



Saguache County, Closed Basin Biological Inventory
Volume I:
A Natural Heritage Assessment
Final Report

Prepared for:

The Nature Conservancy, San Luis Valley Program
Saguache, Colorado

Prepared by:

Colorado Natural Heritage Program
Renée J. Rondeau, Daniel Sarr, Michael B. Wunder
Phyllis M. Pineda, Gwen M. Kittel

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Appendix A: Ownership/close-up maps

Users Guide

The Saguache County Biological Inventory, conducted by the Colorado Natural Heritage Program (CNHP), consisted of three essentially distinct projects that were highly integrated with respect to methodology, field work, and coordination with Saguache County government. This report reflects the separate nature of the projects by being organized in a two-volume set. All three projects utilized the same Natural Heritage methodology that is used throughout North America, and searched for and assessed the plants, animals, and plant communities on Colorado Natural Heritage Program's list of rare and imperiled elements of biodiversity. Each volume prioritizes potential conservation sites based on the relative significance of the biodiversity they support and the urgency for protection of the site. All information explaining Natural Heritage methodology and ranks is repeated in each volume, so that each volume can be used independently.

Volume I presents *all* proposed conservation sites identified in Saguache County that support rare and imperiled plants and animals, and significant plant communities, including wetland and riparian areas. Volume II focuses exclusively on wetland and riparian areas. Additionally, Volume II presents an assessment of the wetland functions performed by each site that was surveyed. These functional assessments are intended to provide the user with a more complete picture of the value wetlands and riparian areas provide to Saguache County residents.

Glossary:

biodiversity- The diversity of living things within an ecosystem ranging from genetic diversity within a species to diversity within a natural community.

ecological processes- A variety of natural forces that influence and direct changes in ecosystems. These forces can be physical (slope erosion, river meandering, flooding), biological (vegetation growth, animal grazing, predation, pollinization), or both (fire cycles, soil development).

ecosystem- The basic functional unit of nature that includes living things, their nonliving environment, and the ecological processes that sustain them. Examples of Saguache County ecosystems include the sand dunes, shallow wetlands and coniferous forests.

endemic- Lifeforms that are restricted to a particular locality such as the Great Sand Dunes tiger beetle, an animal that is only found in the Great Sand Dunes of the San Luis Valley.

non-native- A term used to describe animal or plant species which are not native to a given region or ecosystem. Most noxious weeds fall into this category, having evolved in areas with a long history of human-caused or natural disturbance. In most cases, invasion by non-

native species is more closely linked to human-caused disturbance than deliberate introductions, with the exception of aquatic habitats, where non-native gamefish have been widely introduced.

playa- A shallow depression at the bottom of a drainage basin which receives runoff from snowmelt or rainfall in the surrounding landscape. In most cases, these depressions have no drainage and accumulate salts due to poorly permeable soils and evaporation.

watershed- The area from which a surface watercourse or groundwater system derives its water, e.g. in addition to the Colorado portion, the Rio Grande watershed includes much of New Mexico, west Texas, and northern Mexico.

Acknowledgments

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The information management staff with the CNHP was responsible for integrating the data into the Biological Conservation Database, especially Karen Crumbaker, Anne Ochs, and Jeremy Siemers. Anne Ochs also generously helped produce the GIS generated maps. Liz Phillips graciously volunteered her time to enter all of the site profiles into the Biological Conservation Database.

The University of Colorado, Colorado State University, and Adams State College Herbaria were sources of pertinent information.

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Executive Summary



The San Luis Valley, in south-central Colorado, is the state's largest montane valley housing the state's most extensive wetland complex. Although entirely within the Rio Grande watershed, part of the Valley has no surface drainage resulting in what is known as the Closed Basin. The Closed Basin lies, primarily, in Saguache County, in the northern part of the Valley, and contains a diverse array of upland habitats, including shortgrass prairies, foothill shrublands and woodlands, montane forests, and alpine communities. With funding from Great Outdoors Colorado! (GOCO), the Nature Conservancy, a private nonprofit conservation organization, contracted the Colorado Natural Heritage Program to inventory the Closed Basin of Saguache County for areas of special biological significance. The primary goal of the project was to identify the locations in the Closed Basin portion of Saguache County that have natural heritage significance. Such locations were identified by: 1) examining existing biological data from the Colorado Natural Heritage Program's database, 2) accumulating additional existing information on rare or imperiled plant species, animal species, and significant plant communities (collectively called **elements**), and, 3) conducting extensive field surveys. Areas which were found to contain significant elements were delineated as "proposed conservation sites." These sites were prioritized on the basis of their biological importance and are presented in this report.

Sixteen plants, 7 mammals, 14 birds, 2 fish, 17 invertebrates, and 60 significant plant communities were documented. Several mammals were found to be more common than had been thought, indicating reduced significance for those elements. Other elements are only known from the Closed Basin, and several are of global significance. Of this list, only one

species is federally listed under the Endangered Species Act (ESA), the American peregrine falcon (*Falco peregrinus*). An additional bird species, the mountain plover (*Charadrius montanus*), is proposed for listing under the ESA. The extensive wetlands of Saguache County provide important habitat for migratory birds following the Rocky Mountain Flyway **of North America.** (probably unnecessary since Rocky Mts are in N Am)

We have identified 45 proposed conservation sites, containing the 116 elements documented in this report. If protected, these sites would help to conserve the biological integrity of the San Luis Valley and Colorado. Of these 45 sites, several stand out as extremely significant. Foremost is the Great Sand Dunes proposed conservation site. The unique insects of this ecosystem place it as one of the most important in Colorado. At least four endemic insects were found within this site; i.e., the Great Sand Dunes is the only place in the world where these occur. Adjacent to this system is the playa lake landscape, another unique area important for abundant nesting and migratory birds, plants, and plant communities. Within the playa lake region we found Russell, Mishak, and Weisman Lakes to be the most significant. Within the playa lake system, the globally rare slender spiderflower (*Cleome multicaulis*) was abundant. Russell Lakes harbors one of the world's largest known populations of this small, delicate, alkaline wetland specialist.

Of the 45 proposed conservation sites, we identified one that was ranked as *outstanding* (B1), 13 *very significant* (B2), 17 *significant* (B3), 10 *moderate* (B4), and 4 of *general biodiversity significance* (B5). Overall, the concentration and quality of imperiled elements and habitats attest to the fact that conservation efforts in Saguache County will have both state and global significance. In order to enhance conservation efforts in Saguache County we provide a list of the major threats to biodiversity in the Closed Basin and identify nine recommendations for enhancing conservation efforts.

Introduction

The Saguache County Biological Inventory conducted by the Colorado Natural Heritage Program (CNHP) consisted of three essentially distinct projects that were highly integrated with respect to methodology, field work, and coordination with Saguache County government. One project focused primarily on upland habitats, another on wetlands, and the third described streamside communities as part of an ongoing state-wide riparian classification effort. This report reflects the separate nature of the projects by being organized in a two-volume set. All three projects used the same Natural Heritage methodology that is used throughout North America, and searched for the plants, animals, and plant communities on Colorado Natural Heritage Program's list of rare and imperiled elements of biodiversity and assessed their quality and condition.

The primary goal of the collective project was to identify the locations in Saguache County that have natural heritage significance. These locations were identified by:

- Examining existing biological data from CNHP;
- Accumulating additional existing information on rare or imperiled plant species, animal species, and significant plant communities (collectively called **elements**);
- Conducting extensive field surveys

Locations in the County with natural heritage significance (those places where elements have been documented) are presented in this report as proposed conservation sites. **The proposed conservation site boundaries delineated in this report do not confer any regulatory protection of the site.** The boundaries are based on the ecological processes known to support the elements at each site. Forty-seven sites are described and prioritized, including 28 wetland and riparian sites. The sites are prioritized according to their **biodiversity significance rank**, or "B-rank," which ranges from B1 (outstanding biodiversity significance) to B5 (general or state-wide biodiversity significance). The highest ranking sites (e.g., B1-B3) are the highest priorities for conservation actions. The sum of all the sites in this report represents the area CNHP recommends for protection to preserve the natural heritage of the Closed Basin portion of Saguache County.

The Wetland and Riparian Survey follows the same methodology as the general natural heritage assessment, but includes an additional function and value assessment of each survey site. In addition to their biological significance, particularly for wildlife habitat, wetlands perform many functions that provide value to the residents of Saguache County. Wetlands help control flooding, maintain water quality, offer recreational opportunities, and increase the aesthetics of Saguache County, such as magnificent scenery and broad, open landscapes.

Major Threats and Stresses To Biodiversity in The Closed Basin

• Hydrological Modification

Groundwater pumping is one of the greatest threats to the biodiversity of the Closed Basin. Surface water impoundments and diversions present an equally widespread and allied threat. The playa lake ecosystems of the San Luis Valley floor depend upon a complex interaction of surface and groundwater sources which undergo characteristic seasonal and inter-annual fluctuations. Extensive wetlands have developed where sources of fresh surface water, such as creeks or springs, build on the shallow water table to create seasonal groundwater mounds. Preliminary work has shown that not only are hydrologic dynamics in the valley complex, but that the differing water sources vary widely in water quality (Cooper and Severn 1992). Wetland vegetation is strongly affected by water salinities, and valley wetlands have developed unique floristic patterns based on the quantity and quality of water they receive. Water uses which perturb the timing or magnitude of surface flows, or affect the water table, have the potential to negatively affect valley bottom wetlands. Even minor changes in the water depth or duration of inundation in the wetland basins can have profound effects on soil salinities, and consequently, on wetland vegetation. Cooper and Severn (1992) observed that the entire range of soil moisture and salinity, and associated plant communities, from permanently saturated wetland to saline flat to rain-rinsed upland, occurred over an elevation gradient of only 5 to 8 feet. Wetland dependent fauna, such as nesting waterbirds, amphibians, or invertebrates may be affected by even brief fluctuations in wetland hydrology.

For the last six years, the Bureau of Reclamation's Closed Basin Project has pumped shallow groundwater to supplement Rio Grande flows, in order to meet Colorado's commitments to New Mexico, Texas, and Mexico under the Rio Grande Compact. Impacts from this project are purported by land owners and researchers (Cooper and Severn 1992), but not yet quantitatively described. Plans by Stockman's Water Corporation to pump confined aquifer water from the Baca Ranch for trans-basin use represent a serious concern given such scientific uncertainty.

Despite considerable debate, the hydrological connections between surface, as well as shallow and deep groundwater resources and valley bottom wetlands, remain poorly understood. The confusing array of past, present, and anticipated hydrologic disturbances make it exceedingly difficult to accurately estimate management needs and viability potential for the rare plants, animals, and plant communities at many valley bottom sites. Although information needs are immense, independent research has been minimal to date (Cooper and Severn 1992). Effective management will require a much better understanding of the hydrologic connections between surface, shallow, and deep groundwater resources of the Closed Basin, and how they vary in time and space. Management of the valley bottom sites presented in this report will require, therefore, not only local protection of on-site wetland elements, but secure water resources and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands. For an accurate assessment of the risks to Closed Basin biodiversity posed by water development, further quantitative research linking hydrology, vegetation, and wetland fauna is imperative.

- **Development**

Residential development is a localized but increasing threat in the Valley. Although growth rates in the Closed Basin watershed have lagged well behind most other Colorado regions, it is likely that the Valley may begin to receive “overflow” development pressure, especially close to the mountains in northern and eastern Saguache County. Development creates a number of stresses, including habitat loss and fragmentation, introduction of non-native species, fire suppression, and domestic animals (dogs and cats) (Oxley *et al.*, 1974; Coleman and Temple, 1994; Knight *et al.*, 1995). Habitat loss to development is considered irreversible and should therefore be channeled to areas with less biological significance. Pinyon-juniper and ponderosa pine woodlands and various grassland types are the most threatened by these stresses due to their potential for development (i.e., they are flat, scenic, or have good soils) and their vulnerability to sustained fire suppression. Development also tends to occur adjacent to water courses in this arid region, with consequent effects on aquatic and riparian habitats.

- **Mining**

Mining has been a traditional industry in the Valley for over a century. Poorly planned or managed mining operations have the potential to impact biodiversity for decades after the activity has ceased. Summitville, just south of the study area, has been the country’s most highly publicized mining mishap in recent years. Other mines, especially the Rawley Mine have also contributed lead and other heavy metal contamination to Kerber Creek, above Villa Grove. In fact, a major fish kill in Kerber Creek and confluent San Luis Creek was noted during field assessment for this report, presumably due to leaching of toxins from tailings at upstream mines (D. Sarr personal observation). Stresses from mining activities include habitat loss and fragmentation, water pollution by acid mine drainage, which can contain heavy metals and cyanide, and excessive sediment. Aquatic systems are the most threatened by these stresses, but riparian communities can be impacted as well.

- **Livestock Grazing**

The other traditional industry of the Valley, domestic livestock grazing, has left a much more on the landscape. Depending on grazing practices and local environmental conditions, impacts can be minimal, moderate and largely reversible (slight shifts in species composition, willow browsing), to severe and irreversible (extensive gullying, introduction of non-native forage species, extirpation of local willow populations). Also, “pest” control of unwanted rodents and predators can impact native fauna (D. Armstrong, pers. comm.). Stresses due to sediment deposition and water quality changes from improper grazing practices are more difficult to judge, but they may be detrimental to aquatic biota (Gifford *et al.*, 1975; Anderholm *et al.*, 1995).

Observations during the field assessment for this report indicated that livestock impacts are most severe in the foothills of the San Juan Mountains, where mild topography and open range allow the livestock to congregate in nearly all riparian areas. Non-native species and degraded willow and alder stands are abundant in riparian habitats of this area.

- **Recreation**

Recreation, once very local and perhaps even unnoticeable, is on the increase and is becoming a threat to the Valley's ecology. Like grazing, recreation practices and their stresses differ, mostly between motorized and non-motorized activities. All terrain vehicles (ATVs) are becoming increasingly popular and the Rio Grande National Forest is a favorite area for ATV use (especially for big-game retrieval). BLM lands are also used. ATVs can disrupt migration and breeding patterns, and fragment habitat for native resident species. This activity can also threaten rare plants found in non-forested areas.

Non-motorized recreation, mostly hikers but also some mountain biking and rock climbing presents a different set of problems (Cole and Knight, 1990; Knight and Cole, 1991; Holmes *et al.*, 1993). Wildlife behavior can be significantly altered by repeat visits of hikers/bicyclists. Trampling of sensitive plant species, particularly in high alpine areas (among the most popular destinations for hikers), is of concern along the most popular areas such as 14,000 ft. peak routes (Spackman, pers. comm.).

- **Roads**

Much of the Closed Basin watershed is roaded due to past timber harvest and mining operations. Expansion of the existing road network will detrimentally affect the natural heritage values of the region. Roads are associated with a wide variety of impacts to natural communities, including invasion of non-native plant species, increased depredation and parasitism of bird nests, increased impacts of pets, fragmentation of habitats, erosion, pollution, and road mortality (Noss *et al.* 1997).

- **Non-native Species**

Although non-native species are mentioned repeatedly as stresses in the above discussions, because they can come from so many activities they are included here as a general threat as well. Non-native plants or animals can have wide-ranging impacts. Non-native plants can increase dramatically under the right conditions and essentially dominate a previously natural area, e.g., scraped roadsides. This can generate secondary effects on animals (particularly invertebrates) that depend on native plant species for forage, cover, or propagation. Whitetop (*Cardaria* spp.) is an introduced, highly aggressive weed found in irrigated areas and low wetlands that is very difficult to control. Cheatgrass (*Bromus tectorum*), smooth brome (*Bromus inermis*), and crested wheatgrass (*Agropyron spicatum*) are hardy, xeric grasses from Eurasia that are also very difficult to control (H. Dixon, pers. comm.). Effects of non-native fishes include competition that can lead to local extinctions of native fishes and hybridization that corrupts the genetic stock of the native fishes.

Recommendations

1. **Develop and implement a plan for protecting the conservation sites profiled in this report, with most attention directed toward sites with biodiversity rank (B-rank) B1, B2, and B3.** The sites in this report provide Saguache County with a basic framework for implementing a comprehensive conservation program. The B1, B2, and B3 sites, because they have global significance, should receive priority attention. The sum of all the sites in this report represents the area CNHP recommends for protection to ensure that the County's natural heritage is not lost as the population and associated development increase.
2. **Incorporate the information included in this report in the review of proposed activities in or near conservation sites so that the activities do not adversely affect natural heritage elements.** All of the sites presented contain natural heritage elements of state or global significance. Development activities in or near a site may affect the element(s) present. Wetland and riparian sites are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large impact. As proposed activities within Saguache County are considered, they should be compared to the site maps presented herein. If a proposed project potentially would impact a site, planning personnel should contact persons, organizations, or agencies with expertise to get detailed comments. The Colorado Natural Heritage Program, Colorado Natural Areas Program, and Colorado Division of Wildlife routinely conduct environmental reviews statewide and should be considered valuable resources. Addresses for the most pertinent agencies are listed in Appendix A.
3. **Using Volume II of this report, develop and implement a comprehensive county-wide program to protect wetlands.** Use the U.S. Fish and Wildlife Service definition of wetlands to guide this program, and include riparian areas in the wetland conservation program. Recognizing the ability for off-site effects, such as agricultural pollutants, sediment, or groundwater pumping to impair wetlands, develop a system of buffers around wetland habitats. Some wetlands, such as those harboring rare or particularly sensitive species, will require larger buffers.
4. **In the effort to protect natural diversity, promote cooperation among landowners, pertinent government agencies, and non-profit conservation organizations.** The long-term protection of natural diversity in Saguache County will be facilitated with the cooperation of many government agencies, non-government organizations, and private landowners. Efforts to this end should continue, providing stronger ties among federal, state, local, and private interests involved in the protection or management of natural lands.

5. **Promote proper management of the natural heritage resources that exist within Saguache County, recognizing that designation of conservation sites does not by itself confer protection of the plants, animals, and plant communities.** Development of a conservation plan is a necessary component of the site designation. Because some of the most serious threats to Saguache County ecosystems are at a landscape scale (altered hydrology, residential encroachment, and non-native species invasion), considering each site in the context of its surroundings is critical. Building partnerships is essential to the long-term protection of a site. An important component of partnerships could be research and development of techniques to maintain or restore sites for preservation of imperiled elements. Several organizations and agencies are available for consultation in the development of conservation plans, including the Colorado Natural Areas Program, The Nature Conservancy, the Colorado Natural Heritage Program, the Colorado Division of Wildlife, Natural Resources Conservation Service, and various academic institutions. In addition, partnerships with local agencies, non-profits, and other educational groups could provide the means to implement some of the management and protection recommendations. For example, partnerships could be formed with the San Luis Valley Environmental Conservation and Education Coalition (ECEC), the Boy Scouts and Girl Scouts, 4H Club, and Center Soil Conservation District.
6. **Increase public awareness of the benefits of protecting significant natural areas.** Natural lands are becoming ever more scarce, especially those near densely populated metropolitan areas. Rare and imperiled species will continue to decline if not given appropriate protection. This will result not only in the reduction of our natural heritage and quality of life, but may also lead to additional conflicts between developers and natural resource managers. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Finally, to build awareness of the commitment to protect sites of biodiversity significance, the County should publicize the significant conservation and cooperation actions taken.
7. **Consider using incentives, including tax breaks, to promote conservation actions on private lands.** Conservation of important natural heritage resources can only take place with the cooperation of private landowners. Tax incentives could be used to help landowners defray the costs of protecting something that will benefit Saguache County residents.
8. **Continue natural heritage resource inventories where necessary, including inventories for species that cannot be surveyed adequately in one field season and inventories on lands that CNHP could not access in 1997.** Not all targeted inventory areas can be field surveyed in one year due to either access problems or being a low priority. Because some species are ephemeral or migratory, inventory for some species in one field season is often difficult or inconclusive. Despite the best efforts of one field season, it is likely that some elements occur at sites not identified in this report.

9. **Prohibit the introduction and/or sale of non-native species that are known to negatively and profoundly affect natural areas, especially wetlands and riparian areas.** These include but are not limited to purple loosestrife, Russian olive, wild chamomile, and non-native fish species. Natural area managers, public agencies, and private landowners should be encouraged to remove these species from their properties. If restoration of an area is necessary, CNHP recommends the use of natives, if any introductions are necessary.

Project Background

Study Area



Most of Saguache County lies within the Closed Basin of the San Luis Valley of south-central Colorado and covers approximately 2 million acres. This report is specific to the Closed Basin portion of Saguache County and does not include the area west of the continental divide. However, the following land status statistics refer to all of Saguache County. Private lands comprise about 592,000 acres (28%), state lands approximately 84,733 acres (4%) and federal lands of about 1,350,586 acres or 68% (Overall Economic Development Program as cited in Essington 1996). See Table 1 for a more complete breakdown. The majority of the private lands are located on the valley floor or in the lower foothills (Figure 1). Elevations range from 14,295 feet (4,367 m) on Kit Carson Peak to approximately 7,575 feet (2309 m) at the lowlands along the Alamosa County line.

The Closed Basin falls within two ecoregional provinces: the Southern Rocky Mountain Steppe (surrounding mountains) and the Great Plains-Palouse Dry Steppe (valley bottom and foothills) (Bailey et al. 1994). These provinces are further divided into three sections: the Southern Parks and Rocky Mountain ranges, South Central Highlands, and the Northern Rio Grande Basin (McNab and Avers, 1994).

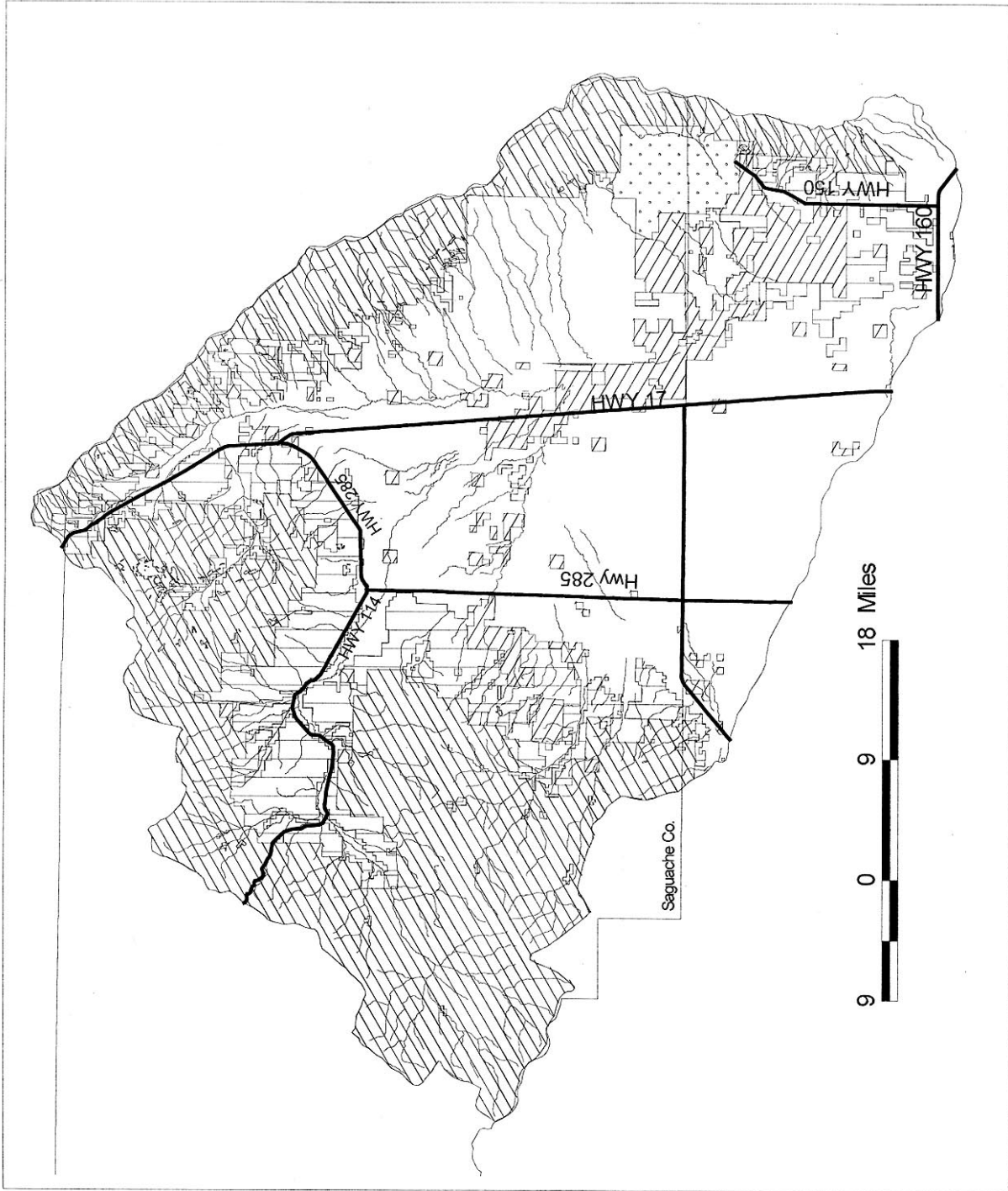
Table 1. Land Ownership of Saguache County.

