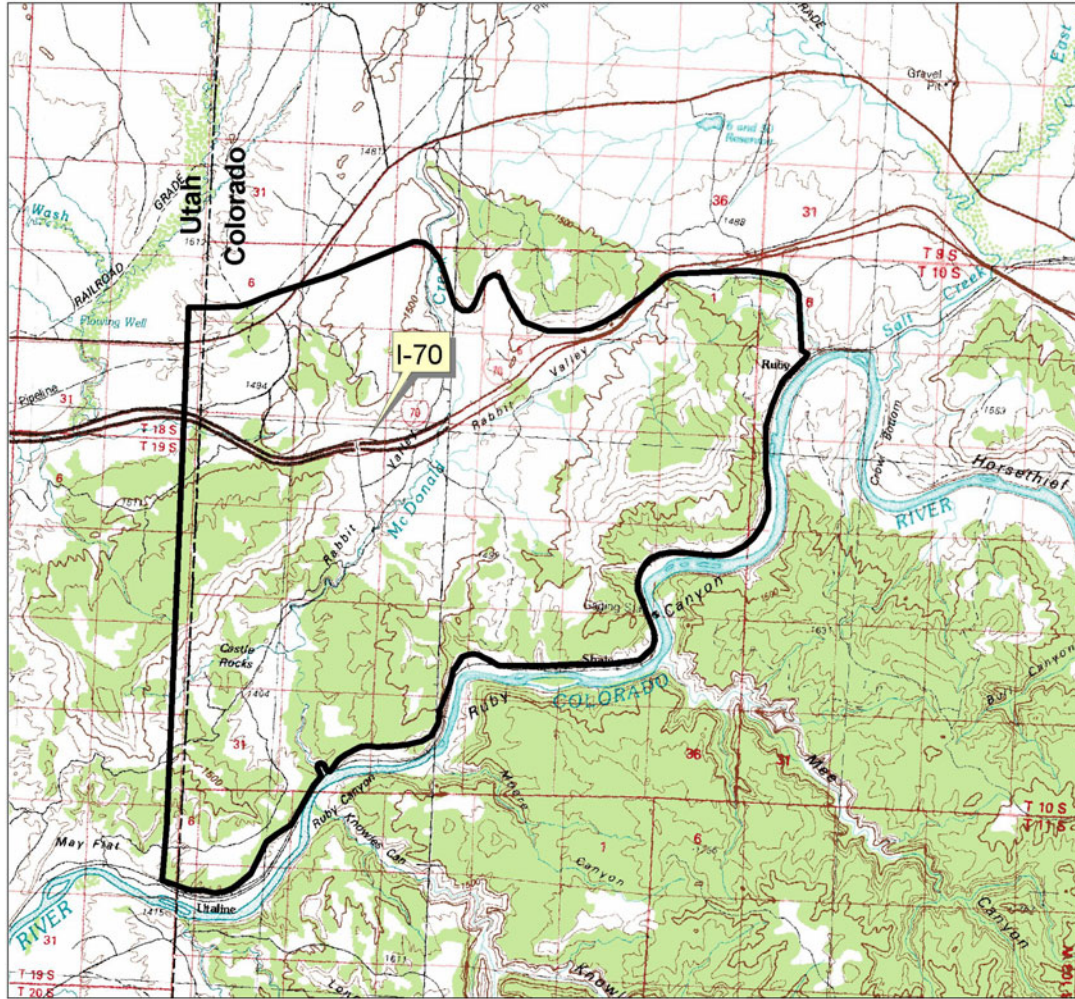
Management Rank Justification: This site is within a heavily used recreational area attractive to bicyclists and ORV users. Kokopelli's Trail, a popular bicycle trail, runs through the site and numerous historic and contemporary ORV routes are also present. Management of ORVs and bicycles is resulting in well signed trails and closure of many opportunistic roads. It appears that these efforts will succeed in reducing dispersed off-road travel.

Many years of intensive grazing and fire suppression have altered the natural communities of the site. The exotic species cheatgrass (*B. tectorum*) and halogeton (*H. glomeratus*) tend to dominate the valley floor. Management efforts to reduce the effect of non-native species would do much to improve quality and quantity of the remnants of natural communities in the

area. Control and eradication of exotic species is likely the most important factor inhibiting the number and quality of element occurrences in the area. Monitoring of the elements to determine if their status is stable, increasing, or decreasing is important to ensure their future viability.

Figure 7. Rabbit Valley PCA.

**Rabbit Valley Potential Conservation Area
B3: High Biodiversity Significance**



1 0 1 2 Miles

Colorado Natural Heritage Program

Colorado State University
College of Natural Resources
8002 Campus Delivery
Fort Collins, CO 80523-8002

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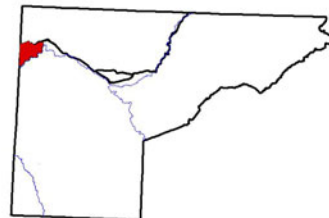
Data are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

PCA Boundary

39108-A1, Grand Junction
39109-A1, Westwater
30x60 Minute Series

Digital Raster Graphics produced
by the U.S. Geological Survey
map created 2 March 2004
UTM, Zone13, NAD27

Location in Mesa County



Element Occurrences of the CCNCA

The complete list of element occurrences documented in the Mack Ridge and Rabbit Valley Planning Areas is provided in Table 7. Previously existing element occurrences that were not updated during this inventory were either not found during CNHP field searches, or are lower priority elements and did not require an immediate effort to update. A complete list of all the species observed in the CCNCA is provided in Appendix 1.

Some targeted elements were not discovered despite specific efforts to locate them based on existing element occurrence records. In some cases this may be the result of imprecise locational information (ie. records with “Minutes” or “General” precision), while in other cases the element may have originally been misidentified or no longer inhabits the area. For example, in the case of plants such as the Ferron milkvetch (*Astragalus musiniensis*), a G2Q S2 element, it is likely that the current drought conditions either prevented or limited its growth this year. Likewise, CNHP searched in appropriate and known habitats for other plant elements including Westwater buckwheat (*Eriogonum scabrellum*), canyon bog-orchid (*Limnorchis ensifolia*), hellebore (*Epipactis gigantea*), Osterhout’s cat’s-eye (*Cryptantha osterhoutii*), Cliffdweller’s Candlestick Cat’s-eye (*Cryptantha elata*), Canyonlands lomatium (*Lomatium latilobum*), Delores skeleton plant (*Lygodesmia doloresensis*), Eastwood evening primrose (*Camissonia eastwoodiae*), and Uinta basin hookless cactus (*Sclerocactus glaucus*), but did not always locate them. Additional searches in subsequent years are required to document the continued presence of these and other imperiled and vulnerable elements in the area.

Species Abstracts are provided for the species elements that determine the Biodiversity Rank of one or more PCAs.

Table 7. List of Element Occurrences Documented in the Mack Ridge and Rabbit Valley Areas

Taxonomic Group	Scientific Name	Common Name	GRANK	SRANK	USESA	FEDSENS	FIRSTOBS	LASTOBS
Amphibians	<i>Hyla arenicolor</i>	Canyon Treefrog	G5	S2		BLM	1992-05-25	1992-05-25
Amphibians	<i>Hyla arenicolor</i>	Canyon Treefrog	G5	S2		BLM	1965-05-15	1965-05-15
Amphibians	<i>Spea intermontana</i>	Great Basin Spadefoot	G5	S3		BLM	1996-07-23	1996-07-23
Amphibians	<i>Spea intermontana</i>	Great Basin Spadefoot	G5	S3		BLM	2003-06-01	2003-06-01
Amphibians	<i>Spea intermontana</i>	Great Basin Spadefoot	G5	S3		BLM	2003-06-02	2003-06-02
Birds	<i>Amphispiza belli</i>	Sage Sparrow	G5	S3B	PS	USFS	1989-05-16	1994-03-01
Birds	<i>Amphispiza belli</i>	Sage Sparrow	G5	S3B	PS	USFS	1988-07-21	1988-07-21
Birds	<i>Amphispiza belli</i>	Sage Sparrow	G5	S3B	PS	USFS	1988-04-11	1988-04-11
Birds	<i>Amphispiza belli</i>	Sage Sparrow	G5	S3B	PS	USFS	1982-06-99	1982-06-99
Birds	<i>Charadrius montanus</i>	Mountain Plover	G2	S2B	PT	BLM/USFS	2002-04-09	2002-04-09
Birds	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B		USFS	1991-99-99	2003-05-31
Birds	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B		USFS	1986-99-99	1998-06-23
Birds	<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T3	S2B		USFS	1995-99-99	1998-07-03
Birds	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B,S3N	PS:LT,PDL		1979-99-99	1979-99-99
Birds	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B,S3N	PS:LT,PDL		1994-05-05	1994-05-05
Birds	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1B,S3N	PS:LT,PDL		1991-99-99	1995-99-99
Birds	<i>Himantopus mexicanus</i>	Black-necked Stilt	G5	S3B	PS		2003-04-16	2003-04-16
Birds	<i>Numenius americanus</i>	Long-billed Curlew	G5	S2B		BLM/USFS	1985-07-12	1985-07-12
Birds	<i>Numenius americanus</i>	Long-billed Curlew	G5	S2B		BLM/USFS	1982-07-18	1989-06-09
Birds	<i>Plegadis chihi</i>	White-faced Ibis	G5	S2B		BLM	2003-05-30	2003-05-30
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			1990-06-09	1991-06-24
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			1987-06-16	1994-06-29
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			1991-06-07	1991-06-07
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			1982-07-99	1982-07-99
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			2003-06-03	2003-06-03
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			2003-06-01	2003-06-01
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			2003-06-02	2003-06-02
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			2003-06-03	2003-06-03
Birds	<i>Vireo vicinior</i>	Gray Vireo	G4	S2B			2003-06-01	2003-06-01
Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1979-08-26	1983-99-99
Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1979-08-99	2000-10-99
Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1978-08-99	1978-08-99
Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1979-08-99	1979-08-99
Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1979-08-99	1979-08-99

Fish	<i>Gila cypha</i>	Humpback Chub	G1	S1	LE		1979-04-99	1979-04-99
Fish	<i>Gila elegans</i>	Bonytail	G1	SX	LE		1984-07-17	1984-07-17
Fish	<i>Gila robusta</i>	Roundtail Chub	G3	S2	PS	BLM/USFS	1980-07-24	1983-99-99
Fish	<i>Gila robusta</i>	Roundtail Chub	G3	S2	PS	BLM/USFS	1980-07-22	1985-05-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-04-99	1979-04-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-08-99	1979-08-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-11-99	1979-11-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-11-99	1979-11-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-08-99	1979-08-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-11-99	1979-11-99
Fish	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow	G1	S1	LE,XN		1979-08-99	1979-08-99
Fish	<i>Xyrauchen texanus</i>	Razorback Sucker	G1	S1	LE		1980-03-99	1980-03-99
Fish	<i>Xyrauchen texanus</i>	Razorback Sucker	G1	S1	LE		1990-99-99	1990-99-99
Mammals	<i>Cynomys leucurus</i>	White-tailed Prairie Dog	G4	S4		USFS	2003-06-01	2003-06-01
Mammals	<i>Cynomys leucurus</i>	White-tailed Prairie Dog	G4	S4		USFS	2003-10-23	2003-10-23
Mammals	<i>Cynomys leucurus</i>	White-tailed Prairie Dog	G4	S4		USFS	2003-06-01	2003-06-01
Mammals	<i>Mustela nigripes</i>	Black-footed Ferret	G1	S1	LE,XN		1986-06-18	1986-06-18
Mammals	<i>Mustela nigripes</i>	Black-footed Ferret	G1	S1	LE,XN		1986-11-17	1986-11-17
Mammals	<i>Perognathus parvus</i>	Great Basin Pocket Mouse	G5	S1			9999-99-99	9999-99-99
Mammals	<i>Perognathus parvus</i>	Great Basin Pocket Mouse	G5	S1			9999-99-99	9999-99-99
Mammals	<i>Vulpes macrotis</i>	Kit Fox	G4	S1	PS	USFS	1963-04-03	1963-04-03
Mammals	<i>Vulpes macrotis</i>	Kit Fox	G4	S1	PS	USFS	1983-99-99	1983-99-99
Mammals	<i>Vulpes macrotis</i>	Kit Fox	G4	S1	PS	USFS	1994-08-01	1995-04-10
Natural Communities	ACHNATHERUM HYMENOIDES SHALE BARREN HERBACEOUS VEGETATION		G2	S2			1996-06-01	1996-06-01
Natural Communities	ARTEMISIA NOVA / LEYMUS SALINUS SHRUBLAND		GU	SU			1996-06-28	1996-06-28
Natural Communities	ATRIPLEX CONFERTIFOLIA / ACHNATHERUM HYMENOIDES SHRUBLAND		G3	S2			1996-06-01	1996-06-01
Natural Communities	ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND		G3G5	S3			1983-06-16	1996-06-01
Natural Communities	ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND		G3G5	S3			1996-06-02	1996-06-02
Natural Communities	ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND		G3G5	S3			1983-99-99	1983-06-16
Natural Communities	ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND		G3G5	S3			1983-99-99	1983-05-12

Natural Communities	<i>ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND</i>		G3G5	S3	1996-06-28	1996-06-28
Natural Communities	<i>ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND</i>		G3G5	S3	1996-06-29	1996-06-29
Natural Communities	<i>ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND</i>		G3G5	S3	2003-09-05	2003-09-05
Natural Communities	<i>ATRIPLEX CONFERTIFOLIA / LEYMUS SALINUS SHRUBLAND</i>		G3G5	S3	2003-10-21	2003-10-21
Natural Communities	<i>ATRIPLEX CONFERTIFOLIA / PLEURAPHIS JAMESII SHRUBLAND</i>		G3G5	S2	1996-06-28	1996-06-28
Natural Communities	<i>ATRIPLEX CORRUGATA DWARF - SHRUBLAND</i>		G5	S2?	1976-99-99	1976-05-99
Natural Communities	<i>ATRIPLEX CORRUGATA DWARF - SHRUBLAND</i>		G5	S2?	2003-09-05	2003-09-05
Natural Communities	<i>ATRIPLEX GARDNERI / LEYMUS SALINUS DWARF - SHRUBLAND</i>		G2?	S2?	1996-06-01	1996-06-01
Natural Communities	<i>ATRIPLEX GARDNERI / LEYMUS SALINUS DWARF - SHRUBLAND</i>		G2?	S2?	2003-09-05	2003-09-05
Natural Communities	<i>ATRIPLEX GARDNERI / PLEURAPHIS JAMESII DWARF-SHRUBLAND</i>		G3G5	S1?	1976-99-99	1976-99-99
Natural Communities	<i>ATRIPLEX GARDNERI / PLEURAPHIS JAMESII DWARF-SHRUBLAND</i>		G3G5	S1?	2003-09-04	2003-09-04
Natural Communities	<i>HESPEROSTIPA COMATA GREAT BASIN HERBACEOUS VEGETATION</i>		G2G4	S2	1996-06-02	1996-06-02
Natural Communities	<i>HESPEROSTIPA COMATA GREAT BASIN HERBACEOUS VEGETATION</i>		G2G4	S2	2003-09-05	2003-09-05
Natural Communities	<i>HESPEROSTIPA COMATA GREAT BASIN HERBACEOUS VEGETATION</i>		G2G4	S2	2003-09-05	2003-09-05
Natural Communities	<i>HESPEROSTIPA COMATA GREAT BASIN HERBACEOUS VEGETATION</i>		G2G4	S2	2003-10-23	2003-10-23
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / CERCOCARPUS MONTANUS WOODLAND</i>	Utah Juniper/mountain-mahogany Woodland	G2Q	S2?	2003-09-04	2003-09-04
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / CERCOCARPUS MONTANUS WOODLAND</i>	Utah Juniper/mountain-mahogany Woodland	G2Q	S2?	2003-10-21	2003-10-21
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / FORSELLESIA MEIONANDRA WOODLAND</i>	Utah Juniper/utah Greasebush	GU	SU	2003-10-23	2003-10-23

Natural Communities	<i>JUNIPERUS OSTEOSPERMA / FORSELLESIA MEIONANDRA WOODLAND</i>	Utah Juniper/utah Greasebush	GU	SU		2003-10-21	2003-10-21
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / LEYMUS SALINUS WOODDED HERBACEOUS VEGETATION</i>		G3	S3		1996-06-28	1996-06-28
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / LEYMUS SALINUS WOODDED HERBACEOUS VEGETATION</i>		G3	S3		1996-06-28	1996-06-28
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / LEYMUS SALINUS WOODDED HERBACEOUS VEGETATION</i>		G3	S3		1986-99-99	1986-06-06
Natural Communities	<i>JUNIPERUS OSTEOSPERMA / LEYMUS SALINUS WOODDED HERBACEOUS VEGETATION</i>		G3	S3		1996-06-20	1996-06-20
Natural Communities	<i>JUNIPERUS OSTEOSPERMA WOODLAND</i>		G5	SU		2003-09-05	2003-09-05
Natural Communities	<i>JUNIPERUS OSTEOSPERMA/ARTEMISIA NOVA/ROCK WOODLAND</i>	Utah Juniper/black Sagebrush/rock Woodlands	G5	SU		2003-09-05	2003-09-05
Natural Communities	<i>JUNIPERUS OSTEOSPERMA/ARTEMISIA NOVA/ROCK WOODLAND</i>	Utah Juniper/black Sagebrush/rock Woodlands	G5	SU		2003-09-04	2003-09-04
Natural Communities	<i>JUNIPERUS OSTEOSPERMA/ARTEMISIA NOVA/ROCK WOODLAND</i>	Utah Juniper/black Sagebrush/rock Woodlands	G5	SU		2003-10-21	2003-10-21
Natural Communities	<i>PINUS EDULIS - (JUNIPERUS MONOSPERMA, JUNIPERUS OSTEOSPERMA) / HESPEROSTIPA COMATA WOODLAND</i>		G2?	S2		1996-06-03	1996-06-03
Natural Communities	<i>PLEURAPHIS JAMESII HERBACEOUS VEGETATION</i>		G2G4	S1		2003-09-05	2003-09-05
Natural Communities	<i>PLEURAPHIS JAMESII HERBACEOUS VEGETATION</i>		G2G4	S1		2003-09-04	2003-09-04
Natural Communities	<i>SARCOBATUS VERMICULATUS / SUAEDA MOQUINII SHRUBLAND</i>		GU	S2S3		1976-99-99	1976-99-99
Reptiles	<i>Coluber constrictor mormon</i>	Western Yellowbelly Racer	G5T5	S3		1986-02-21	1982-06-21
Reptiles	<i>Crotalus viridis concolor</i>	Midget Faded Rattlesnake	G5T3	S3?	BLM	9999-99-99	9999-99-99
Reptiles	<i>Gambelia wislizenii</i>	Longnose Leopard Lizard	G5	S1	BLM	9999-99-99	9999-99-99
Reptiles	<i>Gambelia wislizenii</i>	Longnose Leopard Lizard	G5	S1	BLM	1982-06-99	1982-06-99

Reptiles	<i>Gambelia wislizenii</i>	Longnose Leopard Lizard	G5	S1	BLM	1980-99-99	1980-99-99
Reptiles	<i>Gambelia wislizenii</i>	Longnose Leopard Lizard	G5	S1	BLM	2003-06-01	2003-06-01
Vascular Plants	<i>Amsonia jonesii</i>	Jones Blue-star	G4	S1	BLM	1965-05-16	1965-05-16
Vascular Plants	<i>Amsonia jonesii</i>	Jones Blue-star	G4	S1	BLM	1982-05-06	1982-05-06
Vascular Plants	<i>Amsonia jonesii</i>	Jones Blue-star	G4	S1	BLM	2003-09-05	2003-09-05
Vascular Plants	<i>Amsonia jonesii</i>	Jones Blue-star	G4	S1	BLM	2003-05-18	2003-05-19
Vascular Plants	<i>Astragalus eastwoodiae</i>	Eastwood Milk-vetch	G3?	S3		1995-06-03	1995-06-03
Vascular Plants	<i>Astragalus eastwoodiae</i>	Eastwood Milk-vetch	G3?	S3		2003-10-23	2003-10-23
Vascular Plants	<i>Astragalus musiniensis</i>	Ferron Milk-vetch	G2	S1	BLM	1995-05-14	1995-05-14
Vascular Plants	<i>Camissonia eastwoodiae</i>	Eastwood Evening-primrose	G2	S1		1982-06-10	1982-06-10
Vascular Plants	<i>Camissonia eastwoodiae</i>	Eastwood Evening-primrose	G2	S1		2003-05-16	2003-05-16
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1962-05-19	1962-05-19
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1988-05-03	1988-05-03
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1983-06-16	1996-06-01
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1996-06-01	1996-06-01
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1962-05-99	1962-05-99
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1969-06-10	1979-06-99
Vascular Plants	<i>Cryptantha elata</i>	Cliffdweller's Candlestick Catseye	G3	S2		1982-06-09	1982-06-09
Vascular Plants	<i>Cryptantha osterhoutii</i>	Osterhout Cat's-eye	G2G3	S2	BLM	1983-99-99	1983-06-16
Vascular Plants	<i>Cryptantha osterhoutii</i>	Osterhout Cat's-eye	G2G3	S2	BLM	1983-06-16	1983-06-16
Vascular Plants	<i>Eriogonum contortum</i>	Twisted Wild-buckwheat	G3	S2	BLM	1972-06-07	1972-06-07
Vascular Plants	<i>Eriogonum contortum</i>	Twisted Wild-buckwheat	G3	S2	BLM	1937-08-10	1937-08-10
Vascular Plants	<i>Eriogonum contortum</i>	Twisted Wild-buckwheat	G3	S2	BLM	1983-06-16	1996-06-01

Plants								
Vascular								
Plants	<i>Eriogonum contortum</i>	Twisted Wild-buckwheat	G3	S2		BLM	1983-99-99	1983-06-16
Vascular								
Plants	<i>Eriogonum contortum</i>	Twisted Wild-buckwheat	G3	S2		BLM	1967-06-14	2003-05-18
Vascular								
Plants	<i>Eriogonum leptocladon var. leptocladon</i>	Sand Buckwheat	G5TNR	S1			1983-08-99	1983-08-99
Vascular								
Plants	<i>Eriogonum leptocladon var. leptocladon</i>	Sand Buckwheat	G5TNR	S1			2003-09-05	2003-09-05
Vascular								
Plants	<i>Eriogonum palmerianum</i>	Palmer Buckwheat	G4	S1			1975-05-02	1975-05-02
Vascular								
Plants	<i>Eriogonum palmerianum</i>	Palmer Buckwheat	G4	S1			1983-06-16	1983-06-16
Vascular								
Plants	<i>Eriogonum palmerianum</i>	Palmer Buckwheat	G4	S1			2003-09-04	2003-09-04
Vascular								
Plants	<i>Eriogonum scabrellum</i>	A Wild-buckwheat	G3	S1			2003-10-21	2003-10-21
Vascular								
Plants	<i>Eriogonum scabrellum</i>	A Wild-buckwheat	G3	S1			2003-10-21	2003-10-21
Vascular								
Plants	<i>Glossopetalon spinescens var. meionandrum</i>	Utah Greasebush	G5T3	S3			2003-03-25	2003-03-25
Vascular								
Plants	<i>Lomatium latilobum</i>	Canyonlands Lomatium	G1	S1		BLM	1943-05-25	1943-05-25
Vascular								
Plants	<i>Lygodesmia doloresensis</i>	Dolores River Skeleton-plant	G1Q	S1		BLM	1989-06-17	1989-06-17
Vascular								
Plants	<i>Sclerocactus glaucus</i>	Uinta Basin Hookless Cactus	G3	S3	LT		1981-04-28	1981-04-28

Characterization Abstracts for Imperiled & Vulnerable Animals in the CCNCA

The following animal characterization abstracts provide background information on the Special Status animal elements identified in the CCNCA. The information provided includes the species taxonomic classification, its Natural Heritage rank, the federal or state legal status, a description with comments on the phenology, its habitat, its distribution and abundance, threats and management issues, and the Potential Conservation Areas that support one or more element occurrences.

Species characterization abstracts are provided for the following species:

Falco peregrinus anatum (American Peregrine Falcon)

Haliaeetus leucocephalus (Bald Eagle)

Himantopus mexicanus (Black-necked Stilt)

Vireo vicinior (Gray Vireo)

Plegadis chihi (White-faced Ibis)

Gila robusta (Roundtail chub)

Xyrauchen texanus (Razorback Sucker)

Ptychocheilus lucius (Colorado Pikeminnow)

Gila cypha (Humpback Chub)

Gila elegans (Bonytail Chub)

Spea intermontana (Great Basin Spadefoot)

Gambelia wislizenii (Longnose Leopard Lizard)

Crotalus viridis concolor (Midget Faded Rattlesnake)

Vulpes macrotis (Kit Fox)

Mustela nigripes (Black-Footed Ferret)

Falco peregrinus anatum
American Peregrine Falcon

Taxonomy

Class: *Aves*

Order: *Falconiformes*

Family: *Falconidae*

Taxonomic Comments: While three of the approximately 20 recognized subspecies of Falcon occur in North America (Brown and Amadon 1968), only *Falco peregrinus anatum* (American Peregrine Falcon) occurs in Colorado (U.S. Fish and Wildlife Service 1984).

CNHP Ranking: G4T3 S2B

State/Federal Status: Colorado species of special concern; removed from federal endangered species list in August 1999.

Habitat Comments: In western North America, Peregrine Falcons nest on ledges of high cliffs in the foothills and mountains from 4,500 to over 9,000 ft (1,388 to 2,776 m) in elevation (U.S. Fish and Wildlife Service 1984). The steepest and most inaccessible locations on the tallest cliffs are preferred, especially those that offer flat, protected ledges at least 18 inches wide, with sheer rock above and below (Johnsgard 1979). Peregrine Falcons formerly nested at sites that were much more accessible than tall cliffs; human disturbance at these accessible sites has precluded their use by the birds (Kingery 1998).

In Colorado, pinyon/juniper woodland occurs in the vicinity of about half of all Peregrine Falcon nest sites, and ponderosa pine woodland or forest is found at about one-quarter of the sites (Kingery 1998). Peregrine Falcons in the midwestern and eastern states, where high cliffs generally are unavailable, often nest on human-made structures such as buildings, bridges, and smokestacks (Tordoff *et al.* 1998, Cade *et al.* 1996). Preferred habitats for hunting include agricultural lands, meadows, drainage bottoms, marshes, and lakes (U.S. Fish and Wildlife Service 1984). Migrating and wintering birds often are associated with reservoirs, rivers, and marshes, but they also use grasslands and agricultural areas (Enderson 1965, Andrews and Righter 1992).

In CCNCA, the canyon of the Colorado River provides nesting habitat for the Peregrine Falcon. The birds would be expected to take prey from the riparian areas of the river corridor as well as from the upland areas in other parts of the CCNCA.

Distribution/Abundance: The Peregrine Falcon was once one of the most widely-distributed birds in the world, occurring on all continents except Antarctica, and on many islands (Hickey and Anderson 1969). Throughout its range, the species has undergone major reductions in numbers and density (Hickey 1969). From 1950 to 1965, a severe decline in numbers occurred in Peregrine Falcon breeding populations in North America and in parts of Europe (Hickey 1969). In the Rocky Mountain region, only one-third of historical Peregrine nest sites were still occupied by 1965 (Enderson 1969). By 1971, the North American breeding range, which had formerly covered most of the continent, included only Canada, Alaska, and Baja, California (Cade 1971). In 1977, the Colorado population reached a low of four breeding pairs

(Gray 1995). By 1995, due to an intensive program of captive breeding and reintroduction, Peregrines occupied 71 breeding sites in Colorado (Kingery 1998). Today, Peregrine Falcons breed along the foothills of Colorado's Front Range and (in higher concentrations) in the river valleys and canyons of the Western Slope (Kingery 1998). *Falco peregrinus anatum* nests across Alaska and Canada and throughout much of the western United States to central Mexico (U.S. Fish and Wildlife Service 1999). More northerly-breeding members of this subspecies migrate long distances to wintering areas in South America, whereas more southerly-breeding individuals show more variable migratory behavior (some migrate relatively short distances within western North America and others do not migrate at all) (Yates *et al.* 1988).

Important Life History Characteristics: Peregrine Falcons show very strong fidelity to nesting territories; individual birds commonly return to the same territories year after year (Tordoff and Redig 1997). Peregrine Falcons do not build their own nests, but instead they use old nests of eagles, hawks, or ravens (Hickey and Anderson 1969). A nest site may be reused by Peregrines (different individuals) for decades (Hickey 1942, Cade *et al.* 1967) or even centuries (Ferguson-Lees 1957). Mated pairs of Peregrines defend an area of about 90 m around the nest by performing a sky dance and a high, circling display (Kingery 1998). The female does most of the incubating of the eggs; the male supplies her with food and sometimes relieves her at the nest (Johnsgard 1979). The female also does most of the brooding and feeding of the young during the first two weeks after hatching; later, both parents drop prey items into the nest, where the young must compete for them (Johnsgard 1979). After the young have left the nest, they remain in the area for several weeks (mid-June to mid-July) and they are fed and protected by both adults (U.S. Fish and Wildlife Service 1984). Peregrine Falcons may travel up to 17 miles from their nesting sites to the areas where they hunt (Porter and White 1973, Enderson and Craig 1997). Mated pairs of Peregrines sometimes hunt cooperatively, with one falcon frightening potential prey (birds) into flight paths along which they are vulnerable to attack by the other falcon (Snow 1972). Prey of the Peregrine Falcon includes many types of birds, especially domestic pigeons, wild ducks and other waterfowl, and shorebirds, as well as mammals, fishes (see White and Roseneau 1970), and invertebrates (i.e., beetles, dragonflies, butterflies) (Hickey and Anderson 1969). Flight speeds of 62 mph in horizontal flight, and 175 mph while diving for prey (Terres 1980) have been recorded for Peregrine Falcons.

Known Threats and Management Issues: The severe population declines experienced by Peregrine Falcons in North America were primarily due to the effects of pesticides, particularly DDT and dieldrin (Nisbet 1988, Peakall and Kiff 1988, Risebrough and Peakall 1988). Reproductive symptoms of pesticide exposure included failure to lay eggs, reduced clutch size, excessively thin eggshells, embryonic mortality, nestling mortality, and failure to re-lay after loss of the first clutch (Cade *et al.* 1988). Through captive breeding and reintroduction programs, many agencies and organizations have successfully restored Peregrine Falcon populations to portions of the species' historical range, including Colorado (Andrews and Righter 1992). Direct, human-caused mortality may result from shooting (Bond 1946, Cade 1960, Enderson 1965), poisoning (Enderson 1965, Reichel *et al.* 1974), egg collecting (Rice 1969) or capture-related deaths caused by falconers (Bailey and Niedrach 1965). Historically, the direct killing of Peregrines by pigeon fanciers caused serious reductions in Peregrine populations in the United States and Europe (Olsen and Olsen 1980,

Mebis 1969, Herbert and Herbert 1969, Hickey and Anderson 1969). Peregrines sometimes are killed by collisions with powerlines as they dive at high speeds after prey (Herren 1969, U.S. Fish and Wildlife Service 1984), and collisions with human-made objects are the leading cause of death and injury among midwestern Peregrines (Redig and Tordoff 1994). Human disturbance at nest sites may cause nest abandonment (Herbert and Herbert 1965, Mebis 1969, Snow 1972, Olsen and Olsen 1980, U.S. Fish and Wildlife Service 1984). The increasing popularity of recreational rock climbing in North America is becoming a serious problem for natural resource managers who are trying to protect nesting Peregrine Falcons (Ratcliffe 1969, U.S. Fish and Wildlife Service 1999).