Land Owner	Acres	Percentage of Saguache County
Federal Lands	1,350,586	68
Rio Grande National Forest	624,823	31
BLM	347,704	17
Bureau of Rec.	2,570	1
NPS	22,922	1
Other Federal	352,567	18
State Lands	84,733	4
School Trust	83,040	4
CDOW	793	<0.1
County and City	180	<0.1
Private	592,469	28
Total	2,027,968	

(Figures provided are for all of Saguache County, therefore, acreages as they relate to this study are slightly high). From: SLV Regional Development and Planning Commission. 1992 Overall Economic Development Program as cited in Essington 1996).

The San Luis Valley is Colorado's largest and driest mountain park, and the Closed Basin, which lies primarily in Saguache County, is the driest section of the valley. Significant watercourses in the Closed Basin include the Saguache, San Luis, and La Garita creeks. In addition, the Closed Basin contains many ephemeral lakes (i.e., playas) and permanent wetland systems, such as those found at Russell Lakes, Mishak Lakes, Blanca Wetland Area, and San Luis Lakes.

The Closed Basin is bounded on all sides by imposing mountain ranges. The Sangre de Cristo Mountains line the east and northeast sides of the basin, rising abruptly from the level valley floor to over 14,000 feet above sea level. Alluvial fans are common all along the west slopes of the Sangre de Cristos. The San Juan Mountains, which form the western perimeter, are a less striking feature as viewed from the valley floor. Unlike the narrow, jagged profile of the Sangre de Cristo, the San Juan rise gradually over 40 miles from the valley to the Continental Divide, which forms the western boundary of the study area. Because the upland watersheds are much more extensive in area, and because these basins receive greater annual precipitation, the streams and rivers draining the San Juan Mountains are much larger than those originating in the Sangre de Cristo Mountains (Essington 1996). The Cochetopa Hills, which form the northwest boundary of the basin, bridge the San Juan and Sangre de Cristo highlands.



Colorado

- Saguache county
- Closed basin
- Roads
- Streams
- Land ownership
- USFS
- BLM
- NPS
- CDOW
- State
- Private



Figure 1. Land ownership of the Closed Basin, Colorado.

Geology

The geology of the eastern and western sides of the Closed Basin is quite different. Generally, the Sangre de Cristo range is composed of Precambrian granites and schists with some conglomerates, sandstones and limestones. Pleistocene glaciation dramatically sculpted areas above 10,000 feet, particularly on the northeast side of the range (Peterson 1971). The San Juan Mountains are generally older lava and ash flow deposits of Tertiary origin, with basalts and tuffs of Pliocene/Miocene origin found throughout (Tweto 1979). Alluvial fans line both sides of the valley and contain sedimentary-type cobbles.

The valley floor proper is relatively flat, with a topographic depression on the eastern side. This depression, which contains the remnants of a large Pleistocene lake, is known locally as the “sump” area, and contains many of the wetland features mentioned above (Jodry *et al.* 1989; Rogers *et al.* 1992). The Great Sand Dunes lie just east of this concavity, and abut the west slope of the Sangre de Cristo Range. These aeolian deposits rise almost 800 feet above the valley floor and comprise almost 60 square miles (Landreth 1990).

The valley floor is composed of sediments of up to 30,000 feet thick. Several layers of lava flows are embedded within these sediments. In addition, a layer of largely impermeable clay, 10 to 80 feet thick, underlies the superficial sediments (U.S. Department of Agriculture, 1984a). The clay layer, at depths of 50 to 130 feet, inhibits the vertical movement of water, and creates two separate aquifers, both containing large quantities of water. The lower aquifer is **confined** while the uppermost aquifer is **unconfined** and lies above the clay lens. The locations and degree of contact between these two reservoirs are presently unknown. This hydro-geologic structure results in a relatively high water table (less than 13 feet) in most of the Closed Basin. Soils in both the confined and the unconfined aquifers are composed of unconsolidated clay, silt, sand, and gravel, with particle sizes decreasing towards the center of the valley (Leonard and Watts 1989). Recharge areas for both aquifers are believed to be along the alluvial fans at the base of the planning area’s mountain ranges (U.S. Department of Agriculture 1984a). The San Luis Valley is estimated to contain over 2 billion acre-feet of ground water with over 140 million acre-feet deemed recoverable (Pearl 1974).

Soils

Soils in the basin vary widely, ranging from rocky shallow soils in the mountains, to cobbly, loamy well drained soils in the foothills and alluvial fans, to clayey, sandy, silty and highly alkaline soils in the valley bottom (U.S. Department of Agriculture 1973; U.S. Department of Agriculture 1980a; U.S. Department of Agriculture 1984a). Although many of the soil patterns in the high elevations are common in Colorado, the extremely alkaline nature of valley bottom soils is unusual and is a significant determinant of the vegetation pattern in low elevations (U.S. Department of Agriculture 1972b; U.S. Department of Agriculture 1984b; Galatowitsch 1988; Dick-Peddie 1993).

Climate

The study area is characterized by cold winters and cool summers. At Alamosa, the average January temperature is 18 F and the average July temperature is 65 F (U.S. Department of Agriculture 1973). Local microclimates are strongly influenced by topography. The higher elevations are decidedly cooler and moister, except during winter thermal inversions which trap the coldest air at the valley floor. The valley bottom lies in a double rain shadow. The San Juan Mountains block westerly winter storms and The Sangre de Cristo Mountains block spring moisture, creating a very dry landscape. Alamosa is, in fact, the driest weather station in Colorado. In late summer, southerly “monsoon” flows commence, and provide the only respite from drought. In general, precipitation increases with altitude, from the southeastern basins near San Luis Lakes, where yearly precipitation averages just over six inches, to the crests of the surrounding mountain ranges, where estimated precipitation approaches 40 inches annually (Colorado Weather Center 1998). Runoff and groundwater recharge from higher elevations of the watershed, which receive abundant snowfall and summer rain, are crucial Closed Basin water resources.

Vegetation

The Closed Basin contains an exceptional array of terrestrial and aquatic habitats. Elements of Great Basin, Short Grass Steppe, Rio Grande Valley, and southern Rocky Mountain floras, with steep gradients in elevation, moisture, and soil characteristics produce a landscape unique in Colorado. Valley bottom vegetation is typified by greasewood (*Sarcobatus vermiculatus*) and halophytic (salt-loving) grasses such as alkali sacaton (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*) in the extensive alkali basins. Rubber rabbitbrush (*Chrysothamnus nauseosus*) and xeric grasses, such as indian rice grass (*Oryzopsis hymenoides*), occur on sandy soils where summer rains leach salts below the rooting zone. Valley bottom wetlands support a flora adapted to seasonal soil saturation and saline conditions. The marshes, lakes, and playas vary greatly in depth, salinity, and period of inundation. Regularly flooded basins support well developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), and American three-square (*Scirpus pungens*). Basins with irregular or short duration flooding contain saltgrass and/or western wheatgrass (*Pascopyron smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals which complete their life cycles after surface water evaporates and the late summer rains begin. Several locally common species include seablite (*Suaeda calceoliformis*), seaside heliotropium (*Heliotropium curassavicum*), and red glasswort (*Salicornia rubra*).

The alluvial fans which line the valley bottom have their own characteristic vegetation. Extensive stands of pinyon pine (*Pinus edulis*), Gambel oak (*Quercus gambelii*), needle and thread grass (*Stipa Comata*) and short grass steppe vegetation indicate the greater precipitation and milder winter temperatures of this zone, compared to the valley bottom. Many of the streams in these alluvial fans, particularly at the base of the Sangre de Cristo Range, support excellent riparian forests of narrowleaf cottonwood (*Populus angustifolia*), with dense shrub understories of willows (*Salix* spp.) western birch, (*Betula occidentalis*), ocean spray (*Holodiscus discolor*), and wild rose (*Rosa woodsii*).

The Sangre de Cristo and San Juan Mountains contain typical southern Rocky Mountain vegetation including mixed forests of Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*), and occasional stands of white fir (*Abies concolor*) at lower elevations, and Englemann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) at higher elevations. Dry south-facing slopes at high elevations support open woodlands of bristle-cone pine (*Pinus aristata*). Aspen (*Populus tremuloides*) stands are abundant throughout the study area at elevations over 8,500 feet. Mountain wetlands are largely vegetated with willows, sedges (*Carex* spp.), and wetland grasses, such as Canadian reedgrass (*Calamagrostis canadensis*) and tufted hairgrass (*Deschampsia cespitosa*).

The Natural Heritage Network and Biodiversity

Colorado is well known for its rich diversity of geography, wildlife, plants, and plant communities. However, like many other states, it is experiencing a loss of much of its flora and fauna. This decline in biodiversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that Wilson (1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biodiversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biodiversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically-based approach to preserving biodiversity, Robert Jenkins, in association with The Nature Conservancy, developed the Natural Heritage Methodology in 1978.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as its biology and known threats. By ranking the relative rareness or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate the prioritization of conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community began to realize that plant communities are equally important as individual species, this methodology has also been applied to ranking and preserving rare plant communities as well as excellent examples of common communities.

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. It also enables conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

What is Biological Diversity?

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from species such as bacteria, and protists, through multicellular kingdoms of plants, animals, and fungi. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities

exist, and the interactions among these levels. All levels are necessary for the continued survival of species and plant communities, and all are important for the well-being of humans. It stands to reason that biological diversity should be of concern to all people.

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

1. **Genetic Diversity** -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. This unique genetic information cannot be reclaimed.
2. **Species Diversity** -- the total number and abundance of plant and animal species and subspecies in an area.
3. **Community Diversity** -- the variety of plant communities within an area that represent the range of species relationships and inter-dependence. These communities may be diagnostic or even endemic to an area. It is within communities that all life dwells.
4. **Landscape Diversity** -- the type, condition, pattern, and connectedness of plant communities. A landscape consisting of a mosaic of plant communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through shortgrass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

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

Colorado's Natural Heritage Program

To place this document in context, it is useful to understand the history and functions of the Colorado Natural Heritage Program (CNHP).

CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop state-wide conservation priorities. After operating in Colorado for 14 years, the Program was relocated from the State Division of Parks and Outdoor Recreation to the University of Colorado Museum in 1992, and more recently to the College of Natural Resources at Colorado State University.

The multi-disciplinary team of scientists and information managers gathers comprehensive information on rare, threatened, and endangered species and significant plant communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists. Information management staff carefully plot the data on 1:24,000 scale U.S.G.S. maps and enter it into the Biological and Conservation Data System. The Element Occurrence database can be accessed from a variety of angles, including taxonomic group, global and state rarity rank, federal and state legal status, source, observation date, county, quadrangle map, watershed, management area, township, range, and section, precision, and conservation unit.

CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System (BCD) developed by The Nature Conservancy. CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources and the Colorado Division of Wildlife, the U.S. Environmental Protection Agency, 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 element of natural diversity enables us to evaluate the significance of each location to the conservation of natural biological diversity in Colorado and in the nation. By using species imperilment ranks and quality ratings for each location, priorities can be established for the protection of the most sensitive or imperiled sites. A continually updated locational database and priority-setting system such as that maintained by CNHP provides an effective, proactive land-planning tool.

The Natural Heritage Ranking System

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

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than 5 current locations in Colorado, is ranked G5S1. The Rocky Mountain Columbine which is known only from Colorado, from about 30 locations, is ranked a G3S3. Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1S1. CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to vulnerable (S1 - S3). Those with a ranking of S3S4 are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 2.

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.

Table 2. Definition of Colorado Natural Heritage Imperilment Ranks.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted, respectively, with an "S" or a

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences).
G/S4	Apparently secure globally/state, though it might be quite rare in parts of its range, especially at the periphery.
G/S5	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GX	Presumed extinct.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but not verified for an extended period, usually.
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.

Legal Designations

Natural Heritage imperilment ranks are not legal designations and should not be interpreted as such. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as "Sensitive," as does the Bureau of Land Management. Table 3 defines the special status assigned by these agencies and provides a key to the abbreviations used by CNHP.

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

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

Table 3. 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	Proposed Endangered or Threatened; species or subspecies formally proposed for listing as endangered or threatened.
C	Candidate: species or subspecies for which the 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:
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.
State Status:	
1. Colorado Division of Wildlife	
E	Endangered
T	Threatened
SC	Special Concern

Element Occurrence Ranking

Actual locations of elements, whether they be single organisms, populations, or plant communities, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. In order to prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to their ecological quality whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on 4 factors:

Quality -- the representativeness of the occurrence as compared to element occurrence (EO) specifications including maturity, size, and numbers. The element occurrence specifications are set by a consensus of experts regarding the element in question;

Condition -- how much has the site and EO been damaged or altered from its optimal condition and character;

Viability -- the long-term prospects for continued existence of this occurrence;

Defensibility -- the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it.

Each of these factors are 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** The occurrence is relatively large, pristine, defensible, and viable.
- B** The occurrence is small but in good condition, or large but removed from its natural condition and/or not viable and defensible.
- C** The occurrence is small, in poor condition, and possibly of questionable viability.
- D** The occurrence does not merit conservation efforts because it is too degraded or not viable.
- H** Historically known, but not verified for an extended period of time.
- I** Introduced

Proposed Conservation Sites

In order to successfully protect populations or occurrences of important biological elements, delineation of conservation sites has proven to be useful tool. These proposed conservation sites focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Proposed

Conservation sites may include a single occurrence of a rare element or a suite of rare element occurrences or significant features.

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, and vegetative cover, as well as current and potential land uses. **The proposed boundary does not automatically exclude all activity.** It is hypothesized that some activities will prove degrading to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the proposed conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Proposed Conservation Site Boundaries

Once the presence of rare or imperiled species or significant plant communities has been confirmed, the first step toward their protection is the delineation of a **preliminary** conservation planning boundary. In general, the proposed conservation site boundary is our best estimate of the primary area supporting the long-term survival of targeted species and plant communities. In developing such boundaries, CNHP staff consider a number of factors that include, but are not limited to:

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

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection

goals for natural heritage resources and sensitive species. Please note that these boundaries are based primarily on our understanding of the ecological systems. A thorough analysis of the human context and potential stresses was not conducted. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape requiring wise land-use planning at all levels.

Off-Site Considerations

Furthermore, it is often the case that all relevant ecological processes cannot be contained within the proposed conservation planning boundary of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every site to include the whole globe. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve county-wide efforts as well as coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Conservation Sites

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

- B1** Outstanding Significance: 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 State-wide Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the time frame in which conservation protection should occur to avoid loss or degradation of the occurrences. 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 protection urgency rank reflects the need to take legal, political, or other administrative measures to alleviate threats related to land ownership or designation. The following codes are used to indicate the rank best describing the urgency to **protect** the area:

- P1** Immediately threatened by severely destructive forces, within 1 year of rank date; protect now or never!
- P2** Threat expected within 5 years.
- P3** Definable threat but not in the next 5 years.
- P4** No threat known for foreseeable future.
- P5** Land protection complete or protective measures not required at the site.

A protection action involves increasing the current level of legal protection accorded one or more tracts of a potential conservation area. It may also include activities such as educational or public relations campaigns or collaborative planning efforts with public or private entities to minimize adverse impacts to element occurrences at a site. It does not include management actions, i.e., any action requiring stewardship intervention. Threats that may require a protection action are as follows:

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

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate the time frame in which a change in management of the element or site should occur in order to avoid loss or degradation of the occurrences. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, weed control). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the proposed conservation area.

A management action may include biological management (prescribed burning, removal of non-natives, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include

legal, political, or administrative measures taken to protect a potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

- M1** Management action required immediately or element occurrences could be lost or irretrievably degraded within one year.
- M2** New management action will be needed within 5 years to prevent the loss of element occurrences.
- M3** New management action will be needed within 5 years to maintain current quality of element occurrences.
- M4** Although 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.

The management and protection ranking criteria are subjective in nature and the application of them are based on on-site observation but not in-depth research.

Methods

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

Collect available information

CNHP databases were updated with information regarding the known locations of species and significant plant communities within Saguache County. A variety of information sources were searched for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, Western State, Rocky Mountain Herbarium, and local private collections. The Colorado Division of Wildlife provided extensive data on the fishes of Saguache County as well as information regarding the status of the boreal toad. Both general and specific literature sources were incorporated into CNHP databases as either locational information or as biological data pertaining to a species in general. Such information covers basic species and community biology including range, habitat, phenology (timing), food sources, and substrates. This information was entered into CNHP databases.

Identify rare or imperiled species and significant plant communities with potential to occur in Saguache County

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

A list of elements includes those elements currently monitored by CNHP that were thought to potentially occur in Saguache County, and were therefore targeted in CNHP field inventories. Over 225 rare species and significant plant communities were targeted in these surveys.

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

Identify targeted inventory areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities. Known locations were targeted, and additional potential areas were chosen using a variety of information sources, such as aerial photography. Precisely known element locations were always included so that they could be verified and updated. Many locations were not precisely known due to ambiguities in the original data, i.e., "headwaters of Cataract Creek." In such cases, survey sites for that element were chosen in likely areas in the general vicinity. Areas with potentially high natural values were chosen using aerial photographs, geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and numerous roadside surveys by our field scientists. Aerial photography is perhaps the most useful tool in this step of the process. High altitude infrared photographs at 1:40,000 scale (NAPP) were used for this project and are well suited for assessing vegetation types and, to some extent, natural conditions on the ground.

Using the biological information stored in the CNHP databases, these information sources were analyzed for sites that have the highest potential for supporting specific elements. General habitat types can be discerned from the aerial photographs, and those chosen for survey sites were those that appeared to be in the most natural condition. In general, this means those sites that are the largest, least fragmented, and relatively free of visible disturbances such as roads, trails, fences, quarries, etc.

The above information was used to delineate over 100 survey areas that were believed to have relatively high probability of harboring natural heritage resources. These areas vary in size from less than 10 to several thousand acres and include all major habitat types in the study area.

Roadside surveys were useful in further resolving the natural condition of these areas. The condition of grasslands is especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such features as weed infestation or overgrazing. Similar information was attained by flying low over the study area in a small aircraft.

Because of the overwhelming number of potential sites and limited resources, surveys for all elements were prioritized by the degree of imperilment. For example, all species with Natural Heritage ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented as they were encountered.

Contact Landowner

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

Conduct Field Surveys

Survey sites where access could be attained 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.

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 would attempt to cover the area as thoroughly as possible in the given time. 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

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, hydrological, function, and value data

Fishes: electroshocking, seining, barbless fly fishing, observation

When necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant natural community was discovered its precise location and known extent was recorded on 1:24,000 scale topographic maps. Other data recorded at each occurrence included numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the quality (size, vigor, etc.) of the population or community, the condition or naturalness of the habitat, the long-term viability of the population or community, and the defensibility (ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the section on Natural Heritage Methodology for more about element occurrence ranking.

Delineate Proposed Conservation Site Boundaries

Finally, since the objective for this inventory is to prioritize specific areas for conservation efforts, proposed conservation planning boundaries were delineated. Such a boundary is an estimation of the minimum area needed to assure persistence of the element. Primarily, in order to insure the preservation of an element, the ecological processes that support that occurrence must be preserved. The preliminary conservation planning boundary is meant to include features on the surrounding landscape that provide these functions. Data collected in the field are essential to delineating such a boundary, but other sources of information such as aerial photography are also used. These boundaries are considered preliminary and additional information about the site or the element may call for alterations of the boundaries.

Results

Elements of biodiversity significance

At the beginning of the field season, the CNHP database contained 23 proposed conservation sites and 97 element occurrence records for the Closed Basin portion of Saguache County, of which 45% had not been visited for at least 15 years. At the end of our study we had 310 element occurrence records representing new and updated records.

Our study combined with previous inventories of Saguache County reports a large number of biologically significant elements found throughout the Closed Basin portion of the County. We found 116 biologically significant elements, including 16 plants, 60 plant communities, 7 mammals, 14 birds, 2 fish, and 17 invertebrates. See Table 4 for the complete list. These elements and their occurrences provide the foundation for a total of 45 proposed conservation sites that follow. All of the data collected are housed and maintained in the Biological and Conservation Data System (BCD) at the Colorado Natural Heritage Program.

Table 4. List Of Known Elements of Concern For Saguache County By Taxonomic Group. Elements with the highest global significance (G1-G3) are in bold type.