Potential Conservation Areas that provide nesting or hunting habitat for *Falco peregrinus anatum*: Colorado River PCA, Six and Fifty Reservoir PCA, Mack Ridge PCA, Rabbit Valley PCA.

Haliaeetus leucocephalus
Bald Eagle

Taxonomy

Class: *Aves*

Order: *Falconiformes*

Family: *Accipitridae*

Taxonomic Comments: None.

CNHP Ranking: G4 S1B, S3N

State/Federal Status: State threatened, Federal threatened, Proposed for delisting.

Habitat Comments: Breeding habitat for Bald Eagles consists of forested areas near large bodies of water (Andrew and Mosher 1982, Usgaard and Higgins 1995). Nests typically are placed in tops of tall trees located near suitable foraging habitat (Anthony and Isaacs 1989, Kralovec *et al.* 1992). Factors affecting the quality of foraging habitats include the characteristics of the prey base (Livingston *et al.* 1990), the structure of the aquatic habitat and the extent of human development and disturbance (McGarigal *et al.* 1991). Sites used for diurnal perching tend to include tall trees located near shoreline foraging habitat (Chester *et al.* 1990, Chandler *et al.* 1995). Winter habitats occur along major river systems and along eastern and western North American coasts (Millsap 1986) and are characterized by the presence of abundant food, protected roost sites, and little or no human disturbance (Keister *et al.* 1987). Roosting habitat consists of tall trees that offer protection from prevailing winds and are generally located near aquatic foraging areas (Keister and Anthony 1983, Grubb *et al.* 1989, Chester *et al.* 1990, Buehler *et al.* 1991b). Most roosting sites for Bald Eagles in western North America are in coniferous (or sometimes in riparian) trees (Grubb *et al.* 1989).

Distribution/Abundance: Bald Eagles breed in suitable habitats throughout much of North America, including Alaska, Canada, all 48 contiguous states in the U.S. except Vermont and Rhode Island, and parts of Mexico (Buehler 2000). No records exist of Bald Eagles breeding outside North America (Buehler 2000). Most wintering areas for Bald Eagles are located in the lower 48 states and in coastal areas of Alaska and Canada, in aquatic habitats where open water persists for foraging (Millsap 1986). Some adult Bald Eagles migrate seasonally as necessary when food becomes unavailable (Millsap 1986, Buehler *et al.* 1991a, Harmata and Stahlecker 1993), whereas others remain in the vicinity of their breeding territories throughout the year (Swenson *et al.* 1986, Garrett *et al.* 1993, Jenkins and Jackman 1993). Many of the Bald Eagles that winter in Colorado migrate to breeding areas in Saskatchewan and Manitoba in January-March (Harmata and Stahlecker 1993). Bald Eagles breed in northwestern, southwestern, and north-central Colorado (Andrews and Righter 1992).

Important Life History Characteristics: Bald Eagles are opportunistic foragers and their diet varies greatly, depending upon the location and the availability of various types of prey (Todd *et al.* 1982). In most regions Bald Eagles forage in aquatic habitats and prefer fishes (Brown 1993, Stalmaster and Kaiser 1998). Mammals and birds, however, are important components of the diet at many sites (Todd *et al.* 1982, Kralovec *et al.* 1992). Bald Eagles

typically hunt from perches or while soaring, but they also feed on carrion on the ground in areas where humans do not disturb them (Buehler 2000). At some wintering sites, ungulate carrion is a critical component of the diet (Swenson *et al.* 1986). Bald Eagles often engage in kleptoparasitism or food piracy; typically they steal fishes or other prey items from other Bald Eagles or from Ospreys while in flight or on the ground (Todd *et al.* 1982, Hansen 1986). Bald Eagles use sticks and branches to build large nests, which often are reused each year (Buehler 2000). A well-known nest in Ohio was used for 34 years before the tree in which it was located blew down (Herrick 1924). Bald Eagles roost communally (or sometimes solitarily) at traditional winter roosting sites (Keister *et al.* 1987, Grubb *et al.* 1989), and, in some cases, at post-breeding-season summer roosting sites (Chester *et al.* 1990). Mated pairs of Bald Eagles defend their breeding territories against encroachments by other Bald Eagles (Buehler 2000). Male and female Bald Eagles exhibit strong fidelity to their mates and to their nest sites (Gerrard *et al.* 1992a, Jenkins and Jackman 1993). A female Bald Eagle in Saskatchewan, for example, used the same territory for 13 years (Gerrard *et al.* 1992a). If one member of a mated pair dies or disappears, the surviving eagle typically continues to occupy the same territory and finds a new mate (Grubb *et al.* 1988, Jenkins and Jackman 1993). Many Bald Eagles also show fidelity (i.e., they return year after year) to their wintering areas (Harmata and Stahlecker 1993).

Known Threats and Management Issues: Major threats to the Bald Eagle include the loss of critical habitat components such as nest trees (Weekes 1974), perch sites, and winter roosts (Hansen *et al.* 1981) to natural or human-induced causes. Throughout the range of the Bald Eagle, loss of critical breeding and wintering habitats is a serious problem (Therres *et al.* 1993). Human activities and disturbance can affect populations of Bald Eagles and other birds in many important ways. These factors can alter foraging patterns, distribution, and habitat use (Buehler *et al.* 1991b, Grubb and King 1991, Knight *et al.* 1991, McGarigal *et al.* 1991, Brown and Stevens 1997), reduce reproductive success (White and Thurow 1985) and foraging efficiency (Knight *et al.* 1991, Stalmaster and Kaiser 1998), and increase energy expenditures (Stalmaster 1983) and stress (Fernandez and Azkona 1993). Additional threats to the Bald Eagle include shooting (Reichel *et al.* 1984), trapping, electrocution (Smith and Murphy 1972), and poisoning by pesticides or lead shot (Hickey and Anderson 1968, Swenson *et al.* 1986, Kramer and Redig 1997).

Potential Conservation Areas which include nesting sites or otherwise directly support *Haliaeetus leucocephalus*: Colorado River PCA.

Plegadis chihi
White-faced Ibis

Taxonomy:

Class: *Aves*

Order: *Ardeidae*

Family: *Threskiornithidae*

Taxonomic Comments: No subspecies are currently recognized in North America.

CNHP Ranking: G5 S2B

State/Federal Status: BLM Sensitive

Description and Phenology: With its decurved bill, long wading legs, and metallic bronze plumage, the White Faced Ibis is a very attractive and distinctive bird. Adults develop white feathers along the bare facial skin during the breeding season. Most birds will arrive at breeding sites on the Colorado Plateau by early April. Egg laying is typically completed by early June and begin departing for wintering ranges by September (Ryder and Manry 1994).

Habitat Comments: White-faced Ibises feed in marshes and the shallow water of ponds, lakes, and reservoirs. In Colorado, irrigated croplands of alfalfa and barley, and native hay meadows are important feeding areas (Ryder and Manry 1994). Most ibises nesting in Colorado favor tall emergent vegetation such as bulrushes and cattails growing as “islands” surrounded by water more than 45 cm deep (Ryder 1998).

Distribution/Abundance: In North America the White-faced Ibis nests from central California south to central Mexico and east through southern Texas to Louisiana (mainly coastal) and throughout portions of the Great Basin. In Colorado, this species is a local breeder mainly nesting in portions of the San Luis Valley (Ryder 1998).

Important Life History Characteristics: Individual birds will sometimes forage alone, however, this species is highly gregarious and prefers to forage in flocks and nest in colonies. Most ibises leave Colorado in September, some as late as October. Breeding populations vary considerably from year to year, depending on water levels in favored marshes (Ryder 1967).

Known Threats and Management Issues: Loss of habitat due to wetland degradation, failure of nests stranded due to reservoir drawdown, cattle grazing in nesting areas, and human encroachment pose threats to this species (Ryder and Manry 1994).

Potential Conservation Areas that support White-Faced Ibis: Six and Fifty Reservoir.

Gila robusta
Roundtail chub

Taxonomy

Class: *Osteichthyes*
Order: *Cypriniformes*
Family: *Cyprinidae*

CNHP Ranking: G2G3 S2

State/Federal Status: State Special Concern, BLM sensitive species

Description and Phenology: The roundtail chub is a relatively large minnow that reaches a maximum total length of about 43 cm. The number of dorsal, anal, and pelvic fin rays is usually nine (8-10). The body is completely scaled, and scales are small, thin, and only slightly embedded. Both sexes have an orange-red color on ventrolateral surfaces and on all fins except the dorsal fin (Muth *et al.* 1985). This coloration becomes more intense in males during the breeding season (Minckley 1973).

Habitat Comments: Roundtail chub inhabit rocky runs, rapids, and pools of creeks and small to large rivers; also large reservoirs in the upper Colorado River system. They generally prefer cobble-rubble, sand-cobble, or sand-gravel substrate. Adults are associated with the largest, most permanent water in streams (Minckley 1981). They inhabit pools and eddies, below or adjacent to rapids and boulders, in cool to warm water mid-elevation streams and rivers (Minckley 1973, Bestgen and Propst 1989). They are usually found near cover such as rocks, rootwads, undercutts, or deep water (Bestgen and Propst 1989). Large populations often occur in pools behind irrigation diversions (Barber and Minckley 1966).

Distribution/Abundance: The species is known only from the western U. S., in Arizona, Colorado, New Mexico, Nevada, Utah, and Wyoming. It has been extirpated from California. There are 98 collection sites mapped. In Colorado, Roundtail chub is known from Archuleta, Delta, Dolores, Eagle, Garfield, Grand, Jefferson, La Plata, Mesa, Moffat, Montrose, Montezuma, Rio Blanco, Routt, and San Miguel counties (CNHP 2004). Similar to other native fish of the upper Colorado River Basin, the abundance of this species is greatly reduced from its historic levels.

Known Threats and Management Issues: Threats include interactions of watershed changes, such as reductions in suitable habitat due to impoundment, channel downcutting, substrate sedimentation, water diversion, and groundwater pumping, and the invasion of non-native predatory and competitive species.

Potential Conservation Areas that support Roundtail chub: Ruby and Horsethief Canyon reaches of the Colorado River.

Xyrauchen texanus
Razorback Sucker

Taxonomy:

Class: *Osteichthyes*

Order: *Cypriniformes*

Family: *Catostomidae*

CNHP Ranking: G1 S1

State/Federal Status: State Endangered, Federally Endangered

Description and Phenology: The razorback sucker has a sharp keel on the nape of the neck that can grow to 91 cm in length. They are planktonic, plantivorous and benthic feeders consuming algae, crustaceans and aquatic insect larvae.

Habitat Comments: Habitats include slow areas, backwaters and eddies of medium to large rivers. Razorbacks utilize flooded lowlands and lower portions of tributary streams as resting-feeding areas during breeding season (Tyus and Karp 1990). Razorbacks are often associated with sand, mud and rock substrate in areas with sparse aquatic vegetation, where temperatures are moderate to warm (Sigler and Miller 1963). In non-breeding season, adults are most common in shoreline runs and along mid-channel sand bars, with average water depth of less than 2 m and average velocity of less than 0.5 m/sec (Tyus and Karp 1989).

Distribution/Abundance: Razorbacks were historically widespread and common in warm water reaches of many medium and large-sized streams and rivers of the Colorado River Basin from Wyoming south to Mexico. They were more common in the lower than the upper Colorado River Basin (Behnke and Benson 1980). The Colorado distribution included the lower Yampa, Green, Colorado, Gunnison, Dolores, and San Juan rivers (Tom Nesler pers. comm., Kevin Bestgen pers. comm.). Colorado's populations are in the upper limits of the watershed distribution. The razorback sucker remains in the lower Green, lower Yampa, and occasionally in the Colorado River near Grand Junction (Bestgen 1990). In 1998 and 1999 a total exceeding 50,000 razorback suckers were released into the Upper Colorado River Basin including 25,000 just north of Parachute, Colorado (Bob Burdick pers. comm.). The razorback sucker is now being reintroduced throughout its original range from propagated stocks.

Known Threats and Management Issues: Razorback suckers are confined to the Colorado River system, where a large decline has occurred due mainly to alteration and destruction of habitat by dams and interactions with non-native fishes (Tom Nesler pers. comm.). A number of problems confront razorbacks including habitat change (e.g., high winter flows, reduced high spring flows, altered river temperatures, and reduced flooding resulting primarily from dam construction), competition and especially predation on larvae and juveniles by introduced fishes (USFWS 1990), paucity of spawning adults and hybridization with other suckers (Tyus and Karp 1990, Minckley *et al.* 1991). See USFWS (1990) for many details on habitat changes that have affected this species.

Potential Conservation Areas: This species occupies the Colorado River including the Ruby and Horsethief Canyon reaches of the Colorado River PCA.

Ptychocheilus lucius
Colorado Pikeminnow

Taxonomy:

Class: *Osteichthyes*

Order: *Cypriniformes*

Family: *Cyprinidae*

CNHP Ranking: G1 S1

State/Federal Status: State Threatened, Federal Endangered

Description and Phenology: The Colorado pikeminnow is a large minnow that is capable, but rarely reaches, a length of about 6 feet. While it was once a common commercial species, it is currently very restricted and rare.

This species spawns under decreasing flow regimen with increasing temperatures in summer. In the Green River, Wyoming, it spawns in July-August, apparently when water temperature is at least 20-22 degrees centigrade (Tyus 1986, Tyus and Karp 1989). In the lower Yampa River it apparently spawned as early as mid-June or as late as August in different years. Eggs hatch in 3.5-6 days at 20-22 C. Survival and hatching was best at 20 C. The larvae enter stream drift and are transported downstream for about 6 days, traveling an average distance of 160 km to reach low gradient nursery areas. They become sexually mature in 5-7 years (at 50 cm TL in the Green River). This species may live 30 years or more (Tyus 1986, Tyus and Karp 1989).

Habitat Comments: This species prefers to occupy medium to large tributary rivers in the Colorado River basin. Adults use various habitats, including deep, turbid, strongly-flowing water, eddies, runs, flooded bottoms, or backwaters (especially during high flow). Lowlands inundated during spring high flow appear to be important habitats. The young prefer small, quiet backwaters. In winter, this species can be most common in shallow, ice-covered shoreline areas. See Tyus and Karp (1989) for details on seasonal habitat use and distribution in the Yampa River, Colorado (upper Yampa is a winter concentration area for adults).

Reproductively active adults seek faunally depauperate white-water canyons for deposition of gametes (Tyus 1991). This species appears to select river canyons that receive freshwater input of groundwater from sandstone/limestone seeps (Tyus 1985). In lower Yampa River, it spawns where large, deep pools and eddies (resting and feeding areas) are intermingled with riffles and runs and cobble bars of gravel, cobble, and boulder substrates (Tyus and Karp 1989, Tyus 1991). This species returns to its previous spawning site. Larvae drift downstream after hatching, then move to shoreline areas and backwaters. Young-of-year (postlarval) occupy shallow, alongshore, ephemeral backwaters formed in late summer by receding water levels. Juveniles tend to occur downstream from area occupied by adults, though larger juveniles are not uncommon in shoreline habitats similar to those occupied by adults (Tyus 1991).

The Colorado pikeminnow makes extensive spawning migrations (up to 205 km one-way) in late spring, different individuals migrate upstream from Green River and downstream in Yampa

River to a common spawning area (Tyus 1985, Tyus and McAda 1984, Tyus and Karp 1989). After spawning, adults in the Green River return to the areas they previously occupied in spring (Tyus 1991). The area of the Ruby and Horsethief Canyon reaches on the Colorado River, near the Colorado-Utah state line, has been identified as a spawning site used in multiple years (Federal Register, 21 March 1994).

Irving and Modde (2000) radio-tracked 12 wild adults captured in the tailwaters of Taylor Draw Dam on the White River, Colorado. Individuals migrated an average of 658 km from the White River to spawning areas in the Yampa River or in the Green River (Desolation/Gray Canyon), then moved back to the White River. Individuals that were translocated above Taylor Draw Dam successfully passed over the dam during their downstream migration.