Element	Common Name	Global Rank	State Rank	Federal and State Status
Plants				
<i>Astragalus bodinii</i>	Bodin's milkvetch	G4	S2	
<i>Astragalus cerussatus</i>	milkvetch	G2	S2	
<i>Cleome multicaulis</i>	slender spiderflower	G2	S2	(C2)
<i>Cryptantha cinerea pustulosa</i>	Jame's catseye	G5T?	S1	
<i>Cryptantha weberi</i>	Weber's catseye	G2	S2	(3C)
<i>Draba fladnizensis</i>	arctic draba	G4	S2S3	
<i>Draba grayana</i>	Gray's peak whitlow-grass	G2	S2	
<i>Draba smithii</i>	Smith whitlow-grass	G2	S2	(C2), FS
<i>Epipactis gigantea</i>	helleborine	G4	S2	FS
<i>Eriophorum altaicum var neogaeum</i>	Altai cottongrass	G4T?	S2	
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS
<i>Platanthera sparsiflora var ensifolia</i>	canyon bog-orchid	G4G5T3	S2	
<i>Sisyrinchium demissum</i>	blue-eyed grass	G5	S2	
<i>Sisyrinchium pallidum</i>	pale blue-eyed grass	G3	S2	(C2)
<i>Stellaria irrigua</i>	Altai chickweed	G4?	S2	(3C)
<i>Woodsia neomexicana</i>	New Mexican cliff fern	G4?	S2	
Plant Communities				
<i>Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum</i>	montane riparian forest	G1	S1	
<i>Abies lasiocarpa-Picea</i>	montane riparian forest	G4	S4	

Element	Common Name	Global Rank	State Rank	Federal and State Status
<i>engelmannii/Salix drummondiana</i>				
<i>Alnus incana</i> -mixed willow	thinleaf alder-mixed willow riparian shrubland	G3G4	S3S4	
<i>Alnus incana</i> /mesic forb	thinleaf alder/mesic forb riparian shrubland	G3	S3	
<i>Alnus incana</i> /mesic graminoid	montane riparian shrubland	G2G3	S3	
<i>Atriplex canescens/Bouteloua gracilis</i>	shortgrass prairie	G3	S3	
<i>Betula occidentalis</i> /mesic forb	foothills riparian shrubland	G2G3	S2	
<i>Calamagrostis stricta</i>	slimstem reedgrass	GU	S1?Q	
<i>Cardamine cordifolia-Caltha leptosepala</i> alpine wetland	alpine wetland	G4	S4	
<i>Carex aquatilis</i> wetland	montane wet meadow	G5	S3S4	
<i>Carex lanuginosa</i> montane wetland	montane wet meadow	G4	S3	
<i>Carex lasiocarpa</i> montane wetland	montane wetland	G4	S1	
<i>Carex simulata</i>	wet meadow	G3	S3	
<i>Carex utriculata</i>	beaked sedge montane wet meadow	G5	S3	
<i>Catabrosa aquatica-Mimulus glabratus</i>	spring wetland	GU	S3	
<i>Krascheninnikovia lanata/Bouteloua gracilis</i>	winterfat grassland	G4	S1?	
<i>Cercocarpus montanus/Muhlenbergia montana</i>	mixed mountain shrubland	GU	S2	
<i>Eleocharis palustris</i>	spikerush wetland	G5	S3S4	
<i>Festuca arizonica-Muhlenbergia montana</i>	montane grassland	G3	S3?	
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2	
<i>Oryzopsis hymenoides-Psoraleidum lanceolatum</i>	sand dune swale	G4	S1?	
<i>Pinus aristata/Festuca arizonica</i>	montane woodland	G4	S3	
<i>Pinus aristata/Festuca thurberi</i>	lower montane woodland	G3	S2	
<i>Pinus edulis-Stipa scribneri</i>	foothills pinyon-juniper woodland	G3	S1?	
<i>Pinus edulis/Stipa comata</i>	xeric western slope pinyon-juniper woodland	G2	S2	
<i>Pinus ponderosa/Festuca arizonica</i>	lower montane forest	G4G5	S4	
<i>Populus angustifolia-Juniperus scopulorum</i>	montane riparian forest	G2	S2	
<i>Populus angustifolia/Alnus</i>	montane riparian forest	G3	S3	

Element	Common Name	Global Rank	State Rank	Federal and State Status
<i>incana</i>				
<i>Populus angustifolia/Betula occidentalis</i>	montane riparian forest	G3	S1	
<i>Populus angustifolia/Salix drummondiana-Acer glabrum</i>	montane riparian forest	G1	S1	
<i>Populus angustifolia/Salix lucida</i> var. <i>caudata</i>	montane riparian forest	G1	S1	
<i>Populus angustifolia/sand dunes</i>	sand dune riparian forest	G1	S1	
<i>Populus tremuloides/Acer glabrum</i>	montane riparian forest	G2	S1S2	
<i>Populus tremuloides/Alnus incana</i>	montane riparian forest	GU	S3	
<i>Populus tremuloides/Betula occidentalis</i>	montane riparian forest	G1	S1	
<i>Populus tremuloides/Cornus sericea</i>	montane riparian woodland	G3	S2S3	
<i>Populus tremuloides/tall forb</i>	montane aspen forest	G5	S5	
<i>Pseudotsuga menziesii/Acer glabrum</i>	mixed deciduous-evergreen forest	G?	S?	
<i>Pseudotsuga menziesii/Betula occidentalis</i>	montane riparian forest	G4	S3	
<i>Quercus gambelii-Symphoricarpos oreophilus</i>	mixed mountain shrubland	GU	S3S4	
<i>Quercus gambelii/Stipa comata</i>	Gambel oak woodland	G2?	S2	
<i>Redfieldia flexuosa</i>	sand dune blowout grassland	G2?	S1	
<i>Salicornia rubra</i>	western slope salt meadow	G2	S1?	
<i>Salix bebbiana</i>	montane willow carr	G3	SU	
<i>Salix brachycarpa/Carex aquatilis-Carex utriculata</i>	subalpine willow carr	GU	S3S4	
<i>Salix brachycarpa/Carex aquatilis-Carex utriculata</i>	subalpine willow carr	GU	S3S4	
<i>Salix drummondiana/mesic forb</i>	montane riparian shrubland	G4	S4	
<i>Salix exigua/barren soil</i>	coyote willow/bare soil	G5	S5	
<i>Salix geyeriana-Salix monticola/mesic graminoid</i>	montane riparian willow carr	GU	S3	
<i>Salix geyeriana/mesic forb</i>	montane willow carr	G3	SU	
<i>Salix monticola/Calamagrostis canadensis</i>	montane willow carr	G3	S3	
<i>Salix monticola/mesic graminoid</i>	montane riparian willow carr	GU	S3	
<i>Salix planifolia/Calamagrostis canadensis</i>	subalpine willow carr	G4	S4	
<i>Salix planifolia/Caltha</i>	subalpine willow carr	G4	S4	

Element	Common Name	Global Rank	State Rank	Federal and State Status
<i>leptosepala</i>				
<i>Salix planifolia/Deschampsia cespitosa</i>	montane willow carr	G2G3	S3	
<i>Sarcobatus vermiculatus/Distichlis spicata</i>	Saline bottomland shrubland	G3	S1	
<i>Scirpus maritimus</i> wetland	emergent wetland (marsh)	G4	S?	
<i>Scirpus pungens</i>	bulrush	G?	S?	
<i>Sporobolus airoides</i>	great plains salt meadow	G2?	SU	
<i>Stipa comata-Oryzopsis hymenoides</i>	sand grassland	G?	S1	
Mammals				
<i>Centrocercus minimus gunnisonii</i>	Gunnison sage grouse	G1	S1	
<i>Corynorhinus townsendii pallescens</i>	pale lump-nosed bat	G4T4	S2	
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3	
<i>Perognathus flavescens relictus</i>	plains pocket mouse subsp.	G5T2	S2	
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3	
<i>Spermophilus tridecemlineatus blanca</i>	thirteen-lined ground squirrel subsp.	G5T3	S3	
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	G5	S1	
Birds				
<i>Amphispiza belli</i>	sage sparrow	G5	S3B,SZN	
<i>Asio flammeus</i>	short-eared owl	G5	S2B,SZN	(C2)
<i>Athene cunicularia</i>	burrowing owl	G4	S3S4B	
<i>Buteo regalis</i>	ferruginous hawk	G4	S3B,S4N	(C2), SC, FS
<i>Charadrius montanus</i>	mountain plover	G2	S2B,SZN	C, SC, FS
<i>Circus cyaneus</i>	northern harrier	G5	S3B, SZ	
<i>Cistothorus palustris</i>	marsh wren	G5	S3B,SZN	
<i>Egretta thula</i>	snowy egret	G5	S2B,SZN	
<i>Falco peregrinus anatum</i>	American peregrine falcon	G4T4	S2B,SZN	LE, T
<i>Numenius americanus</i>	long-billed curlew	G5	S2B,SZN	(3C), SC, FS
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN	
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS
<i>Podiceps nigricollis</i>	eared grebe	G5	S3B,SZN	
<i>Sterna forsteri</i>	Forster's tern	G5	S2B,S4N	
Fish				
<i>Gila pandora</i>	Rio Grande chub	G3	S1?	SC

Element	Common Name	Global Rank	State Rank	Federal and State Status
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS
Invertebrates				
<i>Aeshna constricta</i>	lance-tailed darner	G5	S1?	
<i>Amblyscirtes simius</i>	Simius roadside skipper	G4	S3	
<i>Amblyderus n.sp.1</i>	anthicid beetle	G1?	S1?	
<i>Amblyderus n.sp.2</i>	anthicid beetle	G1?	S1?	
<i>Cicindela theatina</i>	Great Sand Dunes tiger beetle	G1	S1	
<i>Daihinbaenetes giganteus</i>	giant sand treader cricket	G3?	S1	
<i>Eleodes hirtipennis</i>	circus beetle	G1	S1	
<i>Libellula nodisticta</i>	hoary skimmer	G5	S1	
<i>Ochlodes snowi</i>	Snow's skipper	G4	S3	
<i>Oeneis alberta</i>	Alberta arctic	G5	S3	
<i>Physa cupreonitens</i>	hot springs physa	G2?	S2	
<i>Polites sabuleti ministigma</i>	San Luis sandhill skipper	G5T3	S5	
<i>Prochoerodes n.sp.</i>	geometrid moth	G2?	S1?	
<i>Proctacanthus n.sp. 1</i>	robber fly	G1?	S1?	
<i>Proctacanthus n.sp. 2</i>	robber fly	G1?	S1?	
<i>Promenetus umbilicatellus</i>	umbilicate sprite	G?	S3	
<i>Yvretta rhesus</i>	Rhesus skipper	G4	S2S3	

In the San Juan Mountain foothills, we discovered the first Colorado location of the Wyoming ground squirrel (*Spermophilus elegans*), significantly extending its known range. We also found Colorado's fourth known breeding colony of Townsend's big-eared bat (*Plecotus townsendii*) in an abandoned mine shaft on private land. We located several new populations of slender spiderflower (*Cleome multicaulis*), and a new population of Smith's whitlow-grass (*Draba smithii*), bringing the total number of known locations for this species to eight.

While conducting wetland inventories, we discovered a new county location for the plains spadefoot toad (*Spea bomifrons*), and a new population of the Rio Grande chub (*Gila pandora*), a declining fish that is a concern of regulatory agencies. But despite our efforts, we were unable to find any location for the northern leopard frog (*Rana pipiens*). This frog, reported to be abundant in the San Luis Valley during the 1970's, has been declining over much of its range and will continue to be a concern of CNHP.

In addition to finding rare elements of concern, we discovered that several mammals we once thought were rare are more common and, therefore, have been taken off of CNHP's list. These mammals include the Ord's kangaroo rat subspecies (*Dipodomys ordii montanus*), northern pocket gopher (*Thomomys talpoides macrotis*) and least chipmunk subspecies (*Tamias minimus caryi*).

Sites of biodiversity significance

In order to protect Saguache County's most biologically important areas, we have delineated 45 proposed conservation sites (Figure 2 and Table 5). These sites include all of the elements of concern found in the Closed Basin portion of Saguache County and will serve as an important step in preserving Saguache County's diverse species and plant communities.

Due to the diverse geology within the Closed Basin, we have divided Saguache County into six sub-regions: 1) Sand dunes, 2) Playa Lakes, 3) Middle Sangre de Cristo Mountains, 4) North Sangre de Cristo Mountains-North Valley Floor, 5) Cochetopa Hills, 6) San Juan Mountains-Upper Saguache Creek.

Of the 45 proposed conservation sites, several stand out as extremely significant. Foremost is the Great Sand Dunes. This site has been given the highest biodiversity rank of B1. The unique insects of this ecosystem place it as one of the most important conservation site in Colorado. The playa lakes landscape is also a very important area, with four sites delineated, of which three are very significant: Russell, Mishak, and San Luis Lakes/Sand Creek. The playa lake landscape is important for abundant nesting and migratory birds, plants, and plant communities. Within the playa lake system, the globally rare slender spiderflower (*Cleome multicaulis*) was abundant. Russell Lakes harbors one of the world's largest known populations of this small, delicate, alkaline wetland specialist.

Table 6 lists all of the proposed conservation sites in order of their biological or conservation significance, i.e., a site with a B1 biodiversity rank is the most irreplaceable and in need of permanent protection, while a site with a B5 biodiversity rank is of general significance. Overall, of the 45 proposed conservation sites, we identified one that was ranked as *outstanding* (B1), 13 *very significant* (B2), 17 *significant* (B3), 10 *moderate* (B4) and 4 of *general biodiversity significance* (B5). Figure 3 highlights the highest priority sites (B1 and B2) for Saguache County and the Closed Basin (note the Blanca Wetlands site is in Alamosa County, and is included in this figure since the site is profiled in Volume II of this report). The concentration and quality of imperiled elements and habitats in Saguache County attest to the fact that conservation efforts in the County will have both state and global significance.

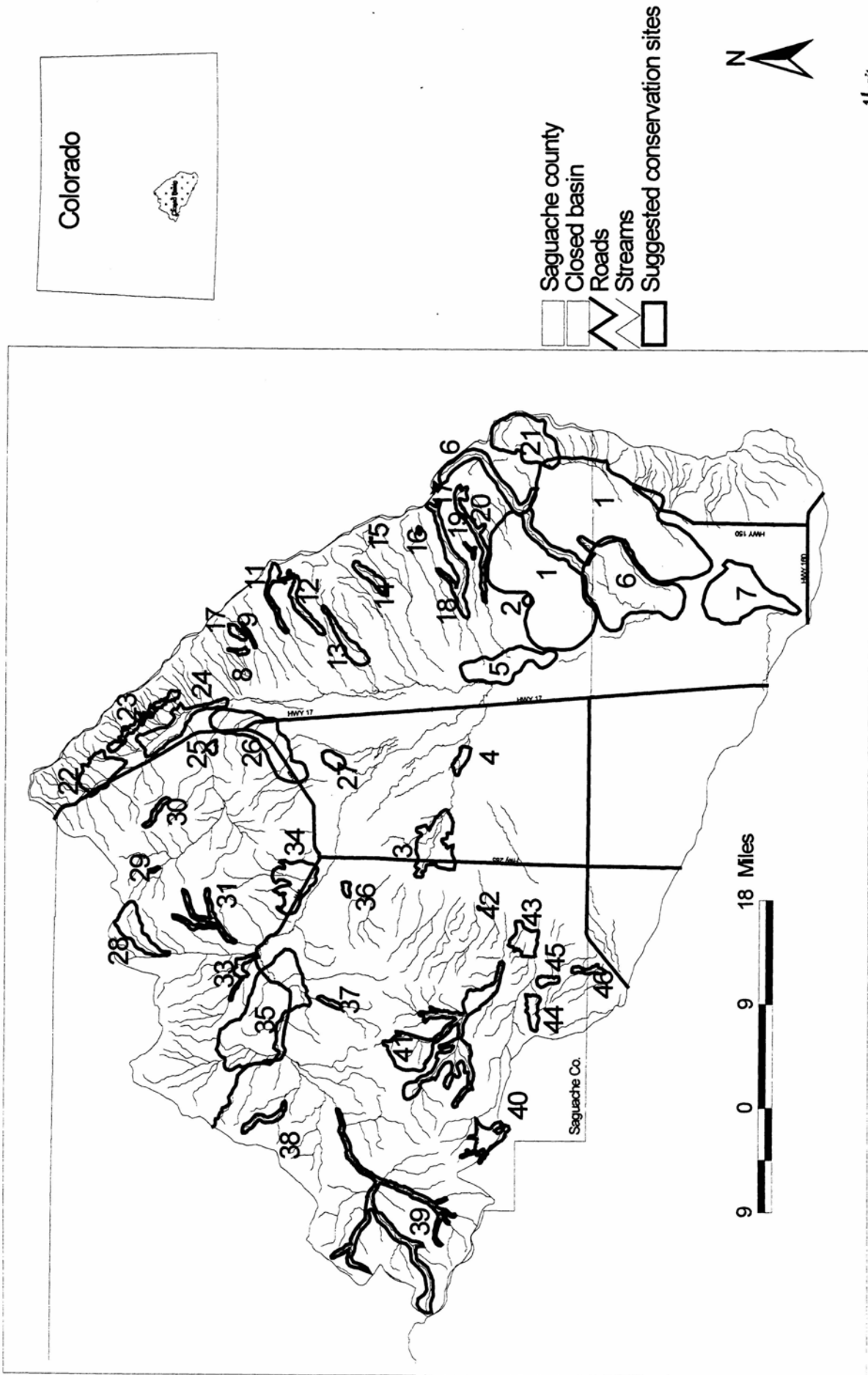


Figure 2. Saguache County, Closed Basin Proposed Conservation Sties. See following table for site names.

Table 5. Saguache County, Closed Basin Proposed Conservation Sites, by identification number listed in Figure 2.

Identification Number from Figure 2	SITENAME	Biodiversity Rank	Sub-Region within this report
1	Great Sand Dunes	B 1	Sand Dunes
2	Antelope Springs	B 2	Sand Dunes
3	Russell Lakes	B 2	Playa Lakes
4	Mishak Lakes	B 2	Playa Lakes
5	Weisman Lakes	B 3	Playa Lakes
6	San Luis Lakes/Sand Creek	B 2	Playa Lakes
8	Valley View Hot Spring	B 2	Middle Sangre's
9	Valley View	B 3	Middle Sangre's
10	Garner Creek	B 4	Middle Sangre's
11	Cotton Creek	B 3	Middle Sangre's
12	Wild Cherry Creek	B 4	Middle Sangre's
13	Rito Alto Bosque	B 3	Middle Sangre's
14	Dimick Gulch	B 3	Middle Sangre's
15	Lake Fork of North Crestone Creek	B 3	Middle Sangre's
16	Head of Spanish Creek	B 2	Middle Sangre's
17	Milwaukee Peak	B 3	Middle Sangre's
18	Cottonwood Creek	B 3	Middle Sangre's
19	Cedar Canyon	B 4	Middle Sangre's
20	Deadman Creek	B 2	Middle Sangre's
21	Upper Medano Creek	B 3	Middle Sangre's
22	Decker Creek	B 2	North Sangre's-N. Valley Floor
23	Sangre's Alluvial Fan	B 3	North Sangre's-N. Valley Floor
24	Villa Grove	B 2	North Sangre's-N. Valley Floor
25	Clayton Cone	B 4	North Sangre's-N. Valley Floor
26	Mineral Hot Springs	B 4	North Sangre's-N. Valley Floor
27	Moffat playas	B 4	North Sangre's-N. Valley Floor
28	East Middle Creek	B 5	Cochetopa Hills
29	Slaughterhouse Creek	B 4	Cochetopa Hills
30	Kelley Creek	B 3	Cochetopa Hills
31	Ford Creek	B 3	Cochetopa Hills
32	Jacks Creek Cemetery	B 3	Cochetopa Hills
33	Jacks Creek Uplands	B 2	Cochetopa Hills
34	Findley Gulch	B 3	Cochetopa Hills
35	Trickle Mountain	B 2	Cochetopa Hills
36	Devils Knob	B 4	Cochetopa Hills
37	Houselog Creek	B 4	Cochetopa Hills
38	Luder Creek	B 4	Cochetopa Hills
39	Saguache Creek	B 3	San Juan Mountains
40	Groundhog Park	B 5	San Juan Mountains
41	Carnero Creek	B 3	San Juan Mountains
42	Cottonwood Creek Hills	B 3	San Juan Mountains
43	La Garita	B 5	San Juan Mountains
44	Eagle Mountain	B 5	San Juan Mountains
45	660 Road Site	B 2	San Juan Mountains
46	Elephant Rocks	B 2	San Juan Mountains



Colorado

-  Saguache county
-  Closed basin
-  Roads
-  Streams
-  Suggested conservation sites

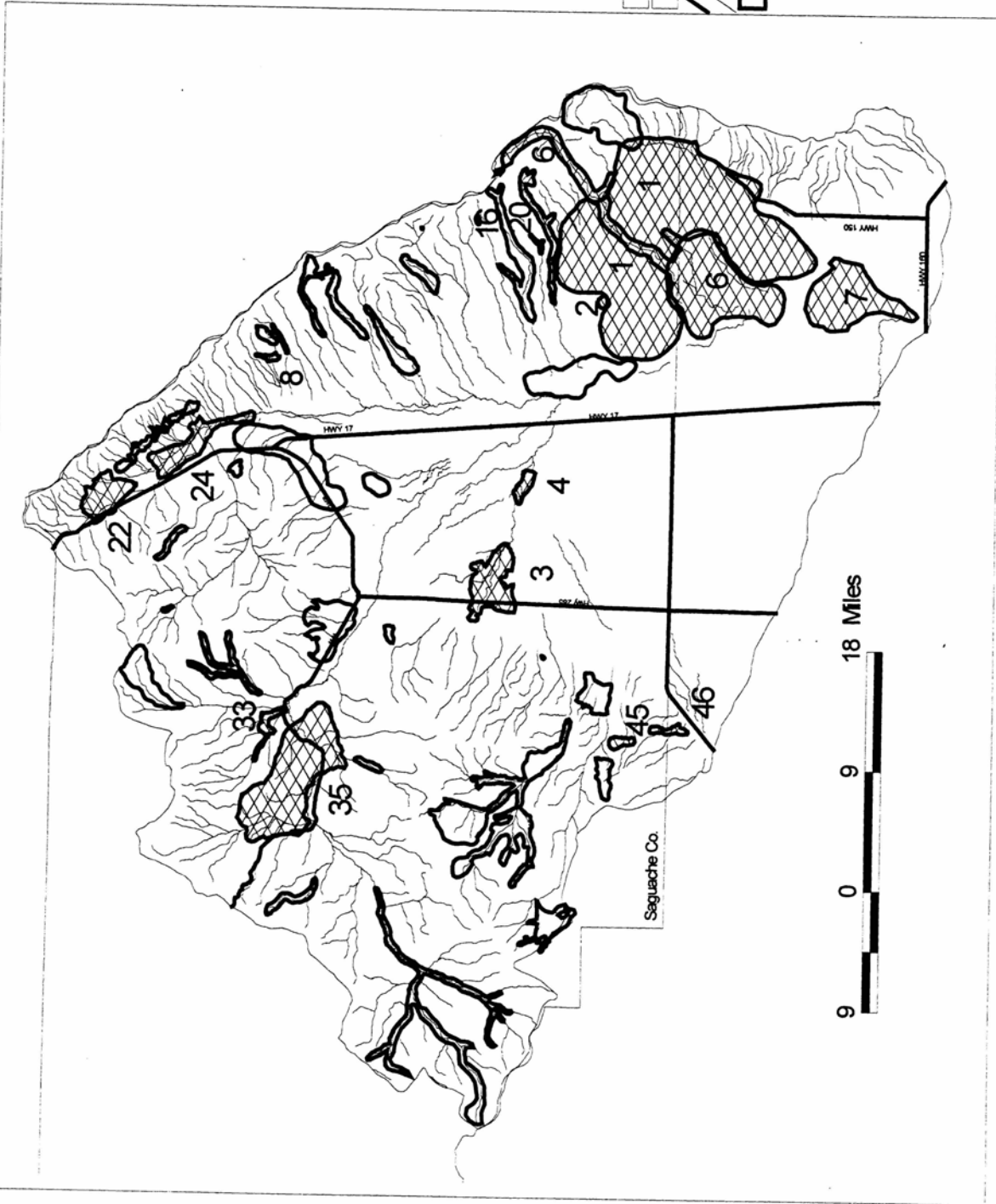


Figure 3. Closed Basin highest priority sites (B1 and B2). See the following table for site names.

Table 6. List of Saguache County Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Sub-Region within this report
Great Sand Dunes	B 1	P3	M4	Sand Dunes
660 Road Site	B 2	P 3	M 4	San Juan Mountains
Antelope Springs	B 2	P 3	M 4	Sand Dunes
Deadman Creek	B 2	P 3	M 3	Middle Sangre's
Decker Creek	B 2	P 4	M 4	North Sangre's-N. Valley Floor
Elephant Rocks	B 2	P 3	M 4	San Juan Mountains
Head of Spanish Creek	B 2	P 2	M 4	Middle Sangre's
Jacks Creek Uplands	B 2	P 2	M 3	Cochetopa Hills
Mishak Lakes	B 2	P 2	M 3	Playas
Russell Lakes	B 2	P 2	M 3	Playa Lakes
San Luis Lakes/Sand Creek	B 2	P 4	M 4	Playa Lakes
Trickle Mountain	B 2	P 4	M 4	Cochetopa Hills
Valley View Hot Spring	B 2	P 3	M 3	Middle Sangre's
Villa Grove	B 2	P 3	M 3	North Sangre's-N. Valley Floor
Carnero Creek	B 3	P 4	M 2	San Juan Mountains
Cotton Creek	B 3	P 4	M 3	Middle Sangre's
Cottonwood Creek	B 3	P 3	M 3	Middle Sangre's
Cottonwood Creek Hills	B 3	P 4	M 4	San Juan Mountains
Dimick Gulch	B 3	P 4	M 5	Middle Sangre's
Findley Gulch	B 3	P 4	M 4	Cochetopa Hills
Ford Creek	B 3	P 3	M 3	Cochetopa Hills
Jacks Creek Cemetery	B 3	P 3	M 4	Cochetopa Hills
Kelley Creek	B 3	P 4	M 4	Cochetopa Hills
Lake Fork of North Crestone Creek	B 3	P 4	M 4	Middle Sangre's
Milwaukee Peak	B 3	P 4	M 4	Middle Sangre's
Rito Alto Bosque	B 3	P 3	M 3	Middle Sangre's
Saguache Creek	B 3	P 4	M 3	San Juan Mountains
Sangre's Alluvial Fan	B 3	P 4	M 4	North Sangre's-N. Valley Floor
Upper Medano Creek	B 3	P 4	M 4	Middle Sangre's
Valley View	B 3	P 5	M 5	Middle Sangre's
Weisman Lakes	B 3	P 2	M 4	Playa Lakes
Cedar Canyon	B 4	P 3	M 3	Middle Sangre's
Clayton Cone	B 4	P 4	M 4	North Sangre's-N. Valley Floor
Devils Knob	B 4	P 4	M 4	Cochetopa Hills
Garner Creek	B 4	P 3	M 3	Middle Sangre's
Houselog Creek	B 4	P 4	M 4	Cochetopa Hills
Luder Creek	B 4	P 4	M 3	Cochetopa Hills
Mineral Hot Springs	B 4	P 4	M 4	North Sangre's-N. Valley Floor
Moffat playas	B 4	P 2	M 2	North Sangre's-N. Valley Floor
Slaughterhouse Creek	B 4	P 4	M 5	Cochetopa Hills
Wild Cherry Creek	B 4	P 4	M 4	Middle Sangre's
Eagle Mountain	B 5	P 4	M 3	San Juan Mountains
East Middle Creek	B 5	P 4	M 4	Cochetopa Hills
Groundhog Park	B 5	P 4	M 3	San Juan Mountains
La Garita	B 5	P 4	M 4	San Juan Mountains

Site Profile Explanation

Each preliminary site is described in a standard site report which reflects data fields in CNHP's Biological and Conservation Data System (BCD), used to track rare and imperiled elements. The sections of this report and the contents are outlined and explained below.

Biodiversity Rank (B-rank): The overall significance of the site in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see page 28 for the definitions of the ranks.

Protection Urgency Rank (P-rank): An estimate of the time frame in which conservation protection must occur. This rank generally refers to the need for a major change of protective status (e.g., ownership or designation as a natural area). Please see page 19 for the definitions of the ranks. Also included is a summary of major land ownership issues that may affect the site and the element(s) in the site.

Management Urgency Rank (M-rank): An estimate of the time frame in which conservation management must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (legal, political, or administrative measures). See page 28 for the definitions of the ranks. Also included is a summary of site management issues that may affect the long-term viability of the site.

Location: General location and specific road/trail directions.

Legal Description: U.S.G.S. 7.5 minute Quadrangle name and Township Range Section(s).

General Description: A brief narrative picture of the topography, vegetation, and current use of the proposed conservation site. Common names are used along with the scientific names. The approximate hectares (acres) included within the proposed conservation site boundary for the site is reported.

Biodiversity Rank Justification: A synopsis of the rare species and significant plant communities that occur on the conservation site. A table within the site profile lists each element occurrence found in the site, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. The species or community that is the primary element of concern is bolded within the table. See Table 2 for explanations of ranks and Table 3 for legal designations.

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

Sand Dune Sub-Region



The Sand Dune Sub-region lies in the southeast corner of Saguache County and includes part of Alamosa County. It contains two proposed conservation sites, Great Sand Dunes and Antelope Springs (Figure 4) Of these two sites, the Great Sand Dunes is of national and international significance.

“Hotspots” are areas of concentrated conservation value. They include centers of endemism and regions of high native species richness for various taxa. Within regions, hotspots include concentrated occurrences of rare species, habitats of unusually high quality for target species, watersheds of high value for fisheries, and other critical areas (Noss et al. 1997). One important conservation goal is to represent all endemic species in protected areas, with highest priority given to centers of endemism for each taxonomic group, where the occurrences of many endemic species overlap. **By definition, areas with concentrated occurrences of endemic species are irreplaceable.** Due to the unique insect fauna, the proposed Great Sand Dunes site is one of Colorado’s biological “hotspots”. The importance of this site is outlined in more detail in the following section.

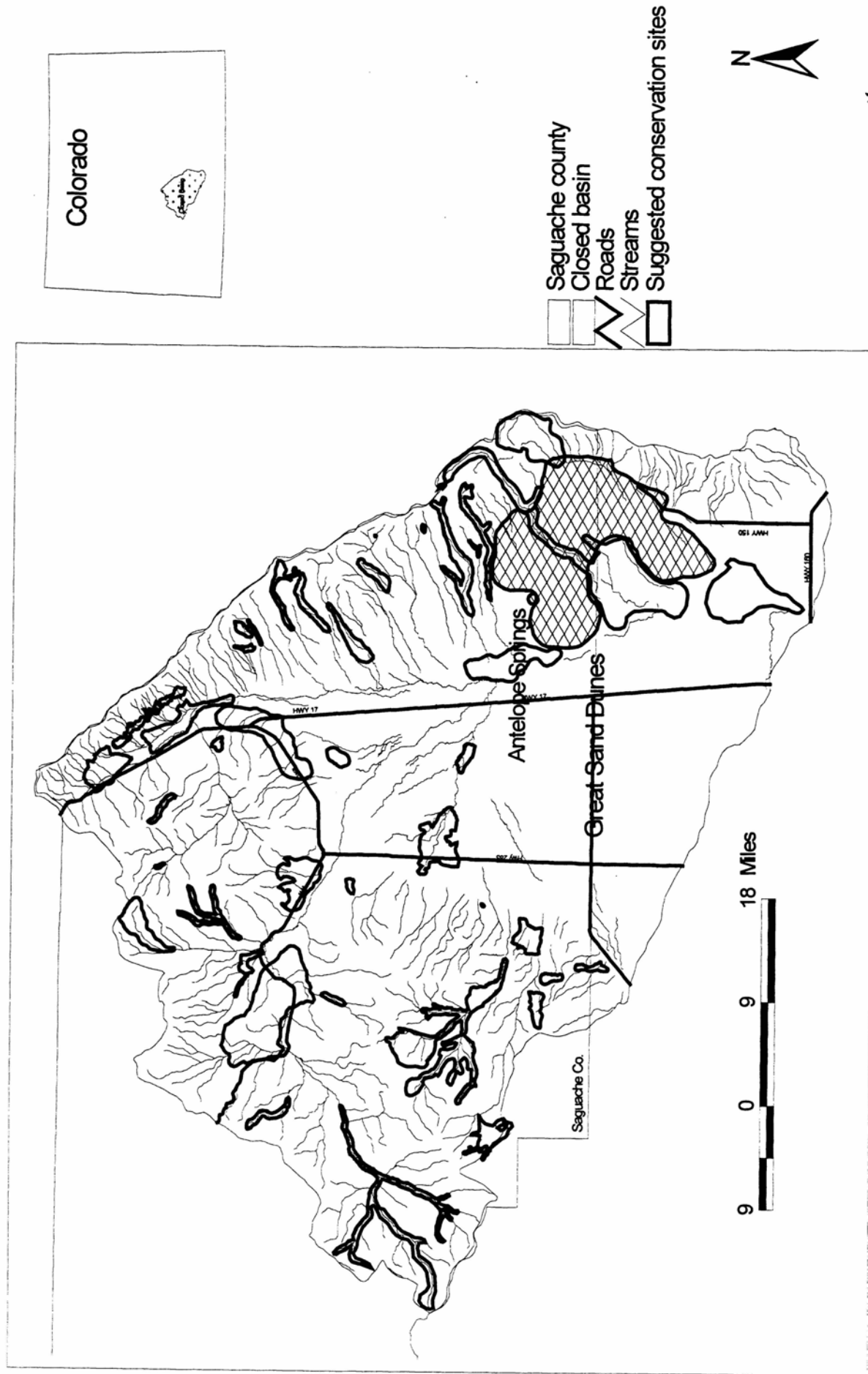


Figure 4. Sand Dune sub-region proposed conservation sites.

Great Sand Dunes

Biodiversity Rank: B1 (Outstanding significance)

The Great Sand Dunes ecosystem is the most outstanding site documented during the 1997 Saguache County inventory, and is one of Colorado's most significant. The unusual and harsh conditions are home for four rare insects whose entire global range is limited to 103,000 acres (i.e., endemic species). Although approximately 900 insect species are documented, experts estimate some 2,000 species when an inventory is complete. A total of 13 rare insects, seven plant communities, two plants, and two mammals make this site a "biological hotspot".

Protection Urgency Rank: P3

Twenty five percent of this site has formal protection within the Great Sand Dunes National Monument. The other 75% is private and state land (see Appendix A for ownership map). The state lands, 50% of the site, are on the south and western portion and mostly under lease by the Zapata Ranch. The private lands (25%) on the north are part of the Luis Maria Baca Ranch. The comparatively simple land ownership of this site makes it possible to develop a conservation plan that would preserve an entire ecosystem. Several tools exist, e.g., conservation easements, habitat conservation plans, nomination of the state land board lands for Stewardship Trust designation, direct acquisition, and cooperative management plans. The development of a conservation plan at this stage may prevent the federal listing of the endemic species of insects.

Management Urgency Rank: M4

Due to the high quality condition of most element occurrences at this site, current management of both the private and public portions of this site appear adequate. To further understand viability needs of the insects and their associated plant communities, future research might address livestock-insect interactions, insect-plant interdependency, impacts of recreation on insects, groundwater-interdunal wetland relationships, effects of grazing and fire on grass and shrublands, and a more thorough inventory of the insect fauna.

Location: The Great Sand Dunes site straddles the border of Alamosa and Saguache counties in the southeast portion of the Closed Basin. Figure 4.

U.S.G.S. 7.5 minute quadrangles: Deadman Camp, Dry Lakes, Crestone, Liberty, Medano Ranch, Sand Camp, Zapata Ranch

Legal Description: T25S R72W Sections 16-22, 27-34

T25S R73W Sections 20-36

T26S R72W Sections 4-8

T26S R73W Sections 1-35

T27S R73W Sections 2-10, 15-21, 29-31

T40N R12E Sections 1-4, 11-14, 23-26, 35;

T40N R13E Sections 6,7,18,19,30,31;

T41N R12E Sections 1, 2, 10-16, 21-36;

T41N R13E Sections 7, 18, 19, 31, 31

T2S R80W Sections 1, 12

General Description: The Great Sand Dunes site lies at the base of the Sangre de Cristo mountain range which towers some 7,000 feet above the dunes. The site is approximately 103,640 acres ranging in elevation from 7,500 to 9,200 feet (2,290-2,800 meters). This site straddles the Saguache and Alamosa county line on the eastern side of the San Luis Valley. It includes massive and nearly barren sand dunes, grass and shrublands, interdunal wetlands, and two sand bottomed rivers.

Sand and Medano Creeks cut through the dunes and form braided and shifting stream beds. Sand Creek slices through the dunes from the northeast to southwest corner, while Medano Creek borders the eastern edge. Sand Creek supports a newly described riparian vegetation type of narrowleaf cottonwood (*Populus angustifolia*) and shifting sand.

The main sand dune vegetation is characterized by sand dune blowout grass (*Redfieldia flexuosa*) on shifting sands, and indian rice grass (*Oryzopsis hymenoides*) with scurf pea (*Psoralidium lanceolatum*) on the more stabilized dunes. Scurf pea forms ubiquitous stands in some of the low and wetter areas. The unique insect fauna, including the great sand dunes tiger beetle (*Cicindela theatina*), circus beetle *Eleodes hirtipennis*), robber fly (*Proctacanthus* sp), and giant sand treater cricket (*Daihinibaenetes giganteus*), are found primarily in this habitat.

Interdunal and isolated wetlands in the western portion provide important habitat for unusual plant communities and rare plants. Numerous wetland plant associations can be found. The most commonly encountered are: bulrush (*Scirpus pungens*), coyote willow (*Salix exigua*), and Baltic rush (*Juncus balticus*). Several of these wetlands have small populations of the globally rare slender spiderflower (*Cleome multicaulis*).

An older, more stabilized sand dunes at the outer edges of the main dune mass provides habitat for expansive grass and shrublands. To the north approximately 10,000 acres are dominated by needle and thread grass and indian rice grass (*Stipa comata-Oryzopsis hymenoides*). The south and western edges are characterized by shrublands dominated by rabbitbrush (*Chrysothamnus nauseosus*) with needle and thread grass or indian rice grass. Both the grass and shrublands contain isolated sand dunes which harbor many endemic insects. This system is also important habitat for the endemic mammals of the San Luis Valley, especially the Ord's kangaroo rat (*Dipodomys ordii montanus*) and the silky pocket mouse (*Perognathus flavescens sanluisi*).

Major land uses at the site include recreation on the National Monument and bison and cattle ranching on the adjacent private, state, and federal lands. Recreation includes hiking, camping, sandboarding, skiing on the dunes, and wading in Medano Creek.

Biodiversity Rank Justification: The Great Sand Dunes site is a biological "hotspot". This harsh and isolated environment provides habitat for a tiger beetle, two anthicid beetles, a circus beetle, and a robber fly that have not been found outside of the Great Sand Dunes ecosystem to date (see table below for a complete list). Of these, the anthicid beetles and

robber fly have yet to be scientifically described. Experts estimate that some 2000 insect species may exist in this area. Presently of these 2000, only 900 have been documented. The 10,000 acre occurrence of the sand dune grassland is the largest recorded occurrence for this grassland in the state of Colorado, and may be the largest in the world.

Natural Heritage element occurrences at the Great Sand Dunes site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Alnus incana-Salix lucida</i> var. <i>caudata</i>	thinleaf alder-mixed willow riparian shrubland	G3G4	S3S4		A 7/23/97
<i>Oryzopsis hymenoides-Psoraleidium lanceolatum</i>	sand dune swale	G4	S1?		A 6/11/97
<i>Populus angustifolia/Alnus incana</i>	montane riparian forest	G3	S3		B 7/24/97
<i>Redfieldia flexuosa</i>	sand dune blowout grassland	G2?	S1		A 6/11/97
<i>Salix exigua</i> /barren soil	coyote willow/bare soil	G5	S5		A 7/8/97
<i>Scirpus pungens</i>	bulrush	G?	S?		A 6/11/97
<i>Stipa comata-Oryzopsis hymenoides</i>	sand grassland	G?	S1		B 6/27/97
Insects					
<i>Aeshna constricta</i>	lance-tailed darner	G5	S1?		unranked no date
<i>Cicindela theatina</i>	great sand dunes tiger beetle	G1	S1		A 6/29/97
<i>Cicindela theatina</i>	great sand dunes tiger beetle	G1	S1		A 6/29/97
<i>Cicindela theatina</i>	great sand dunes tiger beetle	G1	S1		A 6/12/97
<i>Cicindela theatina</i>	great sand dunes tiger beetle	G1	S1		A 6/29/97
<i>Daihinibaenetes giganteus</i>	giant sand treader cricket	G?	S1		A 6/12/97
<i>Daihinibaenetes giganteus</i>	giant sand treader cricket	G?	S1		A 6/29/97
<i>Daihinibaenetes giganteus</i>	giant sand treader cricket	G?	S1		A 6/12/97
<i>Eleodes hirtipennis</i>	circus beetle	G1	S1		unranked 7/13/94
<i>Aeshna constricta</i>	lance-tailed darner	G5	S1?		
<i>Ammopsen masonii</i>	sphecid wasp	G2?	S1?		A 7/27/97
<i>Exetastes flavus</i>	ichneumonid wasp	G3?	S1?		A 7/12/97
<i>Curtonotum helvum</i>	curtonotid fly	G5?	S1?		1990, 1983, 1976, 1974
<i>Amblyderus n.sp.1</i>	anthicid beetle	G1?	S1?		
<i>Amblyderus n.sp.2</i>	anthicid beetle	G1?	S1?		
<i>Proctacanthus n.sp.</i>	robber fly	G1?	S1?		unranked 7/27/97
<i>Proctacanthus n.sp.</i>	robber fly	G1?	S1?		unranked 8/7/90
<i>Prochoerodes n.sp.</i>	geometrid moth	G2?	S1?		unranked 8/7/91
Plants					
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	C 6/10/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	C- 7/7/86

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	unranked 9/15/88
<i>Cryptantha cinerea</i> ssp. <i>pustulosa</i>	Jame's catseye	G5T?	S1		A 8/10/97
Vertebrates					
<i>Oncorhynchus clarki</i> <i>virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 7/13/88
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		A 6/27/97
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		unranked no date

*EO = element occurrence; date indicates the date of last observation

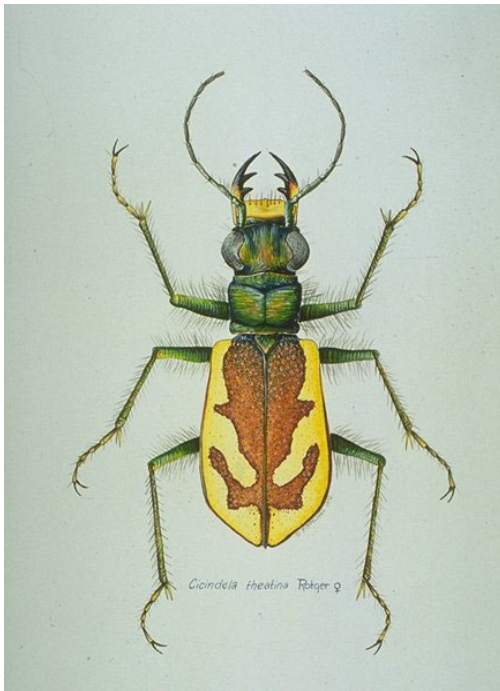
Boundary Justification: The boundaries encompass the furthest reaches of open sand dune habitat as well as the sparsely vegetated edges and the associated grass and shrublands with isolated dunes. Both Medano and Sand Creeks are included because of their important role in the maintenance of the sand dune landform.

Further Protection Comments: The natural hydrology of the San Luis Valley has been altered for nearly a century, and such hydrological perturbations may be responsible for the loss of the interdunal wetlands reported by the National Park Service (Fred Bunch, pers. comm.). Groundwater pumping is proposed for the Baca Ranch, which could further affect the hydrology of the area. Addressing nearby water development as part of a protection package is essential for this site.

Further Management Comments: The effect of recreation and grazing on the insect fauna is of interest. As recreation activities and plans at the Great Sand Dunes National Monument change, insect/recreation interaction should be considered in order to insure protection of the insect fauna. The critical roles of fire and grazing in the maintenance of grasslands are globally recognized (Milchunas & Lavenforth 1993). Models developed to help understand the intricacies of these and other ecological processes supporting this unique habitat would be useful tools for future management decisions.



Sand dunes south of National Monument



Sand dunes tiger beetle



Giant sand treader cricket photo by W. Crenshaw

Antelope Springs

Biodiversity Rank: B2 (Very high significance)

The Antelope Springs site contains a good example of the globally rare slender spiderflower and a Great Plains salt meadow wetland.

Protection Urgency Rank: P2

The site is in the center of a large, working, privately owned cattle ranch. The current and primary stress is water diversion from the springs into ditches. The primary use of the water is for irrigated hay meadows in the lower part of the Deadman Creek drainage. A conservation easement or other forms of protection might be considered to prevent development or other negative impacts to this wetland.

Management Urgency Rank: M3

The hydrology of this site is important to the ecological processes which support the wetland communities. Consideration of the biological effects of current water diversions on the elements of concern would help to develop a well-rounded management plan.

Location: Part of the Luis Maria Baca Ranch approximately 12 miles south-southwest of Alpine Camp

U.S.G.S. 7.5 minute quadrangle: Sand Camp

Legal Description: T41N R11E; not surveyed to sections

General Description: The Antelope Springs site is located near the middle of the Luis Maria Baca No. 4 Ranch, approximately 12 miles south-southwest of Crestone (see Figure 4 and Appendix A). This desert spring creates a seasonal wetland in an alkaline area at the edge of stabilized dunes. A large part of the wetland is dominated by alkali sacaton grass (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*), while the edges, and smaller disjunct meadows, are dominated by Baltic rush (*Juncus balticus*). Within the saltgrass meadow we found the San Luis sandhills skipper (*Polites sublet ministigma*), a rare butterfly subspecies endemic to the San Luis Valley. This skipper requires the saltgrass for its larval stage of development (Scott 1986).

The uplands in the site are shrublands dominated by either rabbitbrush (*Chrysothamnus nauseosus*) with Baltic rush (*Juncus balticus*) or greasewood (*Sarcobatus vermiculatus*) with salt meadow grass (*Distichlis spicata*). The rare slender spiderflower (*Cleome multicaulis*) is found with the Baltic rush at the edge of the wetlands and in the adjacent shrublands. We found this plant to be most prolific where the northern pocket gopher (*Thomomys talpoides macrotis*) has burrowed and created bare ground patches. In approximately 2 acres, thousands of individual plants were found in association with the gopher disturbances.

These pocket gopher holes also create necessary habitat for the burrowing owls (*Athene cumcularia*) found at this site. Another significant owl, the short-eared owl (*Asio flammeus*) was seen hunting at this site in late June. It is very likely that the owl nests in the nearby Weisman Lakes area.

Livestock grazing is the primary use of this site. A two track road bisects the Antelope Springs wetland area, and ditches divert water for livestock and downstream hay meadows. This site is adjacent to the Great Sand Dunes, a site that harbors a diverse and significant insect fauna. The Antelope Springs site may provide an important water source for these insects, although we currently do not understand the needs of the Great Sand Dunes insect fauna.

The site is a total of 320 acres and is at approximately 7,600 feet (2,315 meters) in elevation.

Biodiversity Rank Justification: This site contains the globally rare slender spiderflower, the rare Great Plains salt meadow wetland community, the San Luis sandhills skipper, along with nesting burrowing and short-eared owls.

The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. But, in spite of this large range, the plant is geographically limited due to its specific growing requirements. It needs moist alkaline soils with available water through most of the growing season. In addition to stringent moisture and alkaline needs, the slender spiderflower appears to do very well with some form of soil disturbance, (e.g., pocket gopher (*Thomomys talpoides*) diggings). These rather stringent growing requirements limit the slender spiderflower primarily to the edges of alkaline playa lakes and wetlands. **The Closed Basin of Colorado probably contains the most numerous, largest, and healthiest populations in the world (Jennings 1998).** The Antelope Springs site contains a relatively small but healthy population. At this site the northern pocket gophers are creating ideal habitat for both the slender spiderflower and the burrowing owl.