Distribution/Abundance: This species was originally common in the large tributary rivers of the Colorado River basin (Gunnison, White, Yampa, Dolores, San Juan, Uncompahgre, Animas, and Green rivers, from Mexico and Arizona to Wyoming). The present distribution and abundance of the Colorado pikeminnow are drastically reduced from their original levels. By the mid-1980s Colorado pikeminnow occurred only in the Upper Colorado River basin of Colorado, Utah, New Mexico, and Wyoming. The species was mainly in the Green River in Utah and in the Yampa and Colorado rivers in Colorado and portions of Utah. It has not been observed below Glen Canyon Dam since 1968. Adults predominate in the White and Yampa Rivers, while young are more common in the Green River (Tyus 1986). Karp and Tyus (1990) reported juveniles as rare in the Green River system.

Although this species was common in the lower Colorado River basin in Arizona and California until the 1930s, it was essentially extirpated from those areas by the early 1970s. It now occupies perhaps 25% of its former range (Clarkson and Childs 2000).

Known Threats and Management Issues: This species declined due to dam construction [which replaces riverine habitat with impoundments and makes downstream habitat too cold (Clarkson and Childs 2000, blocks migrations, reduces peak flows)] and introduction of non-native fishes (Moyle 1976). Introduced red shiner (*Cyprinella lutrensis*) may compete with young-of-year squawfish for zooplankton food resources in backwaters of the Green River (Muth and Snyder 1996).

Dam management strategies that promote maintenance and/or return of natural river flows are very important. Maintenance of natural flow conditions in the Yampa River, which is important in shaping the flow conditions in the Green River, is critical to the recovery of this and other rare Colorado River fishes (Tyus and Karp 1989). Management to eliminate or reduce existing exotic fishes species and prevent further introductions of other species will be very beneficial.

Potential Conservation Areas: The Colorado River PCA provides suitable habitat to support the Colorado pikeminnow.

Gila cypha
Humpback Chub

Taxonomy:

Class: *Osteichthyes*

Order: *Cypriniformes*

Family: *Cyprinidae*

Taxonomic Comments: The humpback chub is known to hybridize with *Gila elegans* and *Gila robusta*. See Douglas *et al.* (1989) for a discussion of methods for distinguishing *Gila cypha* from *Gila robusta*.

McElroy and Douglas (1995) examined morphological variation in *Gila robusta* and *Gila cypha* in the upper Colorado River basin and found that the two species were clearly distinct in sympatry and in allopatry. All sampled populations of both species differed significantly, and there was no relationship between morphological similarity and geographic proximity among populations of either species. In Cataract and Desolation canyons, heterospecific populations were more similar to each other than to allospecific conspecifics, due to introgressive hybridization and/or convergent local adaptation.

This species may have experienced substantial allelic loss in recent years; considerable hybridization with *Gila robusta* may have occurred in Upper Colorado River Basin (Rosenfeld *et al.* 1989).

Intermediates between humpback chub and roundtail chub occur in altered river systems (Green River and Colorado River), whereas intermediates appear to be absent in unaltered rivers (Yampa River, Little Colorado); this may emphasize the importance of natural riverine environments for the recovery of this species (Tyus and Karp 1989).

CNHP Ranking: G1 S1

State/Federal Status: State Threatened, Federal Endangered

Description and Phenology: Humpback chub are members of the cyprinid family. They are a large minnow (to 38 cm long) with a slender caudal peduncle and (in large individuals) a hump behind the head.

More information is needed about the feeding preferences of this species. Humpback chub are known to feed on planktonic crustaceans and algae. See Tyus and Minckley (1988) for possible importance of Mormon cricket as a possible food source.

Humpback chub spawn in the spring at reported temperatures of 16-19 degrees C (Arizona) and 11.5-16 degrees centigrade (Colorado), shortly after peak flow. The USFWS reported that spawning occurs when water temperatures approach 20 degrees C (Federal Register, 21 March 1994). Individuals in reproductive condition have been captured usually in May, June, or July, the time depending on location.

Habitat Comments: Humpback chub are inhabitants of the large rivers of the southwestern US. Adults use various habitats, including deep turbulent currents, shaded canyon pools, areas under shaded ledges in moderate current, riffles, and eddies (Federal Register, 21 March 1994). Young have been taken in backwaters over non-rocky substrates. In the Yampa River, Colorado, adults were most often captured in eddy habitat (average depth 2 m), particularly in shoreline eddies created by large boulders and rapids; most young were captured in shoreline eddies and runs (Tyus and Karp 1989). Adults in spawning condition captured in the Yampa River Canyon were in shoreline eddy and run habitat (Tyus and Karp 1989).

Distribution/Abundance: This species formerly occurred throughout much of Colorado River basin, from western Colorado and southwestern Wyoming to northern Arizona and perhaps California, including Green River, lower Yampa River, and White River (Utah). In the lower basin, the largest remaining population occurs in the Little Colorado and Colorado rivers in the Grand Canyon (Douglas and Marsh 1996). In the upper basin, concentrations now occur at Black Rocks (west-central Colorado)/Westwater Canyon and Cataract Canyon of the Colorado River; Desolation and Gray canyons of the Green River; and Yampa and Whirlpool canyons in Dinosaur National Monument, Green and Yampa rivers (see Federal Register, 21 March 1994). A suspected humpback chub recently was found in the lower Little Snake River, Colorado (Wick *et al.* 1991).

Recaptures and radio telemetry indicate limited movements, particularly from summer through winter (Douglas and Marsh 1996); recaptures/relocations averaged 1.6 km or less from release site after up to 434 days (Valdez and Clemmer 1982).

Known Threats and Management Issues: Humpback chub are endangered due to destruction and modification of habitat through impoundment (e.g., stream inundation, reduced water temperatures, and reduced spring flows resulting from construction of Hoover Dam, Glen Canyon Dam, and Flaming Gorge Dam); introduced competitors and predators; hybridization with *G. elegans* and *G. robusta*. Flow reductions and low water temperatures (Clarkson and Childs 2000) may curtail successful spawning and increase competition with other species. Douglas and Marsh (1996) discussed the impact of the Glen Canyon Dam on this species. The range expansion of the introduced Asian tapeworm is a serious threat (Clarkson *et al.* 1997). Three self-sustaining populations indicate that the species is capable of continued existence (Valdez and Clemmer 1982).

Potential Conservation Areas: The Colorado River PCA provides suitable habitat to support the humpback chub.

Gila elegans
Bonytail Chub

Taxonomy

Class: *Osteichthyes*
Order: *Cypriniformes*
Family: *Cyprinidae*
Genus: *Gila*

Taxonomic Comments: In and below Grand Canyon, individuals of *Gila elegans*, *G. cypha*, and *G. robusta* robusta are readily identified by diagnostic morphological and genetic characters (Gerber *et al.* 2001). In the upper basin, several studies have yielded evidence of hybridization among these taxa in mainstem Colorado River above Grand Canyon (Gerber *et al.* 2001).

Gerber *et al.* (2001) found that Lower Colorado River basin populations of *G. cypha* exhibit distinct mtDNA, with only limited introgression of *G. elegans* into *G. cypha*, but most sampled upper basin fishes exhibited only *G. cypha* haplotypes, with some individuals exhibiting mtDNA from *G. elegans*. The complete absence of *G. robusta* mtDNA, even in populations of morphologically pure *G. robusta*, indicates extensive introgression that predates human influence (Gerber *et al.* 2001).

CNHP Ranking: G1 SX

State/Federal Status: State Endangered, Federal Endangered

Description and Phenology: The bonytail chub are members of the *Cyprinid* family. The bonytail is a large minnow (to 62 cm) with a long, slender caudal peduncle. It is characterized as an omnivorous surface feeder. Adults primarily eat terrestrial insects, plant debris, algae and just about anything that falls on the surface of the water. Young feed mainly on aquatic insect larvae.

Bonytail spawn in May and June with water temp >18 degrees C over gravel riffles or rubble in bottom eddies. They spawn in schools once they reach about 5-7 years old (Ferriole 1988).

Habitat Comments: Bonytail are found in the main stream of mid-sized to large rivers in the southwestern US. They are usually in or near deep swift water, in flowing pools and backwaters, over mud or rocks. Most frequently they are associated with eddies just outside the main current and have a high tolerance for turbidity (Matthews and Moseley 1990). Available data suggest that habitats required for conservation include river channels and flooded, ponded, or inundated riverine habitats, especially those where competition from non-native fishes is absent or reduced (USFWS, Federal Register, 21 March 1994).

Distribution/Abundance: Formerly, bonytail were abundant throughout the Colorado River and its larger tributaries; it has been collected from the Green River in Wyoming and Utah, the Yampa and Gunnison Rivers in Colorado, the Colorado River in Arizona, Colorado, Nevada, and California, San Juan River in New Mexico, and the Gila and Salt rivers in Arizona (Lee *et al.* 1980, Matthews and Moseley 1990, Page and Burr 1991). Presently, the bonytail is very near extinction; recently it was found only in the Yampa River (Dinosaur National Monument), the

Green River (Gray and Desolation canyons), the Colorado River (Black Rocks and Cataract Canyon (Kaeding *et al.* 1986; Federal Register, 21 March 1994), Lake Mohave (Arizona-Nevada border), and Lake Havasu (Arizona-California) (Minckley and Deacon 1991). As of the early 1990s, populations were being established in urban lakes in Tempe, on the Buenos Aires NWR, and at TNC's Hassayampa Reserve, all in Arizona; plans called for stocking of experimental populations into Arizona streams (Minckley and Deacon 1991).

Known Threats and Management Issues: The bonytail was federally listed as endangered in 1980. It was listed without identifying critical habitat because reproducing populations were unknown and the threat of extinction appeared imminent. The immediate goal of the 1987 recovery plan is to prevent the extinction of the species. The decline of the species is attributed to flow depletions in its native river habitats, increased sediment loading and deposition, depletions of ground water, and introduction of non-native species.

Continued monitoring of historic habitat areas and research on life history and habitat requirements of the bonytail is needed to ensure survival of the species. Control and elimination of non-native fish in areas of bonytail habitat is important to reducing competition and predation.

Potential Conservation Areas: The Colorado River PCA is the only site in the CCNCA with suitable habitat to support the bonytail chub.

Spea intermontana
Great Basin Spadefoot

Taxonomy

Class: *Amphibia*

Order: *Anura*

Family: *Pelobatidae*

CNHP Ranking: G5 S3

State/Federal Status: State Special Concern Species; BLM Sensitive Species

Description and Phenology: This species has a vertically elongated pupil in bright light. It is distinguished from the New Mexico spadefoot (*Spea multiplicatus*) by the glandular lump on the top of the head directly between the eyes. It emerges from its burrow after heavy rains in the spring or summer. In Colorado they are known to be active from June through September. Although it is known that the Great Basin spadefoot uses pools that form in depressions after heavy rainstorms as breeding areas, very little else is known about the reproduction of this species (Hammerson 1999). As necessary, this species will also use shallow streams and slow flowing irrigation canals for reproduction (Stebbins 1985).

Habitat Comments: The Great Basin Spadefoot is found on dry rocky slopes and canyons vegetated by pinyon-juniper woodlands or sagebrush, saltbrush, and other semi-desert shrublands (Hammerson 1999). The species is a local migrant that may migrate up to several hundred meters between breeding pools and non-breeding terrestrial habitats.

Distribution/Abundance: The Great Basin spadefoot, as its name implies, is endemic to the Great Basin. Colorado defines the southeastern edge of this species' range (Stebbins 1985). In western Colorado, it occurs north of the Uncompahgre Plateau at elevations below 7000 ft (2133 m). There are about 30 locations totaling 3,000 to 10,000 individuals in four western Colorado counties north of the Uncompahgre Plateau (CNHP 2004). There are three occurrence records of Great Basin spadefoots in the CCNCA, all identified during the summer 2003 season.

Known Threats and Management Issues: This species is considered vulnerable (S3) because of its small range in Colorado and the limited number of known occurrences. Surveys specifically targeting this species may identify additional occurrences within the CCNCA. Activities that impact the species burrows or disturb the depressions where the species breeds will have a negative effect on the species population.

Potential Conservation Areas: PCAs that support this species include Rabbit Valley. Although not presently recorded from the Mack Ridge, Six and Fifty Reservoir, and Colorado River areas, it is likely that this species inhabits those areas as well.

Gambelia wislizenii
Longnose Leopard Lizard

Taxonomy

Class: *Reptilia*

Order: *Lacertilia*

Family: *Crotaphytidae*

CNHP Ranking: G5 S1

State/Federal Status: State Special Concern, BLM Sensitive

Description and Phenology: The long-nosed leopard lizard is a large lizard (3.25 - 5.75 in.) with a large head, rounded body, and a long rounded tail. Its body is covered with large dark spots, however, this species is capable of marked color changes and may exhibit light colored crossbars on the tail and body without the large dark spots. They are carnivorous, feeding mainly on insects, but will also eat lizards, small rodents, and some plant material (Stebbins 1985). Adult lizards emerge from winter retreats in late May, are active through July, and then underground again by early August. Adults mate in late May or Early June, eggs are laid in late June or Early July, and hatchlings appear in early August.

Habitat Comments: The habitat includes greasewood and sagebrush stands containing sparse low plants on deep sandy soils and especially areas with abundant rodent burrows. Although habitat is common, much of it shows reduced suitability due to cheatgrass invasion, as this condition makes it difficult for the lizard to run. There is little information on the viability of known occurrences (Hammerson 1999).

Distribution/Abundance: The longnose leopard lizard ranges across the Great Basin and throughout the southwestern U.S. from Idaho south to northern Mexico, including all of Baja California (Stebbins 1985). Colorado occupies the eastern margin of the species range. In Colorado, this species occurs only in Garfield, Mesa, and Montezuma counties (Hammerson 1999). There are no quantitative estimates of abundance or trends, however, repeated searches at occupied sites have revealed low numbers and suggest declines (Geoff Hammerson pers. comm.). The CNHP database includes a total of 28 occurrences in Colorado. Three of those are located in the CCNCA.

Known Threats and Management Issues: Invasion of areas of suitable habitat by the non-native species cheatgrass (*Bromus tectorum*) is thought to have a significant impact on the species locomotion.

Potential Conservation Areas: Three element occurrence records for this species are in the CCNCA. They occur in the Rabbit Valley, and Six and Fifty Reservoir PCAs. It is likely that this species also occurs in the Mack Ridge, and to a lesser extent, the Colorado River PCAs.

Crotalus viridis concolor
Midget Faded Rattlesnake

Taxonomy

Class: *Reptilia*

Order: *Serpentes*

Family: *Viperidae*

CNHP Ranking: G5T3 S3?

State/Federal Status: State Special Concern Species, BLM Sensitive Species

Description and Phenology: The midget faded rattlesnake is one of two subspecies of western rattlesnake that occur in Colorado. The other is the prairie rattlesnake (*Crotalus viridis viridis*). Most distinctive characteristic of this species is the rattle on the tail and the wide head with a narrow body. The skin is blotched in shades of brown to black that maybe edged with a darker or lighter color. Total length rarely exceeds 26" (Hammerson 1999).

Habitat Comments: Midget faded rattlesnakes occur in in a wide variety of terrestrial habitats including pinyon-juniper woodlands, plains grasslands, and desert and mountain shrublands. They tend to prefer arid to semi-arid sites and typically avoid wet sites. They will occupy sites with a wide range of soil types from sandy to rocky (Hammerson 1999).

Distribution/Abundance: This subspecies ranges from southern Wyoming and eastern Utah south to the Four Corners area (Stebbins 1985). The Colorado range occurs from Moffat County south to Montrose County (Hammerson 1999). Colorado is at the eastern margin of the subspecies' range. In Colorado, it occurs in west central Colorado in Mesa, Delta, Garfield, Montrose, and San Miguel counties. There are no range-wide population estimates available, however, midget faded rattlesnakes are visibly common in much of west central Colorado (Chris Pague pers. conv. 2001).