Natural Heritage element occurrences at the Antelope Springs site. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant Communities					
<i>Sporobolus airoides</i>	Great plains salt meadow	G2?	SU		B 6/18/97
Plants					
<i>Cleome multicaulis</i>	slender spiderflower	G2	S2	(C2)	B 6/25/97
Birds					
<i>Asio flammeus</i>	short-eared owl	G5	S2B,SZN		B 6/27/97
<i>Athene cunicularia</i>	burrowing owl	G4	S3S4B	(C2)	B 6/27/97
Insects					
<i>Polites sabuleti ministigma</i>	San Luis sandhill skipper	G5T3	S5		B 6/25/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the wetland occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.



Slender spider flower

Playa Lakes Sub-Region



Snowy egret at Russell Lakes

The Playa Lakes Sub-region lies in the south and central part of Saguache County as well as northern Alamosa County. This sub-region contains five proposed conservation sites, of which the first four are wholly or partially within Saguache County: 1) Russell Lakes, 2) Mishak Lakes, 3) Weisman Lakes, and 4) San Luis Lakes/Sand Creek (Figure 5). The San Luis Lakes/Sand Creek proposed conservation site is in both Saguache and Alamosa Counties. Blanca Wetlands is wholly Alamosa County and only discussed in Volume II of this report. Three of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County. All of these sites, except for Weisman Lakes

have some form of protection in at least a portion of the site, e.g. part of Mishak Lakes is a Nature Conservancy preserve. In spite of this protection, we still believe the protection urgency for the entire site is high, largely due to much of the site falling outside of formal protection. The table below, summarizes the biodiversity, protection, and management ranks for the Playa Lakes Sub-region proposed conservation sites. See the following site descriptions for more detail.

List of Saguache County, Playa Lakes Sub-region Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank
Russell Lakes	2	2	3
San Luis Lakes/Sand Creek	2	2	4
Weisman Lakes	3	2	4
Mishak Lakes	2	2	3

Hydrology of the playa lake landscape

The playa lakes of Saguache County are a unique landscape in the Southern Rocky Mountain ecoregion. In order to give some background on this area, which may be useful towards management and conservation efforts, the following text elaborates on the distinct geomorphology and vegetation of this system.

The Closed Basin of the northern San Luis Valley, of which most is within Saguache County, contains many shallow depressions which support a variety of wetland types. The basins fill

from snowmelt runoff in late spring and most are dry by late summer. Heavy monsoon precipitation can cause some basins to refill in late summer, but summer rains are generally of secondary importance. The soils in the lake basins are alkali clays with low rates of water infiltration allowing rapid evaporation at the water surface and accumulation of salts. They support a flora adapted to seasonal soil saturation and saline conditions. The lakes vary greatly in depth, salinity, and period of inundation.

Regularly flooded basins support well developed aquatic and shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), and American three-square (*Scirpus pungens*). Basins with irregular or short duration flooding contain saltgrass (*Distichlis stricta*) and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals which complete their life cycles after surface water evaporates and the late summer rains begin. Several locally common species include seablite (*Suaeda calceoliformis*), seaside heliotropium (*Heliotropium curassavicum*), and red glasswort (*Salicornia rubra*). Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively.

The playa lake ecosystems of the San Luis Valley floor depend upon a complex interaction of surface and groundwater sources which undergo characteristic seasonal and inter-annual fluctuations. Water uses which perturb the timing or magnitude of surface flows, or affect the valley bottom water table, are likely to affect these wetlands detrimentally. Changes in the water depth or duration of inundation in the basins can have profound effects on soil salinities and wetland vegetation (Cooper and Severn 1992). Wetland dependent fauna, such as waterbirds, amphibians, or vertebrates may be affected by even brief changes in wetland hydrology.

Despite considerable debate, the hydrological connections between surface as well as shallow and deep groundwater resources and valley bottom wetlands are poorly understood. Management of valley bottom wetlands must, therefore, seek not only local protection of on-site wetland elements, but secure water resources providing natural hydrologic variability.

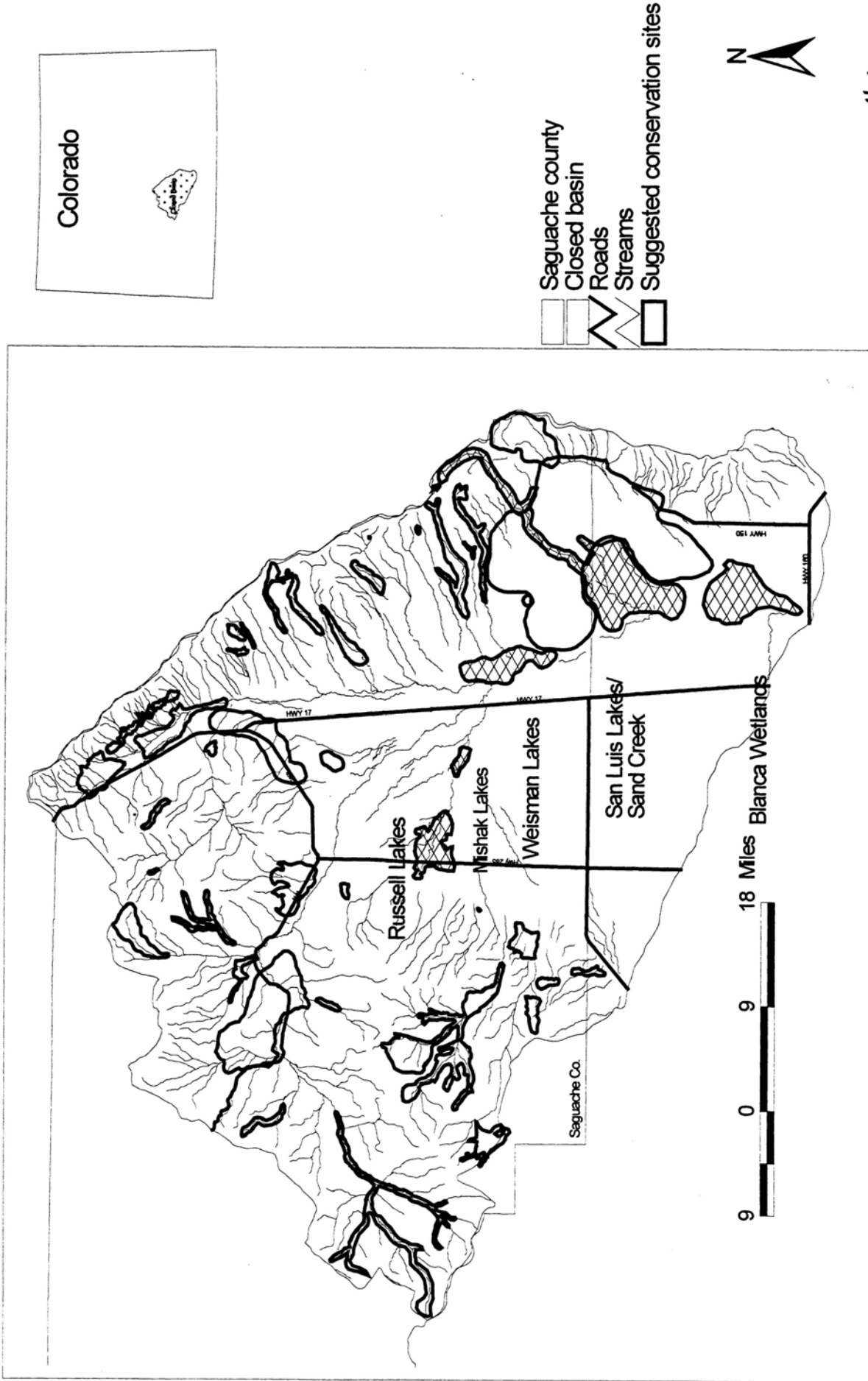


Figure 5. Playa Lakes sub-region proposed conservation sites. (Blanca Wetlands is discussed only in Vol. II)

Russell Lakes

Biodiversity Rank: B2 (Very high significance)

This site contains one of the largest populations known of the rare slender spiderflower, an alkaline wetland specialist with less than 20 occurrences worldwide. In addition, this is the only substantial nesting area in Saguache County for many state rare waterbirds.

Protection Urgency Rank: P2

This site is primarily state land managed by the Colorado Division of Wildlife. The most prevalent threat pertains to surface and ground water. Stable hydrologic conditions are critical to the maintenance of wetland conditions, and stable open water levels, which are critical for many of the nesting birds at this site.

Management Urgency Rank: M3

White-faced ibis are extremely sensitive to changing conditions in the environment, including fluctuating water levels during the breeding cycle; nest abandonment is a common response to disturbance or changing conditions (Ryder et al. 1979, Ryder and Manry 1994). A change from flood irrigation techniques to center-pivot irrigation in recent years has reduced the amount of foraging habitat for white-faced ibis and, in turn, reduced the number of ibis using the area (Ron Ryder pers. comm.). Since center-pivot irrigation uses water more efficiently, there is less wet ground that provides foraging areas for these birds. Management tactics to benefit the white-faced ibis, as well as the other waterbirds nesting at Russell Lakes, will have to address the water quality and quantity available to the site. Cooper and Severn (1992) report that a regional water table decline could detrimentally impact the wetlands. If water management efforts at this site are not ongoing, waterbirds that once depended on the historic wetlands (and subsequent flooded croplands) present in the San Luis Valley, will disappear from the area.

Location: Approximately 10 miles south of Saguache.

U.S.G.S. 7.5 minute quadrangles: Swede Corners, Harrence Lake

Legal Description: T43N, R7E S 13, 14, 23, 24, 25
T43N, R8E S 17-21, 28-33

General Description: The site is located in the western portion of the Closed Basin along Highway 285 approximately 10 miles south of Saguache, and covers an area of approximately 8,000 acres (Figure 5). The Russell Lakes site is nearly flat in relief, and ranges from 7,525 – 7,650 feet (2,295 – 2,330 meters) in elevation. Highest elevations are at the western margin and Russell Creek drains eastward through the site. A shallow underground water table and mildly undulating topography allow for expansive freshwater wetlands to flourish at the site interspersed with meadows, alkali shrublands, and ephemerally wet basins.

Vegetation within the wetlands varies considerably along salinity and moisture gradients. The larger lakes, which are predominantly freshwater, support well developed aquatic and

shoreline emergent vegetation, such as pondweeds (*Potamogeton* spp.), spikerush (*Eleocharis palustris*), hardstem bulrush (*Scirpus acutus*), broadleaf cat-tail (*Typha latifolia*), and American three-square (*Scirpus pungens*). Near Russell Springs, along Russell Creek, and around the outer margins of the large freshwater lakes are meadows of slimstem reedgrass (*Calamagrostis stricta*) and woolly sedge (*Carex lanuginosa*). Smallbeak sedge (*Carex simulata*) becomes locally abundant around springs towards the western edge of the site, and Baltic rush (*Juncus balticus*) is common where soils are slightly saline. Basins with irregular or short duration flooding, accumulate salts due to evaporation, contain saltgrass (*Distichlis spicata*), alkali cordgrass (*Spartina gracilis*), and/or western wheatgrass (*Pascopyrum smithii*) meadows. Spikerush may also dominate these ephemeral wetlands if moisture is sufficient. Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively. The slender spiderflower (*Cleome multicaulis*) forms extensive stands at this site. This annual plant flourishes on alkali soils which remain moist throughout the growing season. Stands can be seen throughout the Russell Lakes site, usually growing in rings around the wetland basins at about the same microelevation as Baltic rush.

Russell Springs, the water source for the Russell Lakes site, occur at the western edge of the site, and form the headwaters of one branch of the Closed Basin playa lake system. In addition, the hydrology is augmented by a series of artesian wells. Hardstem bulrush stands along the margins of the lakes provide excellent habitat for nesting white-faced ibis (*Plegadis chihi*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula*), cattle egret (*Bubulcus ibis*), marsh wren (*Cistothorus palustris*), and perhaps the occasional migrating great egret (*Casmerodius albus*). The perennial lakes also provide habitat for chorus frog (*Pseudacris triseriata*), Great Plains toad (*Bufo cognatus*), introduced carp (*Cyprinus carpio*) and Rio Grande chub (*Gila pandora*), which serve, among other things, to feed the abundance of nesting birds.

Biodiversity Rank Justification: This site supports one of the largest populations known of the globally rare slender spiderflower (*Cleome multicaulis*). The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of its large geographic range, the plant is spatially limited by its specific habitat requirements. It requires moist, alkaline soils for germination and growth. In addition to stringent moisture and alkaline needs, the slender spiderflower appears to do well with some form of soil disturbance. These discriminating restrictions limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations of the slender spider-flower known in the world.

Russell Lakes is unique to Saguache County in that it represents the best known breeding habitat for four state-rare wetland-dependent species of birds (white-faced ibis, black-crowned night-heron, snowy egret, and marsh wren).

Natural Heritage elements at the Russell Lakes site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	State Status	EO* Rank and Date
Plant communities					
<i>Calamagrostis stricta</i>	slimstem reedgrass	GU	S1?Q		B 9/4/97
<i>Carex lanuginosa</i> montane wetland	montane wet meadow	G4	S3		A 8/24/97
<i>Carex simulata</i>	wet meadow	G3	S3		B 9/4/97
Plants					
<i>Astragalus bodinii</i>	Bodin's milkvetch	G4	S2		unranked
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A 8/24/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A 8/24/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A- 7/30/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 8/24/97
<i>Sisyrinchium demissum</i>	blue-eyed grass	G5	S2		unranked 7/14/86
Fish					
<i>Gila pandora</i>	Rio Grande chub	G3	S1?	SC	I 1996
Birds					
<i>Cistothorus palustris</i>	marsh wren	G5	S3B,SZN		A 7/15/97
<i>Egretta thula</i>	snowy egret	G5	S2B,SZN		A 7/15/97
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		A 7/15/97
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		A 7/15/97
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		unranked 5/14/93
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		unranked 5/14/93
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		unranked 6/7/94
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS	B 7/15/97
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 6/14/93
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 5/14/93

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The boundaries for this site were drawn using a satellite image at a scale of 1:100,000 and encompass the spring origin, the lakes, the surrounding wetlands, and adjacent irrigated hay meadows. We considered these components to be the most critical for the long-term persistence of the elements present at the site.



Russell Lakes wetland



Snowy egret at Russell Lakes

Mishak Lakes

Biodiversity Rank: B2 (high significance)

This site contains excellent stands of two plant communities, a spikerush wetland and a saline bottomland shrubland; a globally rare plant species, the slender spiderflower; and one rare invertebrate, the San Luis Valley sand hills skipper.

Protection Urgency Rank: P2

There is a definable threat of hydrologic alteration which may occur in the near future. This site is entirely in private ownership. Approximately 75% of this site is owned and managed by The Nature Conservancy. The remaining 25%, which lies around the perimeter of the TNC preserve, is private or federal rangeland with no formal protection. A conservation easement or other form of protection might be considered to prevent development or other negative impacts to the unprotected wetland habitat. The status of the water supporting the site is volatile and may change dramatically within the next few years.

Management Urgency Rank: M3

Management may be needed within the next five years to maintain the current quality of the element occurrences. The majority of this site is managed for conservation. Livestock grazing at the site is present, and impacts are moderate. The site hydrology is affected by numerous on-site and off-site disturbances. Perturbations from the upper watershed, such as water diversion on the tributary creeks and center pivot irrigation, have complicated hydrologic effects on downstream sites such as this one. In addition to agricultural development, which has affected the local hydrology for many years, the more recent Closed Basin project, located immediately east of the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s.

Due to the confusing array of hydrologic disturbances, it is extremely difficult to accurately estimate management needs and viability potential for the elements of concern at this site. Information needs are vast. Effective management will require a much better understanding of the hydrologic connections between surface, and shallow and deep groundwater resources. Management of this site requires, therefore, not only local protection of on-site wetland elements, but secure water resources, and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands.

Location: The site is located 6 air miles southwest of Moffat.

U.S.G.S. 7.5 minute quadrangles: Moffat South, Harrence Lake

Legal Description: T42N, R9E S 2, 3, 4, 5, 9, 10, 11, 14, 15
T43N, R9E S 32, 33, 34, 35

General Description: This site contains over 1300 acres of shallow wetlands, meadows and shrublands between 7,500 and 7,550 feet (2,288-2,303 meters) in elevation in the west-central part of the Closed Basin. The Mishak Lakes basin receives seasonal runoff from Russell Creek and Werner Arroyo, two ephemeral streams. The sites contains Mishak Lakes

Preserve, which is owned by The Nature Conservancy, with peripheral private and Bureau of Land Management land. The lakes fill from snowmelt runoff in late spring and are usually dry by late summer. The lakes may fill again in late summer if convective precipitation is adequate. The soils in the lake basins are alkali clays with low rates of water infiltration. This allows rapid evaporation at the water surface and an accumulation of salts.

The basins support a flora adapted to seasonal soil saturation and saline conditions (TNC 1993).

The lakes vary in depth, salinity, and period of inundation, all of which influence local vegetation patterns. Regularly flooded basins support aquatic and shoreline emergent vegetation, with pondweeds (*Potamogeton* spp.) in standing water, and spikerush (*Eleocharis palustris*) or American three-square (*Scirpus pungens*) forming marshlands at the lake margins. This site contains some of the most extensive spikerush wetlands in the Closed Basin. At the highest elevations of these basin wetlands, stands of Baltic rush (*Juncus balticus*) or alkali cordgrass (*Spartina gracilis*) usually mark the wetland boundary, interspersed with populations of the globally imperiled slender spiderflower (*Cleome multicaulis*). Stands of this plant are concentrated near the western margin of the site, presumably where hydrologic inputs from Russell Creek are more reliable. Basins with irregular or short duration flooding contain saltgrass (*Distichlis spicata*) and/or western wheatgrass (*Pascopyrum smithii*) meadows, or barren salt flats. Basins which dry by mid-summer often support seasonal stands of salt tolerant annuals, such as goosefoot (*Chenopodium album*), which complete their life cycles after surface water evaporates and the late summer rains begin. Adjacent alkali flats and dunes are dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) vegetation, respectively, with understories of saltgrass or alkali sacaton (*Sporobolus airoides*).

The Mishak Lakes site is unique in its abundance of shallow, seasonal wetlands, and plays a supportive role to the other large wetland complexes in the Closed Basin. Although no rare breeding birds nest at the site, shorebirds, such as Wilson's phalarope (*Phalaropus tricolor*) seem to prefer the shallow water habitats of the site (TNC 1993), and many other shorebirds, waterbirds, and waterfowl use the site for foraging. The saltgrass basins of the site provide habitat for the state rare San Luis Valley sand hills skipper (*Polites sabuleti* ssp. *ministigma*).

Although the majority of the site is now managed for conservation, livestock continue to graze the site. The lands around the edges of the site are managed as rangeland. Site visitation is very limited, with no site for open public access at this time.

Biodiversity Rank Justification: Mishak Lakes is one of the last remaining playa systems in the San Luis Valley with a largely natural pattern of hydrologic variation. The lake system is unique in its shallow and ephemeral nature, and likely represents a wetland type which was formerly much more extensive in the San Luis Valley and the Great Plains (TNC 1993). Most of the wetlands complexes in the San Luis Valley have been modified, intensively managed for waterfowl production, or destroyed (TNC 1993). Protection of this naturally functioning shallow wetland system is an essential complement to the other wetland

communities of the San Luis Valley and a valuable contribution to biodiversity protection in Colorado.

This site supports a medium sized population of the globally rare slender spiderflower. The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of this large range, populations of this plant have decreased sharply in the last 100 years, particularly in the southwestern states. The plant is also limited to very specific microhabitats, requiring alkaline soils which remain moist throughout the growing season. The slender spiderflower also appears to do well with some form of soil disturbance, which presumably limits plant competition. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations known in the world.

The San Luis Valley sandhills skipper (*Polites sabuleti* ssp. *ministigma*) is an endemic subspecies found in the alkaline grasslands of the San Luis Valley. Although its biology is poorly known at present, saltgrass is used by the insect as a host plant. The San Luis Valley sandhills skipper can be found in shallow wetland basins of the valley floor after ponded waters have receded.

Natural Heritage element occurrences at the Mishak Lakes site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Eleocharis palustris</i>	spikerush wetland	G5	S3S4		A 7/10/97
<i>Sarcobatus vermiculatus/Distichlis spicata</i>	saline bottomland shrubland	G3	S1		A 7/10/97
Plants					
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 7/10/97
Insects					
<i>Polites sabuleti</i> ssp. <i>ministigma</i>	San Luis Valley sand hills skipper	G5	S3		
Mammals					
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison prairie dog	G5T3	S3		C 8/97
Birds					
<i>Athene cunicularia</i>	burrowing owl	G4	S3S4B	(C2)	C 5/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals of slender spiderflower can become established over time; and 3) include representation from each of the local plant communities which may support a pollinator for the rare plant species.

Weisman Lakes

Biodiversity Rank: B3 (High significance)

This wetland site includes eight occurrences of globally and state imperiled fish, mammals, birds, and plant communities.

Protection Urgency Rank: P2

This site is comprised of private, state land board properties, and a U. S. Fish and Wildlife refuge on White Ranch. The state parcels are leased by an adjacent landowner, primarily for cattle grazing. There are no current easements on the property, and the status of the water that affects the site is volatile and may change dramatically within the next few years.

Management Urgency Rank: M4

In general, the landscape appears to be more or less intact, with only a few two-track roads and ditches crossing the site. However, the site hydrology is affected by numerous on-site and off-site disturbances. The White Ranch U.S. Fish and Wildlife refuge at the extreme southern end of this site has several active wells which are maintained to enhance waterbird habitat. The Baca Ranch, at the northern part of this site, diverts much of the incoming water from Cottonwood and Deadman creeks into irrigated hay meadows, severely limiting the direct flow into Weisman Lakes. Perturbations from the upper Closed Basin (e.g., water diversion on San Luis and Saguache creeks and center pivot irrigation) have complicated effects on downstream sites such as this one. In addition to agricultural development, which has affected the local hydrology for many years, the more recent Closed Basin project, located adjacent to the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s.

Due to the confusing array of hydrologic disturbances, it is extremely difficult to accurately estimate management needs and viability potential for the elements of concern at this site. Information needs are vast. Effective management will require a much better understanding of the hydrologic connections between surface and shallow and deep groundwater resources. Management of this site requires, therefore, not only local protection of on-site wetland elements, but secure water resources, and greater understanding of how current and anticipated water uses within the watershed will affect the wetlands.

Location: Western edge of the Luis Maria Baca Ranch and the adjacent state lands.

U.S.G.S. 7.5 minute quadrangles: Sheds Camp, Deadman Camp.

Legal Description: T41N, R10E S 1, 2, 11-14, 23-25, 36
T41N, R11E 17-20, 30, 31 and unsurveyed
T42N, R10E S 1, 2, 11-15, 23-26, 35, 36
T42N, R11E unsurveyed

General Description: The Weisman Lakes site occurs in the middle of the playa lake system of the central Closed Basin (see following map). The playa lakes system in the Closed Basin includes ephemeral wetlands that generally support salt meadow grass (*Distichlis spicata*), western wheatgrass (*Pascopyrum smithii*), and spikerush (*Eleocharis palustris*) in the lake basins, and are often surrounded by greasewood (*Sarcobatus vermiculatus*) uplands.

The Weisman Lakes area occurs at the confluence of most of the prominent drainages of the closed basin including San Luis, Saguache, Deadman, Cottonwood, and Russell Creeks. This location allows wetlands to hold open water longer than in other areas of the playa lake system. These permanent wetlands support, spikerush (*Eleocharis palustris*), the native Rio Grande chub (*Gila pandora*), the introduced fathead minnow (*Pimephales promelas*), the eared grebe (*Podiceps nigricollis*), and many amphibians, including striped chorus frog (*Pseudacris triseriata*), plains spadefoot (*Spea bombifrons*), and Great Plains toad (*Bufo cognatus*). This diverse vertebrate biomass base no doubt provides forage for many of the state rare waterbirds that nest in the Closed Basin.

Basin wetlands at the southern end of the site become increasingly ephemeral and support salt meadow grass and western wheatgrass communities which are common throughout the playa lake system. These ephemeral basins abut the greater sand dunes ecosystem to the southeast, which may help to support the richness of endemic small mammals that occur on this site.

The site is approximately 7,800 acres in size and ranges in elevation from 7,500 to 7,515 feet (2,285-2,290 meters).

Biodiversity Rank Justification: In times of drought, the perennial wetlands in the northern portion of the site provide refuge for the globally rare Rio Grande chub (*Gila pandora*). Additionally, they provide nesting habitat for the state rare eared grebe (*Podiceps nigricollis*). The southern portion of the site is more arid and supports an excellent example of the globally rare saline bottomland shrubland (*Sarcobatus vermiculatus*/*Distichlis spicata*). This community in turn supports good populations of two globally rare and San Luis Valley endemic subspecies of small mammal, the silky pocket mouse (*Perognathus flavus sanluisi*), and the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus blanca*).

Natural Heritage elements at the Weisman Lakes site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Eleocharis palustris</i>	spikerush wetland	G5	S3S4		B 6/29/97
<i>Sarcobatus vermiculatus</i>/<i>Distichlis spicata</i>	Saline bottomland shrubland	G3	S1		A 6/29/97

Insects					
<i>Polites sabuleti ministigma</i>	San Luis sandhill skipper	G5T3	S5		B 6/24/97
Fish					
<i>Gila pandora</i>	Rio Grande chub	G3	S1?	SC	B 7/29/97
Mammals					
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		B 8/9/97
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		B 6/24/97
<i>Podiceps nigricollis</i>	eared grebe	G5	S3B,SZN		A 7/28/97
<i>Spermophilus tridecemlineatus blanca</i>	thirteen-lined ground squirrel subsp.	G5T3	S3		A 8/9/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The boundaries for this site were drawn using satellite imagery at a scale of approximately 1:100,000. They include the wetland complex that supports the elements of biodiversity found at the site. The design is intended to encompass enough of the wetland areas in the north to provide refugia for the chub in times of drought or other stresses on the quality of the hydrology of the area. The southern boundary was drawn to include the areas where elements occur. However, it is important to stress that any project that affects surface or groundwater hydrology in the Closed Basin has the potential to affect the hydrology maintaining this site.

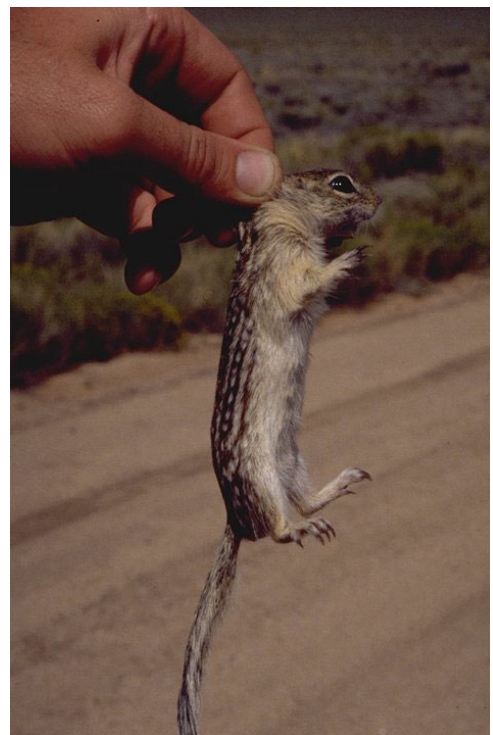
Weisman Lakes



Silky pocket mouse



Rio Grande chub



Thirteen-lined ground squirrel

San Luis Lakes\Sand Creek

Biodiversity Rank: B2 (Very high significance)

The site contains occurrences of eight plant communities, of which four are globally rare, four rare plant species, two rare mammal subspecies, seven rare birds, and one globally rare invertebrate species.

Protection Urgency Rank: P4

Approximately 60 % of this site is public land. The remaining 40% is owned by two large landowners, the Baca and Zapata Ranches (see Appendix A for ownership map). The majority of this site is unprotected. Considering the proximity of this site to the Great Sand Dunes ecosystem, and the concentration of biological elements contained both areas, this would be an excellent site to include in a Habitat Conservation Plan, or other regional conservation plan.

Threats to the San Luis Lakes site include disturbances to site hydrology as a result of current and potential hydrological disturbances in the watershed. The Closed Basin Project, located immediately northwest of the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s. Cumulative effects from this and other proposed water development projects are presently unknown, but potentially detrimental to the aquatic elements at this site.

Management Urgency Rank: M4

Current management appears to be adequate to maintain the elements at this site. Current management goals include: recreation and wetland conservation at San Luis Lakes State Park, livestock production on private and state leased lands, and wilderness preservation in the upper Sand Creek watershed. Surface impacts appear moderate at this time.

Hydrologic connections with the natural surface water sources have been disturbed by the Franklin-Eddy canal, which passes through the site. Management within the San Luis Lakes State Park appears to be supporting and, in some cases, enhancing the element occurrences there. Historically, runoff reached the valley bottom wetlands near San Luis Lakes from the northeast, via Big Springs Creek. Maintenance of the seasonal ground water mound underlying this natural flow pattern is crucial to the viability of the wetland habitats along and downstream of Big Springs Creek. This groundwater is also important to the stability of the sand dunes which form the eastern edge of this site. Water from Franklin-Eddy canal, while invaluable for wetlands at San Luis Lakes, is not an equivalent substitute for natural groundwater discharge entering the site from the east.

Location: This site extends northeast from San Luis Lakes State Park and is located 17 air miles northeast of Alamosa.

U.S.G.S. 7.5 minute quadrangles: Hooper East, Medano Ranch, Sand Camp,
Liberty, Crestone Peak, Beck Mountain

Legal Description: T39N, R11E S 1, 2, 3
T39N, R12E S 6
T40N, R11E S 1-3, 9-11, 13-16, 22-26,34-36
T40N, R12E S 2-10,14-21, 29-31
T41N, R12E S 16, 20, 21, 28-35
(some portions unsurveyed)
T25S, R73W S 1, 6, 7, 11-16,20-22, 28-31
T24S, R73W S 22-23, 25-27, 35, 36

General Description: This large site encompasses nearly 35,000 acres in the southern part of the Closed Basin playa-wetland system and is adjacent to two other significant sites: The Great Sand Dunes and Blanca Wetlands (Figure 5). This site encompasses the San Luis Lakes Basin and Sand Creek, one of its primary water sources. Elevations range from approximately 7,497 feet (2287 meters) at the bottom of San Luis Lake to 12,042 feet (3673 meters) at the headwaters of Sand Creek.

There are two natural lakes at the San Luis Lakes site which have no outlet in most years. The surrounding upland habitats are saline basins or aeolian sand deposits with a decidedly saline character, supporting greasewood (*Sarcobatus vermiculatus*) and saltgrass (*Distichlis spicata*) vegetation. One of the major sources of water to the lakes is Big Springs Creek, which originates at Indian Springs approximately seven miles northeast of the lakes. The area between Indian Springs and San Luis Lakes supports the highest concentration of freshwater wetlands in the southern Closed Basin. Common wetland species include beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), mare's tail (*Hippuris vulgaris*), and water smartweed (*Polygonum amphibium*). Big Springs Creek receives groundwater from the extensive aquifer under Great Sand Dunes National Monument immediately to the east. Other major habitats of the site include subsaline wetlands in the San Luis Lakes basins, alkali cordgrass (*Spartina gracilis*) meadows around the lake periphery, and rabbitbrush (*Chrysothamnus* spp.) shrubland on stabilized dunes. Freshwater dune ponds occur at the eastern edge of the site and support unique wetlands of American three-square (*Scirpus pungens*) and coyote willow (*Salix exigua*).

Sand Creek drains the western slopes of the Sangre de Cristo Mountains. It originates as a steep mountain stream, eventually becoming a braided, sand bottomed stream as it flows out on the San Luis Valley floor and skirts the northern edge of Great Sand Dunes National Monument. In the mountains, Sand Creek is in a wide, steep valley floor with no roads or heavily used trails. On the valley floor, the creek and riparian zone exhibit a unique habitat produced by active fluvial processes (meandering, braiding) juxtaposed with moving sand dunes. Along its course, Sand Creek supports several globally-rare riparian plant associations.

With the exception of San Luis Lakes State Park, which is focused on recreation, and the headwaters of Sand Creek, the majority of this site is used as open range at the present time. The Zapata Ranch maintains large herds of cattle and bison, which graze the private ranch lands and leased state lands contained in the site. Grazing intensity appears moderate at this time. Elk (*Cervus elaphus*) are also numerous at the site and browse the wetland habitats extensively. A number of two track roads traverse the site, but are lightly used.

Although the site hydrology is largely natural over most of the site, there are several ditches which spread water on the Zapata Ranch, and water levels at San Luis Lakes State Park have been stabilized by water input from the Closed Basin Project.

Biodiversity Rank Justification: This site supports 21 elements of concern: eight plant communities, three plant species, two mammal subspecies, seven birds, and one invertebrate species. Five significant wetland communities are found at this site: small flowered sedge (*Carex simulata*) wet meadow, aquatic catabrosa/common monkeyflower (*Catabrosa aquatica/Mimulus glabrata*) spring wetland, spikerush (*Eleocharis palustris*) wetland, mare's tail (*Hippuris vulgaris*) wetland, and aquatic smartweed (*Polygonum amphibium*) wetland. Three riparian communities found at this site are globally-rare: white fir-blue spruce-narrowleaf cottonwood/Rocky Mountain maple (*Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum*) montane riparian forest, narrowleaf cottonwood/Drummond's willow-Rocky Mountain maple (*Populus angustifolia/Salix drummondiana-Acer glabrum*) montane riparian forest, and narrowleaf cottonwood/bare sand (*Populus angustifolia/bare sand*) montane riparian forest. One state rare plant species, Bodin's milkvetch (*Astragalus bodinii*), one globally-rare subspecies, the canyon bog-orchid (*Platanthera sparsiflora* var. *ensifolia*), and the globally-rare Slender spiderflower (*Cleome multicaulis*), have been recorded at this site recently. During the 1875 Hayden expedition, botanist, T. S. Brandegee collected the only specimen known for the Colorado watercress (*Rorippa coloradensis*) (Sturkey 1972, pgs. 303-305). It is presumed that the specimen came from "Lakes of San Luis valley", meaning the San Luis Lakes region. This plant has not been seen since. Given the imprecise nature of this information, this species occurrence is not listed for this site. Should this species be found here in the future, it would dramatically increase the biodiversity significance of this site.

This site supports one of the largest populations known of the globally rare slender spiderflower. The slender spiderflower has a fairly large global range from southern Wyoming to central Mexico. In spite of this large range, populations of this plant have decreased sharply in the last 100 years, particularly in the southwestern states. The plant is also limited to very specific microhabitats, requiring moist alkaline soils. The slender spiderflower also appears to do well with some form of soil disturbance, which presumably limits plant competition. These discriminating habitat requirements limit the slender spiderflower to the edges of alkaline playa lakes and wetlands. The Closed Basin of Colorado contains the most numerous, largest, and healthiest populations in the world.

Several imperiled animal species are represented at the site, as well. Two mammal subspecies, the plains pocket mouse (*Perognathus flavescens relictus*) and silky pocket mouse (*Perognathus flavus sanluisi*), have been recorded from the dunes and alkali

shrublands on the lower elevations of the site. Two invertebrate species, the camel cricket (*Daihinbaenetes giganteus*) and San Luis sandhill skipper (*Polites sabuleti ministigma*), have been recorded from the dune habitats which comprise the eastern edge of the site. Six state or globally rare bird species which use the site include: short-eared owl (*Asio flammeus*), western snowy plover (*Charadrius alexandrinus nivosus*), long-billed curlew (*Numenius americanus*), black-crowned night-heron (*Nycticorax nycticorax*), white-faced ibis (*Plegadis chihi*), and Forster's tern (*Sterna forsteri*).

Natural Heritage element occurrences at the San Luis Lakes site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum</i>	montane riparian forest	G1	S1		A 7/25/97
<i>Abies concolor-Picea pungens-Populus angustifolia/Acer glabrum</i>	montane riparian forest	G1	S1		B 7/25/97
<i>Carex simulata</i>	wet meadow	G3	S3		A 6/10/97
<i>Catabrosa aquatica-Mimulus glabratus</i>	spring wetland	GU	S3		B 6/10/97
<i>Eleocharis palustris</i>	spikerush wetland	G5	S3S4		B 6/11/97
<i>Hippuris vulgaris</i>	mare's tail wetland	GU	S3		A 8/22/97
<i>Polygonum amphibium</i> montane wetland	montane wet meadow	G2	SU		B 8/22/97
<i>Populus angustifolia/Salix drummondiana-Acer glabrum</i>	montane riparian forest	G1	S1		A 7/25/97
<i>Populus angustifolia/sand dunes</i>	sand dune riparian forest	G1	S1		A 7/10/97
Insects					
<i>Polites sabuleti ministigma</i>	San Luis sandhill skipper	G5T3	S5		B 6/13/97
Plants					
<i>Astragalus bodinii</i>	Bodin's milkvetch	G4	S2		unranked 7/30/91
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A 7/8/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A 6/10/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	A- 7/8/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 7/8/86
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 8/22/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 6/11/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	C- 7/8/86
<i>Platanthera sparsiflora</i> var. <i>ensifolia</i>	canyon bog orchid	G4G5T3	S2		C 6/28/97

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Birds					
<i>Asio flammeus</i>	short-eared owl	G5	S2B,SZN		unranked 6.23/93
<i>Charadrius alexandrinus nivosus</i>	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 5/19/92
<i>Charadrius alexandrinus nivosus</i>	western snowy plover	G4T3	S1B,SZN	LT, SC, FS	unranked 6/3/92
<i>Numenius americanus</i>	long-billed curlew	G5	S2B,SZN	(3C), SC, FS	unranked 1975-06
<i>Numenius americanus</i>	long-billed curlew	G5	S2B,SZN	(3C), SC, FS	unranked 6/15/75
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		unranked 5/21/93
<i>Nycticorax nycticorax</i>	black-crowned night-heron	G5	S3B,SZN		unranked 5/26/93
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS	A 6/12/97
<i>Plegadis chihi</i>	white-faced ibis	G5	S2B,SZN	(C2), FS	unranked 5/21/93
<i>Podiceps nigricollis</i>	eared grebe	G5	S3B,SZN		A 6/12/97
<i>Sterna forsteri</i>	Forster's tern	G5	S2B,S4N		unranked 5/26/94
<i>Sterna forsteri</i>	Forster's tern	G5	S2B,S4N		unranked 8/1/94
Mammals					
<i>Perognathus flavescens relictus</i>	plains pocket mouse subsp.	G5T2	S2		unranked 7/2/09
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		unranked no date
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		historic 6/21/09
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		historic 6/30/09

*EO=Element Occurrence; dates indicate date of last observation

Boundary Justification: The San Luis site boundary includes all of the known occurrences listed for the site. It also includes immediate potential habitat that has not been thoroughly inventoried, but is likely to include many of the elements of concern. The adjacent Blanca Wetlands site contains similar habitat and the sites may be regarded as functionally connected. The site boundary was based on initial aerial photo analysis, a field visit by several CNHP scientists, and subsequent validation with satellite imagery.



Narrowleaf cottonwood



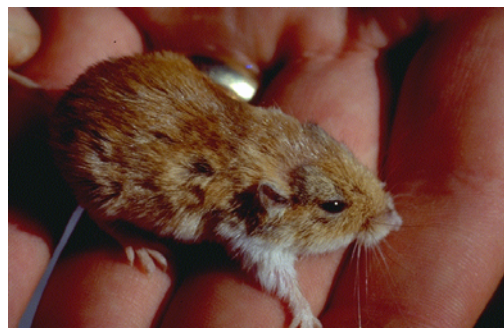
Slender spiderflower



Canyon bog orchid



Sand Creek



Silky pocket mouse

Middle Sangre de Cristo Mountains Sub-Region



The Middle Sangre de Cristo Mountains Sub-region lies in the eastern part of Saguache County and includes sites of which all or part are in the Sangre de Cristo Mountains (Figure 6). This sub-region contains 14 proposed conservation sites (see following table). **Three of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County: Deadman Creek, Head of Spanish Creek, and Valley View Hot Springs.** These three sites contain significant amounts of private land, although most also include some public lands (Appendix A). The following table summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the Middle Sangre de Cristo Mountains sub-region. See the following site descriptions for more detail.

List of Saguache County Middle Sangre de Cristo Mountains Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Identification number in Figure 6
Deadman Creek	B 2	P 3	M 3	20
Head of Spanish Creek	B 2	P 2	M 4	16
Valley View Hot Spring	B 2	P 3	M 3	8
Cotton Creek	B 3	P 4	M 3	11
Cottonwood Creek	B 3	P 3	M 3	18

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Identification number in Figure 6
Dimick Gulch	B 3	P 4	M 5	14
Lake Fork of North Crestone Creek	B 3	P 4	M 4	15
Milwaukee Peak	B 3	P 4	M 4	17
Rito Alto Bosque	B 3	P 3	M 3	13
Upper Medano Creek	B 3	P 4	M 4	21
Valley View	B 3	P 4	M 4	9
Cedar Canyon	B 4	P 3	M 3	19
Garner Canyon	B 4	P 3	M 3	10
Wild Cherry Creek	B 4	P 4	M 4	12

The following descriptions of sites are geographically ordered beginning with the northern most site of Valley View Hot Springs and working south to Upper Medano Creek.

MIDDLE SANGRE DE CRISTO MOUNTAINS SUB-REGION.....	73
<i>Valley View Hot Springs</i>	77
<i>Valley View</i>	80
<i>Garner Canyon</i>	83
<i>Cotton Creek</i>	85
<i>Wild Cherry Canyon</i>	88
<i>Dimick Gulch</i>	94
<i>Lake Fork of North Crestone Creek</i>	96
<i>Head of Spanish Creek</i>	97
<i>Milwaukee Peak</i>	99
<i>Cottonwood Creek</i>	100
<i>Cedar Canyon</i>	102
<i>Deadman Creek</i>	104
<i>Upper Medano Creek</i>	107

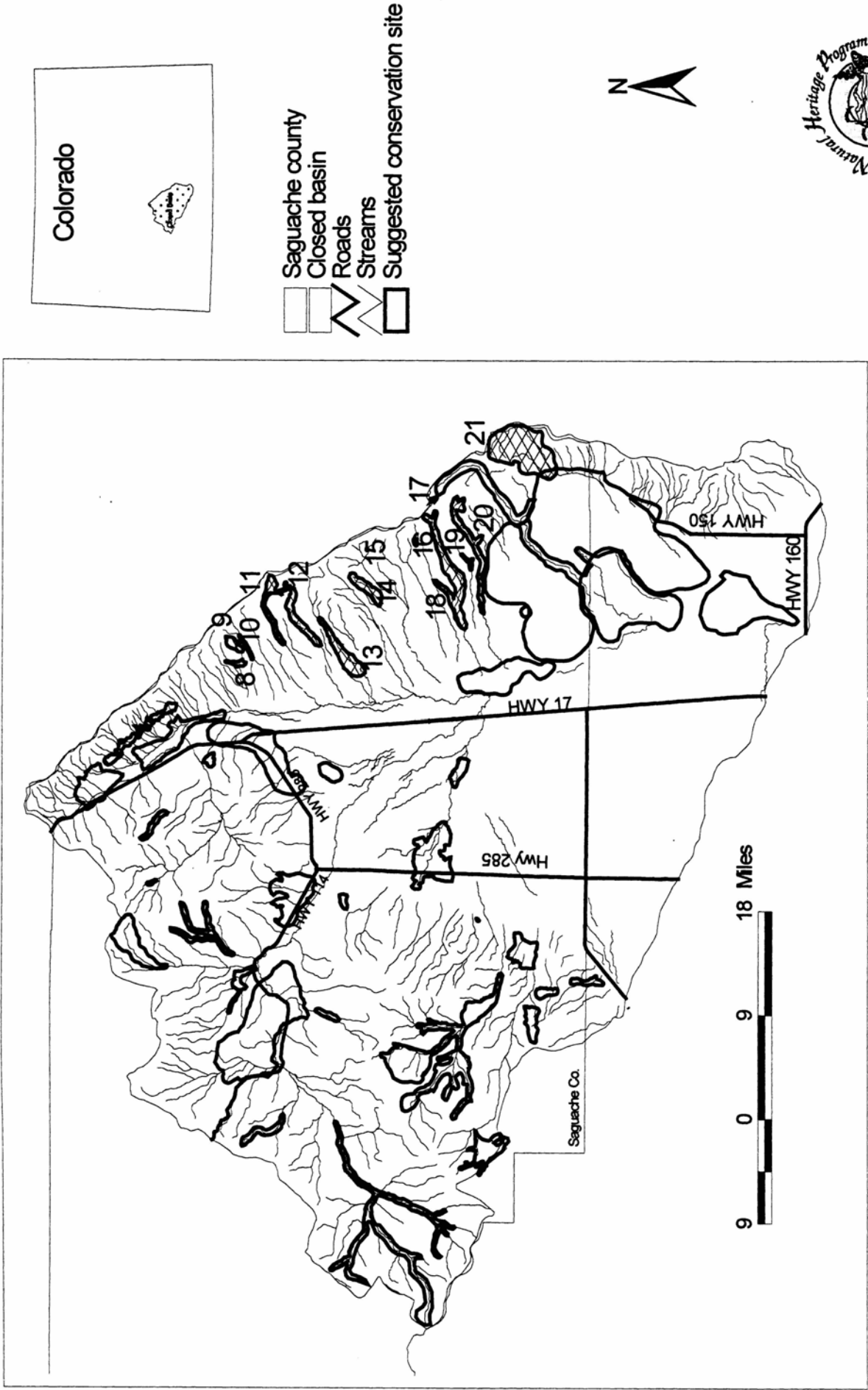


Figure 6. Middle Sangre de Cristo mountains sub-region proposed conservation sites. See following table for site names.

Middle Sangre de Cristo Mountains sub-region proposed conservation sites ordered by identification number listed in Figure 6.

SITENAME	Biodiversity Rank	Identification number in Figure 6
Valley View Hot Spring	B 2	8
Valley View	B 3	9
Garner Canyon	B 4	10
Cotton Creek	B 3	11
Wild Cherry Creek	B 4	12
Rito Alto Bosque	B 3	13
Dimick Gulch	B 3	14
Lake Fork of North Crestone Creek	B 3	15
Head of Spanish Creek	B 2	16
Milwaukee Peak	B 3	17
Cottonwood Creek	B 3	18
Cedar Canyon	B 4	19
Deadman Creek	B 2	20
Upper Medano Creek	B 3	21

Valley View Hot Springs

Biodiversity Rank: B2 (Very high significance)

The Valley View Hot Springs site supports a large population of the hot springs physa, a rare snail limited to hot springs in Colorado. In addition to this hot springs specialist, several rare orchids, the Brazilian free-tailed bat, and a pinyon pine woodland community are found within the site.

Protection Urgency Rank: P3

This site has multiple ownership including private, state, and Bureau of Land Management lands (see the following map). Part of this site is owned by the Valley View Hot Springs resort. The impact of hot springs development to the hot springs elements, for example the hot springs physa snail, is unknown. Any protection strategy for this site will need to work closely with the Valley View Hot Springs resort. Several tools exist, e.g., conservation easements, habitat conservation plans, nomination of the state land board lands for Stewardship Trust designation, direct acquisition, and cooperative management plans.