The CNHP database contains 13 occurrences for this species. The only occurrence for this species in the CCNCA is from 2000. No new occurrences for this species were identified in the CCNCA. This subspecies is considered vulnerable (S3) largely because of threats from human destruction. It is likely that this species populations were severely depleted with the near eradication of large prairie dog towns.

Known Threats and Management Issues: Threats to this species are generally low, but many individual populations are likely threatened from human encroachment near urban areas. Threats are primarily from intentional killing by humans. The rapid population growth of Colorado is most likely negatively impacting this subspecies where it occurs. Historical habitat alteration and current residential expansion in the Grand Valley create threats to rattlesnake populations. Also, there is possible inter-gradation with *C. v. viridis* in northwestern and southwestern Colorado (Hammerson 1999).

Potential Conservation Areas: PCAs that are likely to support this species include the Mack Ridge, Rabbit Valley, and Six and Fifty Reservoir sites.

Vulpes macrotis
Kit Fox

Taxonomy

Class: *Mammalia*

Order: *Carnivora*

Family: *Canidae*

CNHP Ranking: G4 S1

State/Federal Status: State Endangered, No Special Federal Status

Description and Phenology: The kit fox is a small and delicately shaped fox with ears that are relatively larger than the swift fox (*Vulpes velox*) of the eastern Colorado plains. It is yellowish-gray to gray-brown above with a paler yellow to white underneath. The sides of the snout are dark, while the tail is brown with a noticeable black tip (Fitzgerald *et al.* 1994). Adults pair-up and Females select a den in about October. Breeding occurs from December through February and a litter of four to five will be born after a gestation of about 50 days. Pups emerge at about four to five weeks and begin to forage with the adults at about three to four months. Dispersal of young occurs in the fall of the year (Fitzgerald *et al.* 1994).

Habitat Comments: Kit fox primarily inhabit open desert, sparse desert-shrub, or sparse shrub-grass habitats. Community types where the kit fox is commonly found include sparse pinyon-juniper woodlands, and open desert shrublands of sagebrush, shadscale, saltbush, and greasewood. They usually feed on the most abundant nocturnal rodent or lagomorph in the area (e.g. *Dipodomys* spp., *Lepus* spp.). A verified specimen of a road-killed kit fox was taken from the Colorado National Monument in 1998, and a small colony was recently being studied in the vicinity of Delta, Colorado (Fitzgerald *et al.* 1994). Also, observations of kit foxes have occurred sporadically in appropriate habitat in western Garfield County over the past 20 years, but recurrent breeding populations have not been verified.

Distribution/Abundance: The kit fox occurs in the semi-arid environments of the American southwest from the central valley and southern portions of California, throughout Nevada and most of Utah, portions of Arizona and New Mexico, and south into northern and central Mexico. The western and southwestern portions of Colorado represent the eastern edge of the kit fox's continental range. In Colorado this species is known from a restricted range along the Colorado River and in the extreme southwest corner of the state. The species was likely never common or widespread in Colorado (Fitzgerald *et al.* 1994). The kit fox is a secretive species and may be difficult to detect, but it is likely that numbers in Colorado are small. Surveys have not been conducted over large portions of its range.

Known Threats and Management Issues: Agricultural conversion and urban encroachment onto low elevation desert-shrub habitats, as well as increased motor vehicle traffic in those areas have a large impact on kit fox mortality. Coyote predation is thought to be a significant source of mortality (Fitzgerald *et al.* 1994).

Potential Conservation Areas: No kit fox occurrences were observed during this survey of the CCNCA. However, the CNHP database identifies an historic occurrence of a male and pregnant female shot on a sandstone cliff in the Rabbit Valley area by a rancher in 1962. PCAs with suitable habitat to support the kit fox include Rabbit Valley, Mack Ridge, Six and Fifty Reservoir, and Colorado River.

Mustela nigripes
Black-Footed Ferret

Taxonomy

Class: *Mammalia*

Order: *Carnivora*

Family: *Mustelidae*

Taxonomy Comments: Possibly conspecific with *Mustella eversmanni* (Jones *et al.* 1983).

CNHP Ranking: G1 S1

State/Federal Status: State Endangered, Federal Endangered; Nonessential Experimental Population

Description and Phenology: The black-footed ferret is a slim-bodied member of the weasel family. They can grow to as much as 2 feet in length (including the 6 inch tail) with a body weight of approximately 2 to 3 pounds. They are a secretive nocturnal, live in prairie dog burrows and are very quick and agile.

Prairie dogs are the black-footed ferret's most important food source (Hillman and Clark 1980). Other prey, such as ground squirrels, cottontail rabbits, deer mice, and other small mammals are probably also eaten.

Black-footed ferrets in captivity mate in March and early April. Young are born about one and a half months later in May or early June, and emerge from the burrows during July. They disperse from the parent burrow by the fall when the young become independent. In the wild, black-footed ferrets have an average litter size of 3.5 (Hillman and Clark 1980).

Habitat Comments: Black-footed ferrets are limited to the same habitat used by prairie dogs, including grasslands, steppe, and shrub steppe. They occupy the underground burrows made by prairie dogs, spending a large portion of their time underground. It is estimated that a prairie dog colony of about 40-60 ha is needed to support one ferret (Oldemeyer *et al.* 1993). Important factors in the usability of potential habitat include size of the prairie dog complex, prairie dog population density, and spatial arrangement of prairie dog colonies (Oldemeyer *et al.* 1993).

Distribution/Abundance: The black-footed ferret was originally widespread in central North America. By about 1976 it was essentially exterminated from the wild; a remnant wild population from Meetetsee, Wyoming was captured in 1987 to serve as the stock for a captive breeding program. In North America it occurred throughout the Great Plains, the large mountain basins, and other semi-arid grassland areas in the western and southwestern US. In 1996 reintroductions were begun in South Dakota, Wyoming, Montana, and northwestern Arizona (Federal Register, 20 March 1996). As of 2004, 56 reintroductions have been completed with ten of those occurring in northwestern Colorado (CDOW 2004).

Known Threats and Management Issues: The black-footed ferret was extirpated from most of its originally large range as a result of prairie dog and predator control programs. Canine distemper, in conjunction with captures for captive breeding, resulted in extirpation of the last known wild population by early 1987. Forrest et al. (1988) and Thorne and Williams (1988) provide information on the distemper-caused decline that occurred in 1985.

Oldemeyer et al. (1993) provided information on the management of prairie dog complexes for the reintroduction of black-footed ferret. Other threats and management issues include the potential for disease in prairie dogs and ferrets, abundance of ferret predators, future resource conflicts and ownership stability, and public and landowner attitudes.

Potential Conservation Areas: The Rabbit Valley and Six and Fifty Reservoir PCAs contain suitable habitat to support the black-footed ferret.

Characterization Abstracts for Imperiled & Vulnerable Plants in the CCNCA

The following are the plant species located in the CCNCA that either drive the Biodiversity Rank of a PCA or are listed as special status. A plant characterization abstract has been provided for each of these plant species. The characterization abstracts describe the species and its phenology and provide information on the habitat, distribution, abundance, threats, management issues, and which of the PCAs in the CCNCA the support the species.

- Astragalus eastwoodiae* (Eastwood Milkvetch)
- Astragalus musiniensis* (Ferron Milkvetch)
- Camissonia eastwoodiae* (Eastwood Evening Primrose)
- Eriogonum contortum* (Grand Buckwheat)
- Lygodesmia doloresensis* (Dolores Skeletonplant)
- Cryptantha osterhoutii* (Osterhout Cat's-eye)
- Sclerocactus glaucus* (Uinta Basin Hookless Cactus)

Astragalus eastwoodiae
Eastwood Milkvetch

Taxonomy

Class: Dicotyledoneae

Order: Fabales

Family: Fabaceae

CNHP Ranking: G3? S3

State/Federal Status: None

Description and Phenology: Eastwood milkvetch is a low growing perennial with a clump forming habit. The leaves are thick and somewhat yellowish green. The flowers are purple and may be up to 2 cm long. The pods are inflated and pendant, about 1cm in diameter, straw colored with a tough-chartaceous texture (Weber and Wittman 2001).

Habitat Comments: This species prefers draws and creek beds in low gravelly clay hills on gullied badlands and on clay banks or benches of arid escarpments (Barneby 1964).

Distribution/Abundance: The species is known from Utah and Western Colorado. In Colorado, it occurs in Mesa, San Miguel, and Montrose Counties in the Colorado River Valley. The CNHP has two occurrences listed for this species, both of which are in the CCNCA. However, the CU Herbarium has thirteen specimens collected from the above counties over the last 100 years.

Known Threats and Management Issues: No Data

Potential Conservation Areas: This species is supported by the Rabbit Valley and the Mack Ridge sites.

Astragalus musiniensis
Ferron Milkvetch

Taxonomy

Class: Dicotyledoneae

Order: Fabales

Family: Fabaceae

CNHP Ranking: G2 S1

State/Federal Status: BLM Sensitive

Description and Phenology: This is a regionally endemic herbaceous perennial. The compound leaves have three to five leaflets and are gray to silvery in appearance. The seed pods are densely spreading. It produces pink-purple flowers from late April through early June.

Habitat Comments: Spackman *et al.* (1997) report the Colorado habitat to be gullied bluffs, knolls, benches, and open hillsides; in pinyon-juniper woodlands or desert shrub communities, mostly on shale, sandstone, or alluvium derived from them at elevations of 4700-7000 feet.

Distribution/Abundance: This species, ranked G2 S1, or globally imperiled, is very rare in Colorado. In Colorado, it is known from four occurrences in Mesa and Garfield Counties on areas of Mancos shale south of the Book Cliffs. It occupies habitat similar to that of *Eriogonum contortum*, which is also known from those areas. Kartesz (1998) indicates this species is also known from Arizona, however, Welsh *et al.* (1993), Arizona Flora (1951), and Barneby (1964) do not mention Arizona in the distribution. Therefore the species is not likely to be documented from Arizona. In Utah, the species is thought to occur in Carbon, Emery, Garfield, Grand, Kane, and Wayne counties, Utah (Welsh *et al.* 1993).

Known Threats and Management Issues: No data is available on the threats to this species. Its low numbers make it important to continue inventory efforts and determine the possible threats and appropriate management issues.

Potential Conservation Areas: One occurrence of this species exists in the Mack Ridge site. The occurrence record is from 1996, and despite inventory attempts to relocate it during this inventory, it was not found. Similar habitat exists in the Rabbit Valley and Six and Fifty Reservoir Sites.

Camissonia eastwoodiae
Eastwood Evening Primrose

Taxonomy

Class: Dicotyledoneae

Order: Myrtales

Family: Onagraceae

CNHP Ranking: G2 S1

State/Federal Status: None

Description and Phenology: This species is a low growing annual with a maximum height of 30cm. It is characterized by mostly basal leaves that are somewhat succulent. When in flower, it produces bright yellow flowers on tall flower stalks. The timing of flowering in this species is uncertain.

Habitat Comments: This species occurs on adobe hills in the lower valleys of western Colorado (Weber and Wittmann 2001) and eastern Utah. It is found in sparse desert shrub communities of mat-saltbush (*Atriplex corrugata*), shadscale (*Atriplex confertifolia*), blackbrush (*Forsellesia meionandra*), and woodlands of sparse juniper (*Juniperus osteosperma*) at 1190-1800 meters (Welsh *et al.* 1993).

Distribution/Abundance: This species is endemic to the Colorado Plateau, and is known from Carbon, Emery, Garfield, Grand, Kane, San Juan, and Wayne counties in Utah, and Mesa and Delta counties of Colorado. It is found mainly in the Bluegate and Tununk members of the Mancos Shale Formation and on the Tropic shale (Welsh *et al.* 1993). Lower valleys of the western slope of Colorado. In Utah, this species is found mainly on shale formations, while in Colorado it is primarily found on the adobe hills of the western slope's lower valleys (Weber and Wittmann 2001).. Its rangewide abundance is not well known. In Utah there are 22 known sites, while in Colorado there are three occurrences from two counties (Mesa and Delta).

Known Threats and Management Issues: No data is available on the threats to this species. Its low numbers make it important to continue inventory efforts and determine the possible threats and appropriate management issues.

Potential Conservation Areas: This species is supported by the Rabbit Valley and Six and Fifty Reservoir sites.

Eriogonum contortum
Grand Buckwheat

Taxonomy

Class: Dicotyledoneae

Order: Polygonales

Family: Polygonaceae

CNHP Ranking: G3 S2

State/Federal Status: BLM Sensitive

Description and Phenology: Grand buckwheat is a dwarf perennial shrub, with a woody root system and bright yellow flowers. It flowers from May to August in most years.

Habitat Comments: The Grand Buckwheat prefers the Mancos shale badlands on gently rolling hills with sparse salt desert shrub vegetation (Spackman *et al.* 1997). Common associated species include shadscale (*Atriplex confertifolia*), Gardner saltbush (*A. gardneri*), pretty buckwheat (*Eriogonum bicolor*), snakeweed (*Gutierrezia sarothrae*), and Prince's plume (*Stanleya pinnata*). Frequent weeds in this habitat include cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomerata*), and Jim Hill mustard (*Sisymbrium altissimum*).

Distribution/Abundance: The species is known only from Mesa and Garfield counties in Colorado, and Grand County, Utah. The range in Colorado extends from the Utah border to 28 miles east, and from the Mesa/Garfield county line to 16 miles south. Twenty-one occurrences are known in Colorado (all but one in Mesa County) and thirteen in Utah. All records are for locations north of the Colorado River and south of the Book Cliffs. In the CCNCA, there is one large occurrence of about 800 acres, containing thousands of individual plants.

Known Threats and Management Issues: Improper grazing and off-road vehicle traffic may threaten this species.

Potential Conservation Areas: This species was found in the Six and Fifty Reservoir Site. Since this species prefers areas of Mancos shale it is less likely, although possible, that the Rabbit Valley and Mack Ridge sites may also support this species.

Lygodesmia doloresensis
Dolores River Skeletonplant

Taxonomy

Class: Dicotyledoneae

Order: Asterales

Family: Asteraceae

CNHP Ranking: G1Q S1

State/Federal Status: BLM Sensitive

Description and Phenology: This species is very similar to *L. arizonica*, but appears to have a taller habit and more branched form. It is a short perennial aster with milky sap and mostly lavender flowers. The flowers are several to numerous on the much branched plant. The flowering period is late May through June. There is some question regarding the taxonomy and some authors cite this taxon as a variety of *L. grandiflora*.

As is indicated by the “Q” in the rank, there remain some taxonomic questions as to the validity of this species. Weber (pers. comm. 1994) indicated that he did not believe this was a distinct species, and Weber and Wittmann (2001) note that it is “questionably distinct” from *L. arizonica*. The USDA Plants Database (<http://plants.usda.gov/>) and ITIS (<http://www.itis.usda.gov/>) have accepted the classification for this as a distinct species, however, citing *L. grandiflora* var. *doloresensis* as a synonym, indicating a lack of consensus.

Habitat Comments: This species is known as an “Endemic on benches of the Dolores River Valley” (Weber and Wittman 2001). It is known to occur on reddish-brown sandy soils derived from sandstones. It occurs in the bottoms of drainages and adjacent to the drainage floor in somewhat narrow canyons. This species occurs most commonly in sparse to moderately vegetated pinyon-juniper communities.

Distribution/Abundance: This species is endemic to western Colorado in the area of Gateway, Mesa County, Colorado. It was identified in the Rabbit Valley area in 1989. The CNHP database contains 12 occurrences for this species. It is assumed this species also occurs across the Colorado border in the eastern portions of Grand and San Juan Counties, Utah.

Known Threats and Management Issues: It is thought that livestock grazing presents a threat to this species. Observations by Dorn (1988) indicated that the plant mostly was found in areas protected from grazing.