Management Urgency Rank: M3

In order to maintain a native flora, management actions should focus on weed control at the hot springs area. Hand weeding of non-native plants, particularly in the area of known orchid populations, should be conducted prior to seed maturity of the weeds. Care should be taken to avoid physically disturbing native species. The application of herbicides is not recommended due to the presence of the snail and rare plants. Periodic monitoring of the hot springs physa population would help to show trends.

Location: Valley View Hot Springs and Orient mine.

U.S.G.S. 7.5 minute quadrangle: Valley View Hot Springs

Legal Description: T46N R10E S 25, 36
T45N R10E S1

General Description: The Valley View Hot Springs site is located at the base of the Sangre de Cristo Mountains in the northeastern part of Saguache County. The hot springs are a series of springs at the base of the mountains. These springs form a small creek that cuts through an alluvial fan. In 1984, this creek flowed approximately 1 mile or more into the San Luis Valley bottom, but due to changes in water management, the creek no longer reaches its original destination. This change has caused the extirpation of a population of Rio Grande chub (*Gila pandora*).

The majority of this site is a hot springs resort. The hot springs area is privately developed with a swimming pool, sauna, several hot spring pools, a campground, and riding stables. Most of the pools and creeks entering or exiting these pools are excellent habitat for the hot springs physa (a snail). Only the upper springs support much native vegetation with seep monkey flower (*Mimulus guttatus*), *Potamogeton*, and *Catabrosa aquatica* dominating. The

lower springs and creek are comprised of more non-natives than native plants, including thistle (*Cirsium* spp.), clover (*Trifolium repens*), black medic (*Medicago lupulina*), Kentucky bluegrass (*Poa pratensis*) and more. Within this weedy vegetation a few individuals of the rare helleborine (*Epipactis gigantea*) and canyon bog orchid (*Platanthera sparsiflora* var. *ensifolia*) were located.

Orient Mine, a large non-active mine just north of the Valley View Hot Springs Resort, is a very important roost site for the Brazilian free-tailed bat, which use the hot springs pools for drinking and feeding.

The site is approximately 360 acres ranging in elevation from 8,600 to 9,300 feet (2,625-2,830 meters).

Biodiversity Rank Justification: The Valley View Hot Springs site supports an excellent example of a rare snail (*Physa cupreonitens*). This snail appears to be limited to hot springs in Colorado and has been found in Grand, Saguache, Fremont, and Mesa counties. The Colorado Natural Heritage Program (1997) documents six occurrences. In addition to this hot springs specialist, several other significant plants, animals and plant communities are here, including a very large and healthy occurrence of pinyon pine/needle and thread grass (*Pinus edulis/Stipa comata*) on the upland slopes, a globally restricted community.

Natural Heritage element occurrences at the Valley View Hot Springs site. Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant Communities					
<i>Pinus edulis/Stipa comata</i>	xeric western slope pinyon-juniper woodland	G2	S2		A 7/13/97
Invertebrates					
<i>Physa cupreonitens</i>	hot springs physa	G2?	S2		A 7/12/97
<i>Physa cupreonitens</i>	hot springs physa	G2?	S2		unranked 8/14/77
Plants					
<i>Epipactis gigantea</i>	helleborine	G4	S2	FS	C 7/13/97
<i>Epipactis gigantea</i>	helleborine	G4	S2	FS	unranked 1989
<i>Platanthera sparsiflora</i> var. <i>ensifolia</i>	canyon bog-orchid	G4G5T3	S2		B 7/14/97
Mammals					
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	G5	S1		unranked 6/29/65
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	G5	S1		unranked 7/17/93

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) provide suitable habitat where additional individuals can become established over time. The boundary was delineated using 1988 and 1990 NAPP 1:40,000 infrared aerial photographs and satellite imagery.



Pinyon pine savanna at Valley View Hot Springs



Canyon bog-orchid

Valley View

Biodiversity Rank: B3 (high significance)

This site includes an excellent occurrence of the globally restricted bristlecone pine/Thurber fescue woodland.

Protection Urgency Rank: P5

This site is within the Rio Grande National Forest and mostly contained within the Sangre de Cristo Wilderness Area (see Appendix A for ownership map).

Management Urgency Rank: M4

A U.S. Forest Service trail follows Hot Springs Canyon creek up the valley. The trail has some non-native plants and is an avenue for additional invasive species. None of the non-natives along the creek appear to have a direct impact on the bristle cone pine stand. Periodic monitoring of the bristle cone pine stand is suggested. Fires may be an important process for the bristle cone pine stand. Current condition is good, although results of monitoring this site may suggest a change in management practices in future years.

Location: This site lies upstream of the Valley View Hot Springs.

U.S.G.S. 7.5 minute quadrangle: Valley View Hot Springs

Legal Description: unsurveyed

General Description: The Valley View site includes the slopes and stream bottom of Hot Springs Canyon. The south-facing slopes of the upper bowl of the canyon are dominated by bristle cone pine (*Pinus aristata*) forest with varying abundance of limber pine (*Pinus flexilis*) and aspen (*Populus tremuloides*). The north-facing slopes are densely forested with spruce (*Picea* spp.). Stream side vegetation is primarily dominated by an aspen overstory and a mesic forb understory. A few acres of Parry's oat grass (*Danthonia parryi*) with and without aspen were found near the lower parts of this site. Pinyon pine (*Pinus edulis*) and Gambel oak (*Quercus gambelii*) are found at the opening of the canyon near the trailhead. The alluvial fan at the end of the canyon is part of the Valley View Hot Springs site (Figure 6).

Recreation is the primary use within the site, with a trail paralleling the stream bottom. This trail was a 4-wheel drive road prior to wilderness designation. The site is virtually free from non-native plants except for the trail area and adjacent streamsides. Historic use included livestock grazing. Numerous fire scars can still be observed throughout the area.

The site is about 700 acres in size, and ranges in elevation from about 9,650 to 11,750 feet (2,950-3,580 m).

Biodiversity Rank Justification: This site includes an excellent example of a bristle cone pine/Thurber fescue plant community. Bristle cone pines are fairly common in the upper part of the Closed Basin watershed. We found several occurrences of this type throughout the valley, yet this one stands out as an excellent example.

Natural Heritage element occurrences at the Valley View site

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Pinus aristata/Festuca thurberi</i>	lower montane woodland	G3	S2		A 7/13/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This site includes the extent of the bristle cone pine distribution within the canyon and adjacent potential habitat. The boundary was confirmed during a 1997 site visit by CNHP ecologists. The boundary was further verified using a 1988 NAPP 1:40,000 color infrared photograph.

Garner Canyon

Biodiversity Rank: B4 (Moderate significance)

This site contains occurrences of uncommon montane forests, including Douglas-fir/Rocky Mountain maple montane coniferous forest and aspen/western birch montane deciduous forest. In addition, a stand of the globally rare subspecies canyon bog-orchid has been recorded at the site.

Protection Urgency Rank: P3

This site is predominantly publicly owned and managed by Rio Grande National Forest with some private parcels at the base of the watershed. A new residence has recently been erected at the base of the canyon near the lower springs where a population of canyon bog-orchid has been reported. CNHP recommends that the private landowner be informed of this plant and encouraged to conserve its habitat.

Management Urgency Rank: M3

The majority of this site is under public ownership. Activities of concern take place primarily on the private land at the base of the site. Horse grazing and haying operations occur which may detrimentally impact the wetland elements. Both activities should be avoided in the immediate vicinity of the springs and riparian wetlands at the site. If water is diverted from the creek or spring wetlands, sufficient in-channel flow should be preserved to maintain the riparian elements.

Location: This site is located in northeastern Saguache county approximately seven miles east of Mineral Hot Springs resort and two miles south of Valley View Hot Springs
U.S.G.S. 7.5 minute quadrangle: Valley View Hot Springs

Legal Description: T45N, R10E S 1, 12
T45N, R11E S 5, 6
T46N, R11E S 32, 33

General Description: The Garner Canyon site is drawn to delineate a complex of valley bottom and toeslope vegetation communities in the lower reaches of the canyon. The canyon is wider than most of the other gorges draining the western flank of the Sangre de Cristo Mountains, and the valley bottom is less steep. The toeslope on the south side of Garner Creek supports a dense stand of Douglas-Fir (*Pseudotsuga menziesii*) with an understory of Rocky Mountain maple (*Acer glabrum*), snowberry (*Symphoricarpos rotundifolius*), wild rose (*Rosa woodsii*), buffaloberry (*Sheperdia canadensis*), and a lush understory of forbs, sedges, and grasses. At the base of the canyon, where a complex of springs augment the riparian wetlands along Garner Creek, there is a small but lush stand of aspen (*Populus tremuloides*) with western birch (*Betula occidentalis*) in the understory. The site covers over 300 acres and extends from 8700 to 9950 feet (2654-3035 meters) in elevation.

Biodiversity Rank Justification: The site contains occurrences of Douglas-fir/Rocky Mountain maple (*Pseudotsuga menziesii/Acer glabrum*) lower montane forest and aspen/western birch (*Populus tremuloides/Betula occidentalis*) montane riparian forest.

Stands of Douglas-fir/Rocky Mountain maple communities have been reported from less than ten sites in western Colorado. Although both species are common, pure stands with high proportions of Rocky Mountain maple are restricted to mesic montane slopes. The aspen/western birch montane forest is documented from eastern Nevada (Manning and Padgett 1995) and Colorado (Colorado Natural Heritage Program 1997), but less than 20 stands have been reported in this state.

The globally rare canyon bog-orchid (*Platanthera sparsiflora* var. *ensifolia*) which occurs at this site has been recorded at scattered sites throughout southern and western Colorado. It is an obligate wetland plant which favors spring habitats. This occurrence is threatened by livestock trampling and invasive plant species, which can have especially severe impacts on spring ecosystems.

Natural Heritage element occurrences at the Garner Creek site. Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus tremuloides/Betula occidentalis</i>	montane riparian forest	G1	S1		C 9/20/97
<i>Pseudotsuga menziesii/Acer glabrum</i>	lower montane forest	G4	S1		B 9/20/97
<i>Platanthera sparsiflora</i> var. <i>ensifolia</i>	canyon bog-orchid	G4G5T3	S2		unranked 6/30/90

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundaries are drawn to include all the occurrences presented above, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In addition, the boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) provide suitable habitat where additional individuals can become established over time. The boundary was developed following a field visit by a CNHP wetland ecologist and corroborated with remotely sensed data.

Cotton Creek

Biodiversity Rank: B3 (High significance)

This site supports an excellent occurrence of a montane and foothill riparian forest and shrubland, two rare plants, and a mixed population of cutthroat trout (see below for explanation).

Protection Urgency Rank: P4

This site falls within the Rio Grande National Forest (see following map), much of it within the Sangre de Cristo Wilderness area. Protection appears adequate at this time.

Management Urgency Rank: M3

For the botanical resources the current management is adequate, however the trout population is in need of action. The trout population is a mix of native, introduced, and reintroduced cutthroat; and in the lowest reaches, additional introduced non-native brook trout species are present. Colorado Division of Wildlife is aware of the unpurity rating for the fish, although no plans are currently in place to change the status.

Fires may play an important role in maintaining the south-facing mountain-mahogany dominated shrublands, therefore a let-it-burn policy is encouraged.

Location: Cotton Creek is approximately 4 miles southeast of Valley View Hot Springs. A forest service trail parallels the creek.

U.S.G.S. 7.5 minute quadrangles: Electric Peak, Valley View Hot Springs

Legal Description: T45N, R11E S 11-16, 20, 21

T45N R12E S 7, 17-19

General Description: The Cotton Creek site includes Cotton Creek from the alpine lakes of Cotton and Teacup to the mouth of the canyon. The alpine lakes are surrounded by willows (*Salix* spp.) and sedges (*Carex* spp.) with mixed conifer forest on the uplands. Cotton Creek retains a low gradient stream in the glaciated terrain at the head of the watershed, for a short distance before becoming a fast moving stream. After it makes a nearly 90 degree bend, the creek becomes very steep and the streamside vegetation is dominated by Engelmann spruce (*Picea engelmannii*) and Drummond's willow (*Salix drummondiana*), changing to aspen (*Populus tremuloides*) along the lower reaches. South-facing slopes of the valley are precipitous, and are dominated by oceanspray (*Holodiscus dumosus*) and mountain mahogany (*Cercocarpus montanus*) shrublands or pinyon pine (*Pinus edulis*) woodlands. The wetter, north-facing slopes are forested with Engelmann spruce at the upper elevations and Douglas fir (*Pseudotsuga menziesii*) at lower elevations. The streamside community along the lower sections of Cotton Creek is very diverse and includes aspen, water birch (*Betula occidentalis*), Rocky Mountain maple (*Acer glabrum*), Drummond's willow, and Woods rose (*Rosa woodsii*). The site is virtually free from weeds, although small patches of the non-native species such as Kentucky bluegrass (*Poa pratensis*), dandelions (*Taraxacum officinale*), and smooth brome (*Bromus inermis*) were found near the creek at the trailhead.

Cotton Creek is a clear water creek flowing over a cobble substrate, approximately 15 to 20 feet wide in the lower stretches and narrows to three to five feet in places, which creates stronger currents and oxidizes the water. This provides excellent habitat for trout, including the native cutthroat and non-native brook trout. Past stocking records and conversations with the Colorado Division of Wildlife indicate the cutthroat population is unpure and mixed with other subspecies of cutthroat trout.

The primary use within the Cotton Creek site is recreation, with access from a U. S. Forest Service trail that parallels the stream. The area affords good wildlife habitat for common large mammals including mule deer (*Odocoileus hemionus*), American elk (*Cervus canadensis*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*). The scenic views are an added attraction.

This site is approximately 2,100 acres with an elevation range from 8,950 to 12,750 feet (2,040-2,730 meters).

Biodiversity Rank Justification: The Cotton Creek site contains an excellent occurrence of a montane riparian forest and a good occurrence of a foothills riparian shrubland. It is unusual to find healthy and large stands of water birch (*Betula occidentalis*). When water birch is dominant it may denote a perennial spring or subsurface water adjacent to the creek. We found several of the Sangre de Cristo Mountain streams to have water birch present at the lower elevations. In addition to the riparian plant communities the area supports populations of the globally rare canyon bog-orchid, state rare Altai chickweed, and a mix of native, introduced, and reintroduced cutthroat trout.

Natural Heritage elements at the Cotton Creek site. Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Populus tremuloides/Betula occidentalis</i>	montane riparian forest	G1	S1		B 9/12/97
<i>Abies lasiocarpa-Picea engelmannii/Salix drummondiana</i>	montane riparian forest	G4	S4		A 7/12/97
<i>Betula occidentalis/mesic forb</i>	foothills riparian shrubland	G2G3	S2		B 7/15/97
<i>Cercocarpus montanus/Muhlenbergia montana</i>	mixed mountain shrubland	GU	S2		A 7/12/97
Plants					
<i>Platanthera sparsiflora</i> var. <i>ensifolia</i>	canyon bog-orchid	G4G5T3	S2		C 7/12/97
<i>Stellaria irrigua</i>	Altai chickweed	G4?	S2	(3C)	unranked 7/20/43
Fish					

<i>Oncorhynchus clarki</i>	cutthroat trout	G4	S3	(3C), SC, FS	B 7/12/97
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*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals and plant communities can become established over time; and 3) include the alpine lakes which may be important for the cutthroat trout as a refugia. The boundary was delineated using 1988 and 1990 NAPP 1:40,000 infrared aerial photographs.

Wild Cherry Canyon

Biodiversity Rank: B4 (moderate significance)

The Wild Cherry Canyon site contains the region's only known occurrence of Altai cottongrass at the upper elevations, along with a good example of quaking aspen/red-osier dogwood in the lower canyon.

Protection Urgency Rank: P3

The majority of this site is within the Sangre de Cristo Wilderness Area, which is owned and managed by the Rio Grande National Forest. The lower section is privately owned and development of a small Christian retreat is planned there. This would be an excellent opportunity to develop a conservation easement on the floodplain of Wild Cherry Creek. The private owner, Santa Fe Community School, would like the retreat to have minimal impacts on the natural values of the property and has provisionally agreed not to build on, or unnecessarily disturb, the Wild Cherry Creek floodplain. Colorado Natural Heritage Program prepared a brief list of protection guidelines for the landowners on 8/17/97, but a formal conservation agreement is strongly recommended.

Management Urgency Rank: M4

Although the elements at the site are not currently threatened, management adjustments may be needed in the future to maintain the quality of the element occurrences. Livestock grazing, particularly of packstock, occurs along the riparian corridor of Wild Cherry Creek. Current impacts are minor, but invasive plant species are becoming established along the trail corridor and in the small meadow just below the lake basin. The abundance of invasive plant species warrants monitoring, and packstock use may need to be adjusted to minimize disturbance to soils and native vegetation. There is some grazing by goats on the private land at the base of the site.

The land owners should be informed of the destructive effects of confined livestock and encouraged to avoid allowing livestock in the floodplain.

Location: This site is located eight miles east of highway 17, via Saguache County road "AA".

U.S.G.S. 7.5 minute quadrangles: Mirage, Electric Peak

Legal Description: T44N, R11E S 4, 5

T45N, R11E S 23, 24, 25, 26, 27, 28, 33

General Description: The Wild Cherry canyon site designates a 2,060 acre watershed draining the western slope of the northern Sangre de Cristo Mountains. Site elevations range from 12,524 feet (3,819 meters) at the upper edge of the lake basin to 8,072 feet (2,462 meters) at the western boundary below the mouth of the canyon. Wild Cherry Lake basin, at the head of the watershed, contains alpine wetlands which harbor several species of sedges (*Carex* spp.) and willows (*Salix* spp.), as well as elephantella (*Pedicularis groenlandica*), rose crown (*Sedum rhodanthum*), star gentian (*Swertia perennis*), and the state imperiled Altai cottongrass (*Eriophorum altaicum* var. *neogaeum*). Below the lake basin, the canyon

narrows and supports a large aspen (*Populus tremuloides*) forest. The understory is dominated by red-osier dogwood (*Cornus sericea*) near the stream and wild rose (*Rosa woodsii*) and forbs farther upslope. On the alluvial fan below the canyon mouth, the riparian forest is flanked by woodlands of Rocky Mountain juniper (*Juniperus scopulorum*) and Gambel oak (*Quercus gambelii*), creating a structurally diverse riparian ecosystem which extends approximately one mile west from the Sangre de Cristo mountain front.

The setting and hydrology of this site appear largely pristine. A pack trail follows the north side of Wild Cherry Creek from the canyon mouth to the lake basin. Invasive species, such as soft brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*) are present along the trail corridor but did not appear widespread in the canyon. A single house is located next to the creek at the extreme west end of the site.

Biodiversity Rank Justification: The Wild Cherry Canyon site contains the Sangre de Cristo region's only known occurrence of Altai cottongrass. Altai cottongrass is an alpine wetland plant with a geographically broad, but sporadic, distribution through the higher ranges of the Rocky Mountain states. It occurs from Alaska and British Columbia south to the Uinta Mountains of Utah and several ranges of western Colorado. This stand is disjunct by nearly 100 miles from Hinsdale and Park County populations to the west and north, respectively.

A good example of a quaking aspen/red-osier dogwood (*Populus tremuloides*/*Cornus sericea*) community fills the lower canyon. This plant association occurs in Montana (Hansen et al. 1988), Utah (Padgett et al. 1989), and Colorado (Colorado Natural Heritage Program 1997). In Colorado, this plant association is known from only three stands, but is estimated to be somewhat more common. The association typically occurs in deep, narrow valleys along banks of low order streams.

Gray's peak whitlow grass (*Draba grayana*) has been historically reported from higher elevations of the site in 1942. Gray's peak whitlow grass is a Colorado endemic scattered along the eastern crest of the southern Rocky Mountains. It inhabits talus slopes in crevices between rocks or other protected sites (Spackman et al. 1997). This plant was not censused in 1997, and viability or persistence of this population is presently unknown.

Natural Heritage elements at the Wild Cherry Canyon site. Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Populus tremuloides/Cornus sericea</i>	montane riparian woodland	G3	S2S3		B 7/12/97
Plants					
<i>Draba grayana</i>	Gray's peak whitlow-grass	G2	S2		unranked 8/19/42
<i>Eriophorum altaicum var neogaeum</i>	Altai cottongrass	G4T?	S2		B 8/23/97
<i>Eriophorum altaicum var neogaeum</i>	Altai cottongrass	G4T?	S2		unranked 8/19/42

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundaries are drawn to protect the floodplain of Wild Cherry Creek, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In the glaciated headwater basin, all valley bottom wetlands were included. Although not contained in the present site boundary, contributory sub-watersheds should be managed to avoid downstream impacts to elements in the Wild Cherry Creek site. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP wetland ecologist, and subsequent corroboration with satellite imagery.

Rito Alto Bosque

Biodiversity Rank: B (Very High significance)

The Rito Alto site supports some of the best examples of aspen/water birch and narrow-leaf cottonwood/water birch riparian forest in the Closed Basin and Colorado. Both communities are globally restricted to a few sites in the southern Rocky Mountains and Great Basin.

Protection Urgency Rank: P3

This site is almost 90% privately owned with small amounts of Rio Grande National Forest and Bureau of Land Management lands. No known development threats are foreseen in the immediate future; however, with the exception of a small portion of Sangre de Cristo Wilderness at the eastern edge, the site has no formal protection at this time.

Management Urgency Rank: M3

The downstream portion of the site is beginning to show impacts from livestock use, such as invasion of exotic plant species and poor tree regeneration. Cottonwood seedlings and saplings as well as birch shrubs show heavy browsing by cattle. Excessive grazing and browsing will reduce native plant vigor and allow invasion of non-native plant species. Moist soils also make this community susceptible to soil compaction. Cottonwood-dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This type grazing regime maintains high forage quality and quantity.

The hydrologic regime of Rito Alto is moderately altered by small diversions at the top of the watershed. However, several springs that feed the creek in the upper portions of this site are intact. The regeneration and establishment of new stands of cottonwood is dependent upon flooding events, and any further alteration to the natural flow regime of the creek could affect the cottonwood component of this ecosystem. Without periodic disturbance by flooding, riparian areas may become dominated by late successional species, such as conifers, or lose riparian trees entirely.

Location: This site is located eight air miles northeast of the town of Moffat at the base of the Sangre de Cristo Mountains.

U.S.G.S. 7.5 minute quadrangle: Mirage

Legal Description: T44N, R11E S 3, 8, 9, 10, 16, 17, 18, 19
T44N, R10E S 15, 24, 25

General Description: The Rito Alto Bosque site delineates nearly 3000 acres of riparian forests/woodlands which extend down the alluvial fan from the mouth of Rito Alto Canyon on the western edge of the Sangre de Cristo Mountains. The site slopes westward from the mountain front and ranges from an elevation of just under 7600 feet at the western edge to nearly 9450 feet at the eastern margin. The large areal extent, complex canopy structure, and community diversity make this streamside forest/woodland unique in the northern San Luis Valley. The near streamside zone is vegetated with quaking aspen (*Populus tremuloides*)

and narrowleaf cottonwood (*Populus angustifolia*), with an understory of water birch (*Betula occidentalis*), Bebb's willow (*Salix bebbiana*), wild rose (*Rosa woodsii*), and mesic forbs, sedges, and grasses. Further from the channel, mixed woodlands of Rocky Mountain juniper (*Juniperus scopulorum*) and Gambel oak (*Quercus gambelii*) predominate, extending the forest/woodland as much as 100 meters on either side of Rito Alto Creek. At the upland edges of the site, needle and thread (*Stipa comata*) forms extensive grasslands. This is the most extensive riparian corridor extending from the Sangre de Cristo Mountains toward the valley bottom wetlands of the San Luis Valley. Dense canopy shading, with perennial water and abundant cottonwood snags, suggest the site provides excellent habitat for riparian dependent fauna.