Potential Conservation Areas: The Rabbit Valley Site supports an occurrence of this species.

Cryptantha osterhoutii
Osterhout Cat's-eye

Taxonomy

Class: Dicotyledoneae

Order: Lamiales

Family: Boraginaceae

CNHP Ranking: G2G3 S2

State/Federal Status: BLM Sensitive

Description and Phenology: *Cryptantha osterhoutii* is a small perennial herb from a stout taproot, with basal branches, slender stems to 10 cm long, and white flowers that are yellow centrally. It is also known as *Oreocarya osterhoutii* (e.g. Weber and Wittmann 2001; Spackman *et al.* 1997). This species is considered to be sharply distinct from all others (Cronquist *et al.* 1984; Spackman *et al.* 1997). The flowering period is from May to June.

Habitat Comments: This species is found in dry barren sites in reddish purple decomposed sandstone at an elevation of 1370-1860 meters (Spackman *et al.* 1997), or in dry sandy soil in the desert, in blackbrush, mixed desert shrub, oak brush, salt bush, and pinyon-juniper communities at 1520 to 2000 meters (Welsh *et al.* 1993; Cronquist *et al.* 1984).

Distribution/Abundance: This species occurs in Colorado, Utah and perhaps Arizona; it is found on the Colorado Plateau and is considered endemic to the Navajo Basin (Welsh *et al.* 1993). The species is known from Mesa County (type locality), western Colorado (Spackman *et al.* 1997; Weber and Wittmann 2001); and Grand, Wayne, Garfield and San Juan counties, southeastern Utah (Welsh *et al.* 1993). It is also thought to occur in Arizona (Kartesz 1999) based on a 1980 report, but it is not listed in most pertinent publications such as the Arizona Floras (pers. com. Sabra Schwartz Arizona HDMS to K. Fayette 1999). There are seven known occurrences in western Mesa County, Colorado (CNHP 2004). The map for the species in the Utah atlas (Albee *et al.* 1988) indicates eleven occurrences in adjacent southeastern Utah, including one near the border with northeastern Arizona. It is ranked S2 in Utah, but the Utah Natural Heritage Program did not have any records in their database (pers. com. Ben Franklin 1999 to K. Fayette); it is assumed there are over 6 occurrences based on this rank. It is unconfirmed whether it occurs in northern Arizona.

Known Threats and Management Issues: There is no data available on the threats to this species.

Potential Conservation Areas: This species is supported in the Rabbit Valley Site. There are two occurrences known from that site.

Sclerocactus glaucus
Uinta Basin Hookless Cactus

Taxonomy

Class: Dicotyledoneae

Order: Caryophyllales

Family: Cactaceae

CNHP Ranking: G3 S3

State/Federal Status: Listed Federally Threatened

Description and Phenology: *Sclerocactus glaucus* is a low-growing, gray-green, globular, spiny succulent. Each mature stem is 4-6 cm tall and about as wide, although during the driest part of the year the stem may shrink to below ground-level. Plants are inconspicuous except when in flower (April-May), when showy pink to magenta flowers appear at the top of the stem. The central spine or spines in each spine cluster are not hooked but are rather straight. *Sclerocactus glaucus* is distinguished from other *Sclerocactus* species by the presence of these unhooked central spines, although this character can be variable.

Reproduction is predominantly sexual, although individuals may sprout multiple stems. Unpublished work by Vincent J. Tepedino at Utah State University (as cited in Heil and Porter 1994) identified a variety of floral visitors to plants in a Utah population. Small bees of the *Halictidae* and *Anthophoridae* were the most frequent visitors. The species appears to be predominantly outcrossing but is marginally self-compatible. Ants and gravity appear to be the primary dispersal mechanisms (Peggy Lyon pers comm. 1998). Seed dispersal may be a limiting factor in the distribution of *S. glaucus*. Flowering occurs in April-May, and fruits mature in May-June.

Habitat Comments: Populations of this species occur on alluvial benches along the Green, Colorado, and Gunnison Rivers. *Sclerocactus glaucus* generally occurs on cobblely, gravelly, or rocky surfaces on river terrace deposits and lower mesa slopes, with the exception of the morphologically distinct population (= *S. brevispinus*) in the clay badlands of Pariette Draw south of Myton, Utah. Exposures vary, but *S. glaucus* is more abundant on south-facing slopes. Soils are usually coarse, gravelly river alluvium above the river flood plains usually consisting of Mancos shale with volcanic cobbles and pebbles on the surface. Occurrences are found on lower slopes of dry, rocky alkaline hills, especially below the crest of hills and benches of Pleistocene terraces above the Green River. Elevations range from 1200-2000 meters. Associated vegetation is typically desert scrub dominated by shadscale (*Atriplex confertifolia*), galleta (*Pleuraphis jamesii*), black-sage (*Artemisia nova*), and Indian rice grass (*Achnatherum hymenoides*). Other important species include two similar spherical or cylindrical cactus species, strawberry hedgehog cactus (*Echinocereus triglochidiatus* var. *melanacanthus*) and Simpson's pincushion cactus (*Pediocactus simpsonii*). Additional species in the plant community include the prickly pear cactus (*Opuntia polycantha*), winterfat (*Krascheninnikovia lanata*), yucca (*Yucca harrimaniae*), snakeweed (*Gutierrezia sarothrae*), low rabbitbrush (*Crysothamnus viscidiflorus*), sand dropseed (*Sporobolus cryptandrus*), and Salina wildrye (*Elymus salinus*) (USFWS 1990, Scheck 1994).

Distribution/Abundance: This species is known to occur in Mesa, Delta, Montrose and Garfield Counties, Colorado and Uintah, Duchesne and Carbon Counties, Utah. There are 96 occurrences in Colorado and 36 in Utah. It is considered a regional endemic. The Utah populations are treated by some authorities as distinct species, *S. wetlandicus* and *S. brevispinus*.

Population size ranges from 1 to over 1000 individuals (CNHP 2004), and may vary widely between years (Jim Ferguson, pers. comm.). Plants are typically sparsely distributed even in larger populations. Stems may fluctuate in size according to seasonal moisture availability, shrinking below the soil surface in dry times.

Known Threats and Management Issues: Predation by a cactus borer beetle has been observed in Colorado populations, and may be very heavy in localized areas. Some herbivory by rodents has also been observed.

The primary economic use of *S. glaucus* is as a prized addition to the collections of professional and amateur cactus growers. As a rare endemic, the species has been and will likely continue to be of particular value to collectors. There are no known medicinal uses for this species, and it is unlikely to have a major economic impact in its own right.

Habitat destruction or modification by development of energy extraction, water storage projects, transportation, and residential facilities constitutes the greatest threat to *S. glaucus*. This threat is wide-ranging, increasing, and less amenable to mitigation than are the threats of illegal collecting or disturbance by agricultural or recreational activities. The scope and severity of this threat are inferred from numbers of plants known to be impacted by projects such as the Trans-Colorado gas transmission pipeline and Colorado Highway 50 widening, as well as anecdotal observations from field personnel familiar with the species.

Fire is not typically characteristic of *S. glaucus* habitat, but areas with large infestations of cheatgrass (*Bromus tectorum*) may build up sufficient fuel to carry fire into *S. glaucus* populations.

Potential Conservation Areas: The Rabbit Valley Site supports a questionable occurrence of this species. The EOR reported in the Rabbit Valley area from 1981 was searched for during the current survey but was not located. The original EOR may be a misidentification of *S. whipplei*, which is common in the area.

Ecological System Descriptions for Imperiled & Vulnerable Plant Associations of the CCNCA

Ecological Systems are dynamic assemblages or complexes of plant and/or animal communities that occur together on the landscape, are tied together by similar ecological processes and abiotic factors, and form a readily identifiable unit on the ground. Each Ecological System is unified by a defined set of ecological conditions and processes (e.g., fire regime, riverine flooding, soil erosion) and depends on similar abiotic factors (e.g., shallow soils, limestone geology), and/or environmental gradient (elevation). Because an ecological system has a unifying set of ecological processes, the scale at which those processes operate determines the scale of the ecological system and the associations that it defines. Ecological system scales include Matrix, Linear, Small Patch, and Large Patch. Matrix ecological systems manifest themselves across broad areas of the landscape (e.g. Spruce-Fir Forest) and may be 20,000 to 1,000,000 acres. Linear systems are primarily associated with river systems. Large patch systems operate at an intermediate scale and range from 1,000 to 20,000 acres. Small patch systems operate at a local scale and are less than 2,000 acres. Typically, a plant association is included in only one ecological system but occasionally they can be found in two or more ecological systems (e.g., *Carex utriculata* / mesic forb plant association is found in both Montane wet meadow systems and Montane fens systems).

The following Ecological System descriptions present the environmental characteristics and ecological processes for one or more plant associations identified in the CCNCA. Ecological system descriptions are provided for the significant plant associations found in the CCNCA. Significant plant associations are those which, in part, justify the Biodiversity Rank of a PCA. Other plant associations found in the CCNCA are included when they are part of the Ecological System for a significant plant association. The significant plant associations that drive the PCA Biodiversity Rank are bolded in the list below, while the *other* included associations are not. These Ecological System descriptions are excerpted from the NatureServe Organization's Systems 2000 Database[©] and are presented here verbatim (NatureServe 2003b).

COLORADO PLATEAU PINYON-JUNIPER WOODLAND *ECOLOGICAL SYSTEM*

***Juniperus osteosperma/Cercocarpus montanus – Forsellesia meionandra* Woodland**

***Juniperus osteosperma/Forsellesia meionandra* Woodland**

***Pinus edulis/Hesperostipa comata* Woodland**

Juniperus osteosperma / Leymus salinus Wooded Herbaceous Vegetation

Juniperus osteosperma / Artemisia nova / Rock Woodland

INTER-MOUNTAIN BASINS MAT SALTBUSSH SHRUBLAND *Ecological System*

Atriplex gardneri / Leymus salinus Dwarf-shrubland

Atriplex gardneri / Pleuraphis jamesii Dwarf-shrubland

INTER-MOUNTAIN BASINS SEMI-DESERT GRASSLAND *Ecological System*

***Hesperostipa comata* Great Basin Herbaceous Vegetation**

***Pleuraphis jamesii* Herbaceous Vegetation**

INTER-MOUNTAIN BASINS SHALE BADLAND *Ecological System*
***Achnatherum hymenoides* Shale Barren Herbaceous Vegetation**

Colorado Plateau Pinyon-Juniper Woodland

Division 304, Forest and Woodland

Spatial Scale & Pattern: Matrix

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Montane [Lower Montane], Lowland [Foothill], Mesa, Ridge/Summit/Upper Slope, Sedimentary Rock, Temperate [Temperate Xeric], Aridic, *Pinus edulis*, *Juniperus osteosperma*

Non-Diagnostic Classifiers: Forest and Woodland (Treed), Foothill(s), Piedmont, Plateau, Sideslope, Alkaline Soil, Long Disturbance Interval, F-Patch/Medium Intensity

Concept Summary: This ecological system occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim. It is typically found at lower elevations ranging from 1500-2440 m. These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. *Pinus edulis* and/or *Juniperus osteosperma* dominate the tree canopy. *Juniperus scopulorum* may codominate or replace *Juniperus osteosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula*, *Artemisia tridentata*, *Cercocarpus intricatus*, *Cercocarpus montanus*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Purshia tridentata*, *Quercus gambelii*, *Bouteloua gracilis*, *Pleuraphis jamesii*, or *Poa fendleriana*. This system occurs at higher elevations than Great Basin Pinyon-Juniper Woodland (CES304.773) and Colorado Plateau shrubland systems where sympatric.

DISTRIBUTION

Range: Occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim. It is typically found at lower elevations ranging from 1500-2440 m.

Ecological Divisions: 304, 306

Subnations/Nations: AZ:c, CO:c, NM:c, UT:c

CONCEPT

Alliances and Associations:

- JUNIPERUS OSTEOSPERMA WOODED HERBACEOUS ALLIANCE (A.1502)
 - Juniperus osteosperma / Hesperostipa comata Wooded Herbaceous Vegetation (CEGL001489)
 - Juniperus osteosperma / Leymus salinus ssp. salmonis Wooded Herbaceous Vegetation (CEGL001488)
- JUNIPERUS OSTEOSPERMA WOODED SHRUBLAND ALLIANCE (A.2541)
 - Juniperus osteosperma Wooded Shrubland [Placeholder] (CEGL002964)
- JUNIPERUS OSTEOSPERMA WOODLAND ALLIANCE (A.536)
 - Juniperus osteosperma - Juniperus monosperma / Sparse Understory Woodland (CEGL000737)
 - Juniperus osteosperma / Artemisia arbuscula Woodland (CEGL002757)
 - Juniperus osteosperma / Artemisia nova / Rock Woodland (CEGL000729)
 - Juniperus osteosperma / Artemisia nova Woodland (CEGL000728)
 - Juniperus osteosperma / Artemisia tridentata / Achnatherum hymenoides Woodland (CEGL000731)
 - Juniperus osteosperma / Artemisia tridentata Woodland (CEGL000730)
 - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000733)
 - Juniperus osteosperma / Cercocarpus ledifolius Woodland (CEGL000734)
 - Juniperus osteosperma / Cercocarpus montanus Woodland (CEGL000735)
 - Juniperus osteosperma / Coleogyne ramosissima Woodland [Provisional] (CEGL002909)
 - Juniperus osteosperma / Hesperostipa neomexicana Woodland (CEGL000740)
 - Juniperus osteosperma / Pleuraphis mutica Woodland (CEGL000736)
 - Juniperus osteosperma / Pseudoroegneria spicata Woodland (CEGL000738)
 - Juniperus osteosperma / Sparse Understory Woodland (CEGL000732)
 - Juniperus osteosperma / Symphoricarpos oreophilus Woodland (CEGL000741)
 - Juniperus osteosperma Woodland (CEGL000727)

- PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE (A.516)
 - Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland (CEGL000797)
 - Pinus edulis - (Juniperus osteosperma) / Bouteloua gracilis Woodland (CEGL000778)
 - Pinus edulis - Juniperus osteosperma / Arctostaphylos patula Woodland (CEGL002939)
 - Pinus edulis - Juniperus osteosperma / Cercocarpus intricatus Woodland (CEGL000779)
 - Pinus edulis - Juniperus osteosperma / Coleogyne ramosissima Woodland (CEGL000781)
 - Pinus edulis - Juniperus osteosperma / Purshia stansburiana Woodland (CEGL000782)
 - Pinus edulis - Juniperus spp. / Artemisia tridentata Woodland (CEGL000776)
 - Pinus edulis - Juniperus spp. / Cercocarpus montanus Woodland (CEGL000780)
 - Pinus edulis - Juniperus spp. / Quercus gambelii Woodland (CEGL000791)
 - Pinus edulis - Quercus arizonica / Rhus trilobata Woodland (CEGL000790)
 - Pinus edulis / Achnatherum nelsonii ssp. dorei Woodland (CEGL000796)
 - Pinus edulis / Achnatherum scribneri Woodland (CEGL000798)
 - Pinus edulis / Andropogon hallii Woodland (CEGL000774)
 - Pinus edulis / Arctostaphylos pungens Woodland (CEGL000775)
 - Pinus edulis / Bouteloua curtipendula Woodland (CEGL000777)
 - Pinus edulis / Festuca arizonica Woodland (CEGL000783)
 - Pinus edulis / Muhlenbergia pauciflora Woodland (CEGL000785)
 - Pinus edulis / Nolina microcarpa Woodland (CEGL000786)
 - Pinus edulis / Poa fendleriana Woodland (CEGL000787)
 - Pinus edulis / Pseudoroegneria spicata Woodland (CEGL000788)
 - Pinus edulis / Purshia tridentata Woodland (CEGL000789)
 - Pinus edulis / Quercus X pauciloba Woodland (CEGL000793)
 - Pinus edulis / Rockland Woodland (CEGL000794)
- PINUS EDULIS FOREST ALLIANCE (A.135)
 - Pinus edulis / Sparse Understory Forest (CEGL000795)

SOURCES

References: Baker and Kennedy 1985, Stuever and Hayden 1997a, Tuhy et al. 2002, West et al. 1998

Concept Author: NatureServe Western Ecology Team

Inter-Mountain Basins Mat Saltbush Shrubland

Division 304, Shrubland

Spatial Scale & Pattern: Matrix

Classification Confidence: low

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Alluvial flat, Alluvial plain, Plain, Alkaline Soil, Saline Substrate Chemistry, Calcareous, Silt Soil Texture, Clay Soil Texture, Dwarf-Shrub, *Atriplex* spp.

Non-Diagnostic Classifiers: Basin floor, Temperate [Temperate Continental], Oligotrophic Soil

Concept Summary: This ecological system occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept basins and plains across parts of Wyoming. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. These landscapes that typically support dwarf-shrublands composed of relatively pure stands of *Atriplex* spp. such as *Atriplex corrugata* or *Atriplex gardneri*. Other dominant or codominant dwarf-shrubs may include *Artemisia longifolia*, *Artemisia pedatifida*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs such as *Krascheninnikovia lanata* or *Tetradymia spinosa*. *Atriplex confertifolia* or *Atriplex canescens* may be present, but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Elymus lanceolatus* ssp. *lanceolatus*, *Pascopyrum smithii*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions grasslands dominated by *Hesperostipa comata*, *Leymus salinus*, *Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, inclusions of non-saline, gravelly barrens or rock outcrops dominated by cushion plants such as *Arenaria hookeri* and *Phlox hoodii* without dwarf-shrubs may be present. Annuals are seasonally present and may include *Eriogonum inflatum*, *Plantago tweedyi*, and the introduced annual grass *Bromus tectorum*.

DISTRIBUTION

Range: Occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept basins and plains across parts of Wyoming.

Ecological Divisions: 304

Subnations/Nations: AZ:c, CO:c, NM:c, UT:c, WY:c

CONCEPT

Alliances and Associations:

- ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE (A.1109)
Atriplex corrugata Dwarf-shrubland (CEGL001437)
- ATRIPLEX CUNEATA SHRUBLAND ALLIANCE (A.871)
Atriplex cuneata - Frankenia jamesii / Sporobolus airoides Shrubland (CEGL001316)
- ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE (A.1110)
Atriplex gardneri - Picrothamnus desertorum Dwarf-shrubland (CEGL001439)
Atriplex gardneri / Achnatherum hymenoides Dwarf-shrubland (CEGL001444)
Atriplex gardneri / Artemisia tridentata Dwarf-shrubland (CEGL001440)
Atriplex gardneri / Leymus salinus Dwarf-shrubland (CEGL001442)
Atriplex gardneri / Monolepis nuttalliana Dwarf-shrubland (CEGL001443)
Atriplex gardneri / Pascopyrum smithii Dwarf-shrubland (CEGL001445)
Atriplex gardneri / Pleuraphis jamesii Dwarf-shrubland (CEGL001441)
Atriplex gardneri / Xylorhiza venusta Dwarf-shrubland (CEGL001446)
Atriplex gardneri Dwarf-shrubland (CEGL001438)

Environment: This ecological system occurs on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale and arid, wind-swept plains and basins across parts of Wyoming. Substrates are shallow, typically saline, alkaline, fine-textured soils developed from shale or alluvium and may be associated with shale badlands. Infiltration rate is typically low. In Wyoming and possibly elsewhere inclusions of non-saline, gravelly barrens or rock outcrops may be present.

Vegetation: This ecological system typically supports dwarf-shrublands composed of relatively pure stands of *Atriplex* spp. such as *Atriplex corrugata* or *Atriplex gardneri*. Other dominant or codominant dwarf-shrub may include *Artemisia longifolia*, *Artemisia pedatifida*, or *Picrothamnus desertorum*, sometimes with a mix of other low shrubs such as *Krascheninnikovia lanata*, or *Tetradymia spinosa*. *Atriplex confertifolia* or *Atriplex canescens* may be present, but do not codominate. The herbaceous layer is typically sparse. Scattered perennial forbs occur, such as *Xylorhiza glabriuscula* and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Elymus lanceolatus ssp. lanceolatus*, *Pascopyrum smithii*, or *Sporobolus airoides* may dominate the herbaceous layer. In less saline areas, there may be inclusions grasslands dominated by *Hesperostipa comata*, *Leymus salinus*, *Pascopyrum smithii*, or *Pseudoroegneria spicata*. In Wyoming and possibly elsewhere, vegetation dominated by cushion plants such as *Arenaria hookeri*, *Phlox hoodii* without dwarf-shrubs may be present and occur on inclusions of non-saline, gravelly barrens or rock outcrops. Annuals are seasonally present and may include *Eriogonum inflatum*, *Plantago tweedyi*, and the introduced annual grass *Bromus tectorum*.

SOURCES

References: Branson et al. 1976, Knight 1994, Potter et al. 1985, Welsh 1957

Concept Author: NatureServe Western Ecology Team

Inter-Mountain Basins Mixed Salt Desert Scrub

Division 304, Shrubland

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Lowland], Shrubland (Shrub-dominated), Alluvial flat, Alluvial plain, Plain, Alkaline Soil, Saline Substrate Chemistry, Calcareous, Silt Soil Texture, Clay Soil Texture, Xeromorphic Shrub, Dwarf-Shrub, *Atriplex* spp.

Non-Diagnostic Classifiers: Basin floor, Temperate [Temperate Continental], Oligotrophic Soil

Concept Summary: This extensive ecological system includes open-canopied shrublands of typically saline desert basins, alluvial slopes and plains across the Intermountain western U.S. This type also extends in limited distribution into the southern Great Plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as *Atriplex confertifolia*, *Atriplex canescens*, *Atriplex polycarpa*, or *Atriplex spinifera*. Other shrubs present to codominate may include *Artemisia tridentata* ssp. *wyomingensis*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Grayia spinosa*, *Krascheninnikovia lanata*, *Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. *Sarcobatus vermiculatus* is generally absent, but if present does not codominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus lanceolatus* ssp. *lanceolatus*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Pleuraphis rigida*, *Poa secunda*, or *Sporobolus airoides*. Various forbs are also present.

DISTRIBUTION

Range: Intermountain western U.S., extending in limited distribution into the southern Great Plains.

Ecological Divisions: 303, 304, 306

Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ATRIPLEX (LENTIFORMIS, POLYCARPA) SHRUBLAND ALLIANCE (A.864)
 - Atriplex (lentiformis, polycarpa) Shrubland [Placeholder] (CEGL003016)
- ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (A.869)
 - Atriplex canescens - Artemisia tridentata Shrubland (CEGL001282)
 - Atriplex canescens - Ephedra viridis Shrubland (CEGL001287)
 - Atriplex canescens - Krascheninnikovia lanata Shrubland (CEGL001285)
 - Atriplex canescens / Achnatherum hymenoides Shrubland (CEGL001289)
 - Atriplex canescens / Bouteloua gracilis Shrubland (CEGL001283)
 - Atriplex canescens / Calycoseris parryi Shrubland (CEGL001284)
 - Atriplex canescens / Parthenium confertum Shrubland (CEGL001290)
 - Atriplex canescens / Pleuraphis jamesii Shrubland (CEGL001288)
 - Atriplex canescens / Purshia stansburiana Shrubland (CEGL001286)
 - Atriplex canescens / Sporobolus airoides Shrubland (CEGL001291)
 - Atriplex canescens / Sporobolus wrightii Shrubland (CEGL001292)
 - Atriplex canescens Shrubland (CEGL001281)
- ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE (A.870)
 - Atriplex confertifolia - Ephedra nevadensis Shrubland (CEGL001303)
 - Atriplex confertifolia - Krascheninnikovia lanata Shrubland (CEGL001301)
 - Atriplex confertifolia - Lycium andersonii Shrubland (CEGL001308)
 - Atriplex confertifolia - Lycium pallidum / Mirabilis pudica Shrubland (CEGL001309)
 - Atriplex confertifolia - Lycium shockleyi Shrubland (CEGL001310)
 - Atriplex confertifolia - Picrothamnus desertorum / Achnatherum hymenoides Shrubland (CEGL001297)
 - Atriplex confertifolia - Picrothamnus desertorum / Krascheninnikovia lanata Shrubland (CEGL001296)
 - Atriplex confertifolia - Picrothamnus desertorum / Sarcobatus vermiculatus Shrubland (CEGL001298)
 - Atriplex confertifolia - Picrothamnus desertorum Shrubland (CEGL001295)
 - Atriplex confertifolia - Sarcobatus vermiculatus Shrubland (CEGL001313)
 - Atriplex confertifolia / Achnatherum hymenoides Shrubland (CEGL001311)

- Atriplex confertifolia / Elymus elymoides Shrubland (CEGL001302)
- Atriplex confertifolia / Ericameria nauseosa Shrubland (CEGL001300)
- Atriplex confertifolia / Hesperostipa comata Shrubland (CEGL001314)
- Atriplex confertifolia / Kochia americana Shrubland (CEGL001305)
- Atriplex confertifolia / Leymus salinus Shrubland (CEGL001307)
- Atriplex confertifolia / Leymus salinus ssp. salmonis Shrubland (CEGL001306)
- Atriplex confertifolia / Pleuraphis jamesii Shrubland (CEGL001304)
- Atriplex confertifolia / Pseudoroegneria spicata Shrubland (CEGL001312)
- Atriplex confertifolia / Tetradymia glabrata Shrubland (CEGL001315)
- Atriplex confertifolia Great Basin Shrubland (CEGL001294)
- Atriplex confertifolia Wyoming Basins Shrubland (CEGL001293)
- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108)
 - Atriplex obovata / Sporobolus airoides - Sporobolus cryptandrus Dwarf-shrubland (CEGL001447)
 - Atriplex obovata / Tidestromia carnosus Dwarf-shrubland (CEGL004575)
- ATRIPLEX PARRYI SHRUBLAND ALLIANCE (A.2507)
 - Atriplex parryi Shrubland [Placeholder] (CEGL002711)
- ATRIPLEX POLYCARPA SHRUBLAND ALLIANCE (A.873)
 - Atriplex polycarpa / Pleuraphis mutica Shrubland (CEGL001319)
 - Atriplex polycarpa Shrubland (CEGL001318)
- ATRIPLEX SPINIFERA SHRUBLAND ALLIANCE (A.865)
 - Atriplex spinifera Shrubland [Placeholder] (CEGL003015)
- KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE (A.1104)
 - Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland (CEGL001323)
 - Krascheninnikovia lanata / Hesperostipa comata Dwarf-shrubland (CEGL001327)
 - Krascheninnikovia lanata Dwarf-shrubland [Provisional] (CEGL001320)
- PICROTHAMNUS DESERTORUM SHRUBLAND ALLIANCE (A.1128)
 - Picrothamnus desertorum / Elymus elymoides Shrubland [Provisional] (CEGL002992)
 - Picrothamnus desertorum Shrubland (CEGL001452)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532)
 - Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)

Environment: This salt-desert shrubland system is a matrix system in the Intermountain West. This system is comprised of arid to semi-arid shrublands on lowland and upland sites usually at elevations between 1520 and 2200 m (4987-7218 feet). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep, but are sometimes unstable and prone to surface movement. Many areas within this system are degraded due to erosion and may resemble “badlands.” Soil surface is often very barren in occurrences of this system. The interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

This is typically a system of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 13-33 cm. In much of the ecological system, the period of greatest moisture will be mid- to late summer, although in the more northern areas a moist period is to be expected in the cold part of the year. However, plotted seasonality of occurrence is probably of less importance on this desert system than in other ecosystems because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline. Vegetation within this system is tolerant of these soil conditions but not restricted to it. The shallow soils of much of the area are poorly developed Entisols. Vegetation within this system can occur on level pediment remnants where coarse-textured and well-developed soil profiles have been derived from sandstone gravel and are alkaline, or on Mancos shale badlands, where soil profiles are typically fine-textured and non-alkaline throughout (West and Ibrahim 1968). They can also occur in alluvial basins where parent materials from the other habitats have been deposited over Mancos shale and the soils are heavy-textured and saline-alkaline throughout the profile (West and Ibrahim 1968).

Vegetation: Occurrences of this ecological system vary from almost pure occurrences of single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). Occurrences have a sparse to moderately dense cover of woody species

that is dominated by *Atriplex canescens* (may codominate with *Artemisia tridentata*), *Atriplex confertifolia* (may codominate with *Lycium andersonii*), *Atriplex obovata*, *Picrothamnus desertorum*, or *Krascheninnikovia lanata*. Other shrubs that may occur within these occurrences include *Purshia stansburiana*, *Psoralea polydenius*, *Ephedra* spp., *Acacia greggii*, *Encelia frutescens*, *Tiquilia latior*, *Parthenium confertum*, *Atriplex polycarpa*, *Atriplex lentiformis*, *Atriplex spinifera*, *Picrothamnus desertorum* (= *Artemisia spinescens*), *Frankenia salina*, *Artemisia frigida*, *Chrysothamnus* spp., *Lycium* spp., *Suaeda* spp., *Yucca glauca*, and *Tetradymia spinosa*. Dwarf-shrubs include *Gutierrezia sarothrae* and *Eriogonum* spp. Warm-season medium-tall and short perennial grasses dominate in the sparse to moderately dense graminoid layer. The species present depend on the geographic range of the grasses, alkalinity/salinity and past land use. Species may include *Pleuraphis jamesii*, *Bouteloua gracilis*, *Sporobolus airoides*, *Sporobolus cryptandrus*, *Achnatherum hymenoides*, *Elymus elymoides*, *Distichlis spicata*, *Leymus salinus*, *Pascopyrum smithii*, *Hesperostipa comata*, *Pseudoroegneria spicata*, *Poa secunda*, *Leymus ambiguus*, and *Muhlenbergia torreyi*. A number of annual species may also grow in association with the shrubs and grasses of this system, although they are usually rare and confined to areas of recent disturbance (Blaisdell and Holmgren 1984). Forb cover is generally sparse. Perennial forbs that might occur include *Sphaeralcea coccinea*, *Chaetopappa ericoides*, *Xylorhiza venusta*, *Descurainia sophia*, and *Mentzelia* species. Annual natives include *Plantago* spp., *Vulpia octoflora*, or *Monolepis nuttalliana*. Associated halophytic annuals include *Salicornia rubra*, *Salicornia bigelovii*, and *Suaeda* species. Exotic annuals that may occur include *Salsola kali*, *Bromus rubens*, and *Bromus tectorum*. Cacti like *Opuntia* spp. and *Echinocereus* spp. may be present in some occurrences. Trees are not usually present but some scattered *Juniperus* spp. may be found.

Dynamics: West (1982) stated that “salt desert shrub vegetation occurs mostly in two kinds of situations that promote soil salinity, alkalinity, or both. These are either at the bottom of drainages in enclosed basins or where marine shales outcrop.” However, salt-desert shrub vegetation may be an indication of climatically dry as well as physiologically dry soils (Blaisdell and Holmgren 1984). Not all salt-desert shrub soils are salty, and their hydrologic characteristics may often be responsible for the associated vegetation (Naphan 1966). Species of the salt-desert shrub complex have different degrees of tolerance to salinity and aridity, and they tend to sort themselves out along a moisture/salinity gradient (West 1982). Species and communities are apparently sorted out along physical, chemical, moisture, and topographic gradients through complex relations that are not understood and are in need of further study (Blaisdell and Holmgren 1984).

The winter months within this system are a good time for soil moisture accumulation and storage. There is generally at least one good snow storm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches to 1 m. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). *Atriplex confertifolia* shrubs often develop large leaves in the spring, which increase the rate of photosynthesis. As soil moisture decreases, the leaves are lost, and the plant takes on a dead appearance. During late fall, very small overwintering leaves appear which provide some photosynthetic capability through the remainder of the year (IVC 1999). Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

In summary, desert communities of perennial plants are dynamic and changing. The composition within this system may change dramatically and may be both cyclic and unidirectional. Superimposed on the compositional change is great variation from year to year in growth of all the vegetation – the sum of varying growth responses of individual species to specific conditions of different years (Blaisdell and Holmgren 1984). Desert plants grow when temperature is satisfactory, but only if soil moisture is available at the same time. Because amount of moisture is variable from year to year and because different species flourish under different seasons of soil moisture, seldom do all components of the vegetation thrive in the same year (Blaisdell and Holmgren 1984).

SOURCES

References: Barbour and Major 1988, Blaisdell and Holmgren 1984, Branson et al. 1967, Branson et al. 1976, Brown 1982, Campbell 1977, Francis 1986, Holland and Keil 1995, Reid et al. 1999, West 1979, West 1982, West 1983b, West and Ibrahim 1968

Concept Author: NatureServe Western Ecology Team

Inter-Mountain Basins Semi-Desert Grassland

Division 304, Herbaceous

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Foothill], Lowland [Lowland], Herbaceous, Temperate [Temperate Xeric], Alkaline Soil, Aridic, Graminoid

Non-Diagnostic Classifiers: Intermediate Disturbance Interval, F-Landscape/Medium Intensity, G-Landscape/Low Intensity, Forb, Moderate (100-500 yrs) Persistence

Concept Summary: This widespread ecological system occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) in elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy- or loamy-textured soils derived from sedimentary parent materials, but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothills grasslands they will be at lower elevations. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by *Achnatherum hymenoides*, *Aristida* spp., *Bouteloua gracilis*, *Hesperostipa comata*, *Muhlenbergia torreyana*, or *Pleuraphis jamesii*, and may include scattered shrubs and dwarf-shrubs of species of *Artemisia*, *Atriplex*, *Coleogyne*, *Ephedra*, *Gutierrezia*, or *Krascheninnikovia lanata*.

DISTRIBUTION

Range: Occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) in elevation.

Ecological Divisions: 304, 306

Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:p, NM:c, NV:c, OR:c, UT:c, WA:c, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262)
Achnatherum hymenoides - Sporobolus contractus Herbaceous Vegetation (CEGL001652)
- ACHNATHERUM LETTERMANII HERBACEOUS ALLIANCE (A.2524)
Achnatherum lettermanii - Oxytropis oreophila Herbaceous Vegetation (CEGL002734)
- ACHNATHERUM NELSONII HERBACEOUS ALLIANCE (A.1271)
Achnatherum nelsonii - Koeleria macrantha Herbaceous Vegetation (CEGL001707)
- ACHNATHERUM SPECIOSUM HERBACEOUS ALLIANCE (A.1290)
Achnatherum speciosum Herbaceous Vegetation [Placeholder] (CEGL003112)
- ARISTIDA PURPUREA HERBACEOUS ALLIANCE (A.2570)
Aristida purpurea Herbaceous Vegetation (CEGL005800)
- BOUTELOUA ERIPODA HERBACEOUS ALLIANCE (A.1284)
Bouteloua eriopoda - Hesperostipa neomexicana Herbaceous Vegetation (CEGL001753)
Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation (CEGL001751)
Bouteloua eriopoda Semi-desert Herbaceous Vegetation (CEGL001752)
- BOUTELOUA ERIPODA MICROPHYLLOUS EVERGREEN SHRUB HERBACEOUS ALLIANCE (A.1545)
Gutierrezia sarothrae - Krascheninnikovia lanata - Atriplex canescens / Bouteloua eriopoda Shrub Herbaceous Vegetation (CEGL001733)
- BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (A.1282)
Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation (CEGL001754)
Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation (CEGL001755)
Bouteloua gracilis - Hesperostipa comata Herbaceous Vegetation [Provisional] (CEGL002932)
Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation (CEGL001759)
Bouteloua gracilis Herbaceous Vegetation (CEGL001760)
- BOUTELOUA HIRSUTA HERBACEOUS ALLIANCE (A.1285)
Bouteloua hirsuta - Bouteloua radicata Herbaceous Vegetation (CEGL001765)
- BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE (A.3561)
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation (CEGL005264)

- BROMUS TECTORUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.1814)
Bromus tectorum Semi-natural Herbaceous Vegetation [Placeholder] (CEGL003019)
- ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE (A.1546)
Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation (CEGL003495)
- HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE (A.1270)
Hesperostipa comata - (Bouteloua eriopoda, Pleuraphis jamesii) Herbaceous Vegetation (CEGL002997)
Hesperostipa comata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001703)
Hesperostipa comata Great Basin Herbaceous Vegetation (CEGL001705)
- HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE (A.1272)
Hesperostipa neomexicana Herbaceous Vegetation (CEGL001708)
- MUHLENBERGIA ASPERIFOLIA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (A.1334)
Muhlenbergia asperifolia Herbaceous Vegetation (CEGL001779)
- MUHLENBERGIA MONTANA HERBACEOUS ALLIANCE (A.1260)
Muhlenbergia (pungens, montana) - Heterotheca villosa Herbaceous Vegetation (CEGL002938)
- PLEURAPHIS JAMESII HERBACEOUS ALLIANCE (A.1287)
Pleuraphis jamesii Herbaceous Vegetation (CEGL001777)
- PLEURAPHIS JAMESII SHRUB HERBACEOUS ALLIANCE (A.1532)
Atriplex obovata / Pleuraphis jamesii - Sporobolus airoides Shrub Herbaceous Vegetation (CEGL001775)
- PLEURAPHIS RIGIDA HERBACEOUS ALLIANCE (A.1246)
Pleuraphis rigida Herbaceous Vegetation [Placeholder] (CEGL003051)
- PLEURAPHIS RIGIDA SHRUB HERBACEOUS ALLIANCE (A.1539)
Pleuraphis rigida Shrub Herbaceous Vegetation [Placeholder] (CEGL003052)
- POA FENDLERIANA HERBACEOUS ALLIANCE (A.1263)
Poa fendleriana ssp. fendleriana Herbaceous Vegetation (CEGL001655)
- POA SECUNDA HERBACEOUS ALLIANCE (A.1291)
Aristida purpurea var. longiseta - Poa secunda Herbaceous Vegetation (CEGL001781)
- POA SECUNDA SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1410)
Poa secunda - Muhlenbergia richardsonis Herbaceous Vegetation (CEGL002755)
Poa secunda Herbaceous Vegetation (CEGL001657)
- PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (A.1265)
Pseudoroegneria spicata - Achnatherum hymenoides Herbaceous Vegetation (CEGL001674)
Pseudoroegneria spicata ssp. inermis Herbaceous Vegetation (CEGL001661)
- SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (A.1267)
Sporobolus airoides Monotype Herbaceous Vegetation (CEGL001688)
- SPOROBOLUS AIROIDES SOD HERBACEOUS ALLIANCE (A.1241)
Sporobolus airoides - Bouteloua gracilis Herbaceous Vegetation (CEGL001686)
Sporobolus airoides Sod Herbaceous Vegetation [Placeholder] (CEGL001791)
- SPOROBOLUS CRYPTANDRUS HERBACEOUS ALLIANCE (A.1252)
Aristida purpurea var. longiseta - Pseudoroegneria spicata - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001589)
Aristida purpurea var. longiseta - Sporobolus cryptandrus Herbaceous Vegetation (CEGL001515)
Sporobolus cryptandrus - Poa secunda Herbaceous Vegetation (CEGL001516)
Sporobolus cryptandrus Great Basin Herbaceous Vegetation (CEGL002691)
- SPOROBOLUS CRYPTANDRUS SHRUB HERBACEOUS ALLIANCE (A.1525)
Sporobolus cryptandrus Shrub Herbaceous Vegetation (CEGL001514)
- THINOPYRUM INTERMEDIUM SEMI-NATURAL HERBACEOUS ALLIANCE (A.2529)
Thinopyrum intermedium Semi-natural Herbaceous Vegetation (CEGL002935)

Environment: Low-elevation grasslands in the Intermountain West region occur in semi-arid to arid climates at approximately 1450 to 2320 m (4750-7610 feet) in elevation. Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by medium-tall and short bunch grasses, often in a sod-forming growth. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains. These grasslands typically occur on xeric sites. This system experiences cold temperate conditions. Hot summers and cold winters with freezing temperatures and snow are common. Annual precipitation is usually from 20-40 cm (7.9-15.7 inches). A significant portion of the precipitation falls in July through October during the summer monsoon storms, with the rest falling as snow during the winter and early spring months.

These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Soils supporting this system also vary from deep to shallow, and from sandy to finer-textured. The substrate is typically sand- or shale-derived. Some sandy soil occurrences have a high cover of cryptogams on the soil.

These cryptogamic species would tend to increase the stability of the highly erodible sandy soils of these grasslands during torrential summer rains and heavy wind storms (Kleiner and Harper 1977). *Muhlenbergia*-dominated grasslands which flood temporarily, combined with high evaporation rates in this dry system, can have accumulations of soluble salts in the soil. Soil salinity depends on the amount and timing of precipitation and flooding.

Dynamics: This system is maintained by frequent fires and sometimes associated with specific soils, often well-drained clay soils. A combination of precipitation, temperature, and soils limits this system to the lower elevations within the region. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. Grasses that dominate semi-arid grasslands develop a dense network of roots concentrated in the upper parts of the soil where rainfall penetrates most frequently (Blydenstein 1966, Cable 1969, Sala and Lauenroth 1985, as cited by McClaran and Van Devender 1995). *Bouteloua gracilis* is also very grazing-tolerant and generally forms a short sod. *Pleuraphis jamesii* is only moderately palatable to livestock, but decreases when heavily grazed during drought and in the more arid portions of its range where it is the dominant grass (West 1972). This grass reproduces extensively from scaly rhizomes. These rhizomes make the plant resistant to trampling by livestock and have good soil-binding properties (Weaver and Albertson 1956, West 1972). *Achnatherum hymenoides* is one of the most drought-tolerant grasses in the western U.S. (USDA 1937). It is also a valuable forage grass in arid and semi-arid regions. Improperly managed livestock grazing could increase soil erosion, decrease cover of this palatable plant species and increase weedy species (USDA 1937). *Muhlenbergia asperifolia* with its flooding regime combined with high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species. As the saturated soils dry, the salt concentrates until it precipitates out on the soil surface (Dodd and Coupland 1966, Ungar 1968). *Hesperostipa comata* is a deep-rooted grass that uses soil moisture below 0.5 m during the dry summers.

SOURCES

References: Cable 1967, Cable 1969, Cable 1975, Dodd and Coupland 1966, Kleiner and Harper 1977, Mast et al. 1997, Mast et al. 1998, McClaran and Van Devender 1995, Tuhy et al. 2002, Ungar 1968, Weaver and Albertson 1956, West 1983

Concept Author: NatureServe Western Ecology Team

Inter-Mountain Basins Shale Badland

Division 304, Shrubland

Spatial Scale & Pattern: Large Patch

Classification Confidence: medium

Required Classifiers: Natural/Semi-natural, Vegetated (>10% vasc.), Upland

Diagnostic Classifiers: Lowland [Lowland], Badlands, Badland, Alkaline Soil, Shale and Mudstone, Silt Soil Texture, Clay Soil Texture

Non-Diagnostic Classifiers: Shrubland (Shrub-dominated), Moss/Lichen (Nonvascular), Temperate [Temperate Continental], Aridic, Very Short Disturbance Interval, Broad-Leaved Shrub, Dwarf-Shrub, Semi-Shrub

Concept Summary: This widespread ecological system of the Intermountain western U.S. is composed of barren and sparsely vegetated substrates (<10% plant cover) typically derived from marine shales, but also including substrates derived from siltstones and mudstones (clay). Landforms are typically rounded hills and plains that form a rolling topography. The harsh soil properties and high rate of erosion and deposition are driving environmental variables supporting sparse dwarf-shrubs, e.g., *Atriplex corrugata*, *Atriplex gardneri*, *Artemisia pedatifida*, and herbaceous vegetation.

DISTRIBUTION

Range: Intermountain western U.S.

Ecological Divisions: 304, 306

Subnations/Nations: AZ:c, CA:c, CO:c, ID:c, MT:c, NM:c, NV:c, OR:c, UT:c, WA:?, WY:c

CONCEPT

Alliances and Associations:

- ACHNATHERUM HYMENOIDES HERBACEOUS ALLIANCE (A.1262)
Achnatherum hymenoides Shale Barren Herbaceous Vegetation (CEGL001651)
- ARTEMISIA BIGELOVII SHRUBLAND ALLIANCE (A.1103)
Artemisia bigelovii / Achnatherum hymenoides Shrubland (CEGL000990)
- ARTEMISIA PEDATIFIDA SHRUBLAND ALLIANCE (A.1127)
Artemisia pedatifida - Atriplex gardneri Shrubland (CEGL001525)
Artemisia pedatifida / Elymus elymoides Shrubland (CEGL001450)
Artemisia pedatifida / Festuca idahoensis Shrubland (CEGL001526)
Artemisia pedatifida / Pascopyrum smithii Shrubland (CEGL001451)
Artemisia pedatifida / Pseudoroegneria spicata Shrubland (CEGL001527)
- ARTEMISIA PYGMAEA SHRUBLAND ALLIANCE (A.1106)
Artemisia pygmaea / Elymus elymoides - Achnatherum hymenoides Shrubland (CEGL001436)
- ATRIPLEX CORRUGATA DWARF-SHRUBLAND ALLIANCE (A.1109)
Atriplex corrugata Dwarf-shrubland (CEGL001437)
- ATRIPLEX CUNEATA SHRUBLAND ALLIANCE (A.871)
Atriplex cuneata - Frankenia jamesii / Sporobolus airoides Shrubland (CEGL001316)
- ATRIPLEX GARDNERI DWARF-SHRUBLAND ALLIANCE (A.1110)
Atriplex gardneri - Picrothamnus desertorum Dwarf-shrubland (CEGL001439)
Atriplex gardneri / Achnatherum hymenoides Dwarf-shrubland (CEGL001444)
Atriplex gardneri / Artemisia tridentata Dwarf-shrubland (CEGL001440)
Atriplex gardneri / Leymus salinus Dwarf-shrubland (CEGL001442)
Atriplex gardneri / Monolepis nuttalliana Dwarf-shrubland (CEGL001443)
Atriplex gardneri / Pascopyrum smithii Dwarf-shrubland (CEGL001445)
Atriplex gardneri / Pleuraphis jamesii Dwarf-shrubland (CEGL001441)
Atriplex gardneri / Xylorhiza venusta Dwarf-shrubland (CEGL001446)
Atriplex gardneri Dwarf-shrubland (CEGL001438)
- ATRIPLEX OBOVATA DWARF-SHRUBLAND ALLIANCE (A.1108)
Atriplex obovata Dwarf-shrubland [Placeholder] (CEGL001789)
- ERIOGONUM CORYMBOSUM DWARF-SHRUBLAND ALLIANCE (A.1126)
Eriogonum corymbosum / Leymus salinus Dwarf-shrubland (CEGL001343)
- LEYMUS SALINUS SSP. SALMONIS SPARSELY VEGETATED ALLIANCE (A.1258)
Leymus salinus Shale Sparse Vegetation (CEGL002745)
- PAINTED DESERT SPARSELY VEGETATED ALLIANCE (A.2545)
Atriplex obovata Badland Sparse Vegetation (CEGL002928)

- Ephedra nevadensis / Lichens Sparse Vegetation [Provisional] (CEGL002976)
- Eriogonum corymbosum Badlands Sparse Vegetation (CEGL002979)
- PSEUDOROEGNERIA SPICATA SPARSELY VEGETATED ALLIANCE (A.1876)
 - Pseudoroegneria spicata - Eriogonum brevicaule Sparse Vegetation (CEGL001667)

SOURCES

References: DeVelice and Lesica 1993, Knight 1994, Knight et al. 1987

Concept Author: NatureServe Western Ecology Team

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