Livestock graze the site. Impacts are light in the upper reaches of the site, where an abundance of downed aspen logs apparently inhibit access to the creek. At the lower reaches of the site, the forest becomes more open, and livestock impacts are evidenced by browsed and trampled cottonwood seedlings, and large patches of non-native grasses (*Bromus* spp., *Poa pratensis*) in the understory. Several two-track roads skirt the edge of the riparian forest, but they appear to show little use. The extreme eastern edge of the site is contained within the Sangre de Cristo Wilderness and a hiking trail passes through the northeast edge of the site.

Biodiversity Rank Justification: This site supports some of the most extensive stands of aspen/water birch (*Populus tremuloides/Betula occidentalis*) and narrow-leaf cottonwood/water birch (*Populus angustifolia/Betula occidentalis*) riparian forests in Colorado.

The narrow-leaf cottonwood/water birch plant association occurs in Utah and Colorado (Padgett *et al.* 1989, Kittel *et al.* 1994). Similar types may occur in Nevada, Idaho, Montana, Wyoming (Manning and Padgett 1995, Hansen *et al.* 1995, Youngblood *et al.* 1985, and Gerard *et al.* 1995). In Colorado, this association occurs in the White and Gunnison National Forests on the western slope and along the Front Range (Kittel *et al.* 1996, Kittel *et al.* 1995, Kittel *et al.* 1994, Rondeau 1995, Cooper and Cottrel 1990). Thus far, less than twenty occurrences of the type have been reported in the state.

The aspen/water birch plant association is documented from eastern Nevada (Manning and Padgett 1995) and Colorado (Colorado Natural Heritage Program 1997). In Colorado, this plant association is known only from steep foothill streams of the west side of the Sangre de Cristo Mountains and along the Colorado Front Range. This association is highly threatened by development, recreational use, and stream impoundments.

In addition to the rare plant communities, the site contains excellent grassland, woodlands, and aquatic habitats, providing exceptional habitat for common species of plants and animals.

Natural Heritage elements at the Rito Alto Bosque site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus angustifolia/Betula occidentalis</i>	montane riparian forest	G3	S1		B 7/13/97
<i>Populus tremuloides/Betula occidentalis</i>	montane riparian forest	G1	S1		A 7/13/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundary is drawn to encompass the floodplain of Rito Alto Creek and the juniper and oak woodlands which flank the riparian wetlands. This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) to delineate an area of valuable aquatic habitat which may be impacted by hydrological disturbances upstream. The site boundary was based on initial aerial photo analysis, a field visit by CNHP wetland and riparian ecologists, and subsequent corroboration with satellite imagery.



Aspen and birch

Dimick Gulch

Biodiversity Rank: B3 (High significance)

The Dimick Gulch site contains an excellent occurrence of a narrowleaf cottonwood-Rocky Mountain juniper riparian plant association.

Protection Urgency Rank: P4

Over 90% of the Dimick Gulch site is owned and managed by Rio Grande National Forest and Bureau of Land Management. Two small inholdings occur in the lower and middle sections. Development of this site is not likely in the near future, but adequate protection requires continued hydrologic integrity in the watershed. The site has no special protection status on either the private or federal lands. If special protection of this site is desired, actions should focus on preserving the key watershed processes of flooding and natural fluvial disturbance as well as the on-site elements.

Management Urgency Rank: M5

Management of this site is currently adequate.

Location: This site lies two air miles northwest of the town of Crestone.

U.S.G.S. 7.5 minute quadrangle name : Rito Alto Peak

Legal Description: T44N, R11E S 35, 36

T44N, R12E S 20,29,30,31

General Description: The Dimick Gulch site is located on the western slope of the Sangre de Cristo Mountains, at the edge of the San Luis Valley. It is a steep and rugged canyon with dense riparian growth. A four-wheel drive road follows the canyon up to an old cabin, where it terminates. The site contains a diverse array of shrub species on slopes adjacent to the riparian zone. Surrounding hillsides have ponderosa pine (*Pinus ponderosa*) and pinyon pine-juniper (*Pinus edulis-Juniperus monosperma*) woodlands. This site covers approximately 1,750 acres and extends from 7900 to 11600 feet (2420-2890 meter) in elevation.

Biodiversity Rank Justification: The Dimick Gulch site contains an excellent occurrence of a narrowleaf cottonwood-Rocky Mountain juniper (*Populus angustifolia-Juniperus scopulorum*) riparian plant association. Narrowleaf cottonwood (*Populus angustifolia*) and Rocky Mountain juniper (*Juniperus scopulorum*) dominated riparian areas are very uncommon. This plant association is usually restricted to stream banks of narrow washes and creeks on steep-sided canyons such as occur at the Dimick Gulch site. Rocky Mountain juniper grows at the high water line and above, while the narrowleaf cottonwood grades into the active floodplain area. The narrowleaf cottonwood-Rocky Mountain juniper plant association and related types have been reported from Wyoming, and south to New Mexico; excellent occurrences of this type are rare (Hansen *et al.* 1995, Youngblood *et al.* 1985, Gerard *et al.* 1995, Padgett *et al.* 1989, Durkin *et al.* 1995, Johnston 1987, Cooper and Cottrell 1990, Colorado Natural Heritage Program 1997).

Natural Heritage elements at the Dimick Gulch site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus angustifolia</i> - <i>Juniperus scopulorum</i>	montane riparian forest	G2	S2		A 6/17/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The boundary drawn encompasses the riparian community described above and the adjacent uplands. The boundary also includes the immediate upstream watershed to protect against alterations to the stream flow which could impair the regeneration of the cottonwood element of this association.

Lake Fork of North Crestone Creek

Biodiversity Rank: B3 (High significance)

The Lake Fork of North Crestone Creek supports an unranked occurrence of Smith whitlow-grass. This mustard is a south-central Colorado endemic with only eight known occurrences.

Protection Urgency Rank: P4

The site is within the Sangre de Cristo wilderness area of the Rio Grande National Forest (see Appendix A for ownership map). Further field visits are needed to determine protections needs for this site.

Management Urgency Rank: M5

Management may be needed in the future as greater knowledge is gained about the requirements of the Smith whitlow-grass. Monitoring of this population every three to five years may help to establish future management needs and assess the stability and viability of this population.

Location: This site lies near the eastern boundary of Saguache County (Figure 6), approximately four air miles northeast of Crestone.

U.S.G.S. 7.5 minute quadrangle name : Rito Alto Peak

Legal Description: T44N, R12E S 26

General Description: The Lake Fork of North Crestone Creek site is along the south-facing slope of the creek. This is a moist and rocky site dominated by aspen at approximately 10,800 feet. This site was last visited by Tim Hogan, of the University of Colorado Museum, in 1992 and was not visited by CNHP in 1997.

Biodiversity Rank Justification: This site supports an unranked occurrence of the south-central Colorado endemic Smith's whitlow-grass (*Draba smithii*). This species is restricted to south and central Colorado and only known from eight occurrences over five counties: Custer, Las Animas, Mineral, Saguache, and Lake. Five of the eight occurrences have not been reportedly observed since 1978 (CNHP 1997).

Natural Heritage elements at the Lake Fork of North Crestone Creek.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Draba smithii</i>	Smith whitlow-grass	G2	S2	(C2), FS	unranked 6/23/92

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is preliminary as we did not verify the site during the 1997 field season. Therefore, the boundary is conservative and only includes the occurrence. Further field inventories are needed to refine this site boundary.

Head of Spanish Creek

Biodiversity Rank: B2 (Very high significance)

This site includes a good occurrence of the globally rare mustard, Smith whitlow-grass, one of only eight known occurrences.

Protection Urgency Rank: P2

The site is within the Sangre de Cristo wilderness area of the Rio Grande National Forest (see Appendix A for ownership map). Further field visits are needed to determine protection needs for this site.

Management Urgency Rank: M4

Management may be needed in the future as greater knowledge is gained about the requirements of the Smith whitlow-grass. Monitoring of this population every three to five years may help to establish future management needs and assess the stability and viability of this population.

Location: This site lies near the crest of the Sangre de Cristo Mountains (number 15 in Figure 6), approximately four miles east-southeast of the town of Crestone. Access is extremely difficult, as there are no trails and the site is privately owned.

U.S.G.S. 7.5 minute quadrangle name : Crestone Peak

Legal Description: unsurveyed

General Description: This site encompasses the ridge and south-facing open slopes above Spanish Creek and below Kit Carson Peak (Challenger Point). The elevation is approximately 11,400 to 12,200 feet. It encompasses approximately 100 acres. The site is dominated by unstable talus slopes near timberline with common juniper (*Juniperus communis*), bristle cone pine (*Pinus aristata*), fleabane (*Erigeron pinnatisectus*), and shrubby cinquefoil (*Pentaphylloides floribunda*).

Biodiversity Rank Justification: This site includes a good occurrence of a globally rare mustard species within a pristine and hard-to-access setting. This species is restricted to south and central Colorado and only known from eight occurrences over five counties: Custer, Las Animas, Mineral, Saguache, and Lake. Five of the eight occurrences have not been reportedly observed since 1978 (CNHP 1997).

Natural Heritage elements at the Head of Spanish Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Draba smithii</i>	Smith whitlow-grass	G2	S2	(C2), FS	B 7/14/91

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This site includes the occurrence and the adjacent slopes with suitable habitat. This site was not visited by CNHP in 1997. The boundary was drawn using the 7.5 minute topographic map and a 1988 NAPP 1:40,000 color infrared photograph along with satellite imagery.

Milwaukee Peak

Biodiversity Rank: B3 (High significance)

The Milwaukee Peak site contains an unranked occurrence of the globally rare Gray's Peak whitlow-grass. This is one of eight occurrences known for this alpine Colorado endemic.

Protection Urgency Rank: P4

The site is within the Sangre de Cristo wilderness area of the Rio Grande National Forest. The most important issue is one of management.

Management Urgency Rank: M4

Very little is known about the life history of the Gray's Peak whitlow-grass. Further research is needed to refine future management plans. A U.S. Forest Service trail passes through this site, but we do not know if it is impacting the Gray's Peak whitlow-grass occurrence. We recommend monitoring of the population for changes in abundance as well as any impacts the trail system may have on the Gray's Peak whitlow-grass. Further field visits are needed to determine extent, quality, condition, and management needs.

Location: Milwaukee Peak (number 17 in Figure 6).

U.S.G.S. 7.5 minute quadrangle name : Crestone Peak

Legal Description: T24S R73W S 21, 22

General Description: This site is in the alpine scree of Milwaukee Peak. The last observation date recorded is 1985, Colorado Natural Heritage Program ecologists did not visit this site in 1997. We do not have any other information at this time.

This site covers approximately 85 acres and ranges in elevation from 13,200 to 13,500 feet.

Biodiversity Rank Justification: The Milwaukee Peak site contains an unranked occurrence of the globally rare Gray's Peak whitlow-grass. This is one of eight occurrences known for this Colorado alpine endemic

Natural Heritage elements at the Milwaukee Peak site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Draba grayana</i>	Gray's Peak whitlow-grass	G2	S2		unranked 1985-07-25

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The boundary encompasses the scree slopes including the ridge top and known occurrence. Ecological processes which support fellfield succession are believed to be incorporated.

Cottonwood Creek

Biodiversity Rank: B3 (High significance)

This site includes three plant communities of concern and two rare plants, of which the slender spiderflower and the narrowleaf cottonwood/rocky mountain juniper riparian community are the most significant elements.

Protection Urgency Rank: P3

The upper elevations of this site is owned and managed by Rio Grande National Forest, while the lower elevations are privately owned (see following map). This private section of this site is an excellent candidate for a partnership conservation agreement with the landowner, e.g., a conservation easement.

Management Urgency Rank: M3

Management of water resources and livestock grazing may be needed, especially with regards to the privately owned part of this site. The riparian vegetation shows little to no cottonwood regeneration. This is most likely caused by cattle grazing on seedlings, since a natural hydrologic regime is intact. Preventative and restoration actions could include fencing off the riparian areas or limiting grazing to early spring and summer, or only in the winter, which would minimize grazing on seedlings. Periodic monitoring of the riparian area and especially the slender spiderflower occurrence would help assess any future changes in quality and condition of these elements.

Location: Approximately 5 miles south of the town of Crestone.

U.S.G.S. 7.5 minute quadrangles: Crestone, Crestone Peak

Legal Description: not surveyed to sections

General Description: Cottonwood Creek begins in the alpine zone at the 14,000 foot peaks of Kit Carson Mountain and Crestone Peak in the Sangre de Cristo Mountains and ends at the Weisman Lake area on the San Luis Valley floor. The alpine lakes support a small occurrence of the arctic draba (*Draba fladnizensis*). The lower montane riparian areas support the unusual combination of Douglas fir (*Pseudotsuga menziesii*) and river birch (*Betula occidentalis*). As Cottonwood Creek reaches the San Luis Valley floor it becomes a lower gradient and more meandering stream. The vegetation reflects this change in geomorphology with narrowleaf cottonwood (*Populus angustifolia*) and rocky mountain juniper (*Juniperus scopulorum*) dominating the creek side. At the lowest elevations of this site a small occurrence of the slender spiderflower (*Cleome multicaulis*) was found scattered across an area where the water table apparently approaches the soil surface. It was found in a dry, sandy soil dominated by an open community of saltgrass (*Distichlis spicata*). Adjacent to the saltgrass, nearer the creek, is a wet meadow dominated by Baltic sedge (*Juncus balticus*) and Kentucky blue grass (*Poa pratensis*).

The upland vegetation at the upper elevations is dominated by mixed conifer forests, including pinyon pine (*Pinus edulis*), Douglas fir, and Engelmann spruce (*Picea*

engelmannii). The upland vegetation at the lower elevations is a shrubland comprised of rabbitbrush (*Chrysothamnus nauseosus*) and greasewood (*Sarcobatus vermiculatus*). The slender spiderflower occurs in the transition area between the shrubland and the wet meadow.

The site include approximately 5,724 acres ranging in elevation from 14,000 to 7600 feet.

Biodiversity Rank Justification: The Cottonwood Creek site is biologically significant for its plant communities and plant occurrences. A good example of the globally rare slender spiderflower, is the species of primary concern. This small annual plant has its center of distribution in the Closed Basin of Colorado. Also of global importance is the riparian community of narrowleaf cottonwood/rocky mountain juniper. The nearby Deadman Creek supports the exemplary occurrence of this riparian community. The excellent example of the Douglas fir/river birch community in the foothills portion of this site adds further importance to this site.

Natural Heritage elements at the Cottonwood Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Pinus edulis-(Juniperus monosperma)/Stipa scribneri</i>	foothills pinyon-juniper woodland	G2G3	S1?		historic 1977-02
<i>Populus angustifolia-Juniperus scopulorum</i>	montane riparian forest	G2	S2		B 6/27/97
<i>Pseudotsuga menziesii/Betula occidentalis</i>	montane riparian forest	G4	S3		A 6/29/97
<i>Cleome multicaulis</i>	slender spiderflower	G2G3	S2S3	(C2)	B 6/27/97
<i>Draba fladnizensis</i>	arctic draba	G4	S2S3		C 7/22/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time. The boundary was delineated using a 1988 NAPP 1:40,000 aerial photograph and satellite imagery.

Cedar Canyon

Biodiversity Rank: B4 (Moderate significance)

The Cedar Canyon site includes a good condition, but small example of a foothills riparian forest.

Protection Urgency Rank: P3

This site is privately owned, although no future development plans are known.

Management Urgency Rank: M3

The riparian vegetation shows little or no cottonwood regeneration. This is most likely because of cattle grazing on seedlings and sapling, since other natural processes and a natural hydrologic regime appear intact. Improved livestock management could include fencing off the riparian areas, or limiting grazing to short duration summer or winter only use, which would minimize grazing on seedlings. Regeneration of cottonwoods is essential to prevent loss to the occurrence.

Location: This site is on an unnamed tributary of Cedar Canyon, located near the center of the Luis Maria Baca Ranch.

U.S.G.S. 7.5 minute quadrangle: Crestone

Legal Description: unsurveyed

General Description: Cedar Canyon contains an unnamed tributary that is a cobble - bottomed, clear water creek, arising in the Sangre de Cristo mountains(see following map). The surrounding uplands are sand ridges covered with pinyon-juniper (*Pinus edulis-Juniperus* sp.), rabbitbrush (*Chrysothamnus nauseosus*), and ponderosa pine (*Pinus ponderosa*) communities on the north-facing sides. The south-facing sides are similar in vegetation, but lack the ponderosa pine. The creek runs over an alluvial at the mouth of the canyon before reaching the San Luis Valley floor. The creek has a narrow band of riparian vegetation, containing cottonwood (*Populus angustifolia*) and Rocky Mountain juniper (*Juniperus scopulorum*). Numerous mayflies were observed on the overhanging vegetation.

Biodiversity Rank Justification: This site includes a small but good quality example of a narrowleaf cottonwood-Rocky mountain juniper riparian forest. This riparian community is limited to foothill streams in Colorado. A much larger occurrence of this is found along Deadman Creek, just south of Cedar Canyon.

Natural Heritage element occurrence at Cedar Canyon site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus angustifolia- Juniperus scopulorum</i>	montane riparian forest	G2	S2		B 6/28/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to include the riparian area that supports the above community. It is designed to protect the occurrence from direct impacts such as trampling or other surface disturbances; and to include the immediate slopes which contribute surface and groundwater flow to the riparian area. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.

Deadman Creek

Biodiversity Rank: B2 (Very high significance)

The Deadman Creek site supports a good example of the globally rare Smith whitlow-grass. In Additionally, it supports the state's exemplary and largest occurrence known of the rare narrowleaf cottonwood-Rocky Mountain juniper montane riparian forest, and excellent examples of other riparian and upland plant communities. A population of the Rio Grande cutthroat trout, a breeding colony of the pale lump-nosed bat, and a globally rare orchid subspecies add to the importance of this site.

Protection Urgency Rank: P3

The upper part of this site is well-protected as a research natural area within a U.S. Forest Service wilderness area. The lower part of this site is privately owned and operated as a cattle ranch which affords no formal conservation protection. This site is an excellent candidate for a partnership conservation agreement with the landowner, e.g. a conservation easement, or habitat conservation plan. This site is adjacent to the Sand Dunes site (see following map).

Management Urgency Rank: M3

Management actions may be needed on the private section. The riparian vegetation shows little to no cottonwood regeneration. This is most likely caused by cattle grazing on seedlings, since a natural hydrologic regime is intact. Preventative and restoration actions could include fencing off the riparian areas or limiting grazing to early spring and summer, or solely in the winter, which would minimize grazing on seedlings.

If the abandoned mines on this site are scheduled for closure, installing bat-friendly gates, rather than simply plugging the entries, would allow the colony of pale lump-nosed bats to persist.

Location: Approximately 12 miles south of Crestone, on Rio Grande National Forest and Luis Maria Baca Ranch.

U.S.G.S. 7.5 min. quadrangles: Crestone Peak, Crestone

Legal Description: Not available, this area has not been surveyed

General Description: The Deadman Creek site encompasses much of the Deadman Creek watershed. This creek drains steeply out of the western flank of the Sangre de Cristo Mountains, tumbles out over a large alluvial fan, slowing considerably when it meets the valley floor. Once on the valley floor, the creek bed meanders and becomes braided in places. Historically, it appears to have been a "flashy" stream with consistent high flows in the spring from melting snow. In very wet years, the stream flowed through multiple channels, deposited abundant sediment, and changed courses, building the alluvial fan along the mountain front. Lower on the valley floor, the creek becomes entrenched in places and rarely leaves its banks. This active alluvial plain supports three excellent examples of globally rare deciduous forests. The upper, montane and foothill reaches support the

aspen/Rocky Mountain maple (*Populus tremuloides/Acer glabrum*) plant association. The foothill, or transition, reaches support the largest known occurrence of the globally rare narrowleaf cottonwood-Rocky Mountain juniper (*Populus angustifolia-Juniperus scopulorum*). On the valley floor, where the stream becomes intermittent, a stand of a newly described community, the narrowleaf cottonwood/whiplash willow (*Populus angustifolia/Salix lucida* var. *caudata*) plant association occurs.

In addition to these unique riparian communities, Deadman Creek also supports a population of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) and the Canyon bog orchid (*Platanthera sparsiflora* var. *ensifolia*). In a near-by abandoned mine in the foothills is a maternity nursery for the pale lump-nosed bat (*Corynorhinus townsendii pallescens*). The uplands of the steep mountain sides contain an excellent occurrence of Smith whitlow-grass (*Draba smithii*) and mixed mountain shrubland (*Cercocarpus montanus/Muhlenbergia montana*). The entire valley and riparian area is nearly roadless and in excellent to moderate condition.

The purity rating of the Rio Grande cutthroat trout population is potentially low and at best confusing due to the numerous stockings of Pike's Peak cutthroat trout in the 70's and Snake River cutthroat trout in the 80's and 90's (Harig and Fausch 1996). We also found rainbow trout in the lower section, which are known to hybridize with cutthroats.

The land use of this site varies considerably. The Forest Service Research Natural Area in the mountains is rarely used by humans due to difficult access, while the valley floor and foothills portions of the site are primarily used for cattle grazing. An old and unmaintained trail exists in the montane zone and a two-track road crosses Deadman Creek several times on the valley floor. Downstream of the lower boundary for the proposed conservation site, Deadman Creek is diverted into a hay meadow pasture.

The site is approximately 3,500 acres in size and ranges in elevation from 7,600 to 12,300 feet (2,315-3,745 meters).

Biodiversity Rank Justification: The Deadman Creek site supports a good example of the globally-rare Smith whitlow-grass (known, globally, from eight sites). In addition, it supports the largest occurrence known of the rare narrowleaf cottonwood-Rocky Mountain juniper montane riparian forest, and an excellent example of a rare aspen forest. Also, a newly described cottonwood community occurs within this site. A population of the Rio Grande cutthroat trout and a breeding colony of the pale lump-nosed bat (of which only four are documented in Colorado) add to the importance of this site. This site also includes one of the highest elevation occurrences of the mixed mountain shrubland and a globally rare orchid subspecies.

Natural Heritage element occurrences at the Deadman Creek site. Multiple listings of the same element represent suboccurrence. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Communities					
<i>Cercocarpus montanus/Muhlenbergia montana</i>	mixed mountain shrubland	GU	S2		B 6/28/97
<i>Populus angustifolia/Salix lucida</i> var. <i>caudata</i>	montane riparian forest	G1	S1		C 6/30/97
<i>Populus angustifolia-Juniperus scopulorum</i>	montane riparian forest	G2	S2		B 6/30/97
<i>Populus tremuloides/Acer glabrum</i>	montane riparian forest	G2	S1S2		A 6/28/97
Plants					
<i>Draba smithii</i>	Smith whitlow-grass	G2	S2	(C2), FS	B 6/28/97
<i>Platanthera sparsiflora</i> var. <i>ensifolia</i>	canyon bog orchid	G4G5T3	S2		C 6/28/97
Vertebrates					
<i>Corynorhinus townsendii pallescens</i>	pale lump-nosed bat	G4T4	S2		A 7/28/97
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	C 6/26/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundaries drawn encompasses most of the Deadman Creek watershed and the bat maternity roost. Because of the imminent threat of ground water pumping, a much larger area should be considered in any management or protection strategy.



Townsend's big-eared bat



Indian rice grass and needle and thread grassland



Smith whitlow grass

Photo by Loraine Yeatts

Upper Medano Creek

Biodiversity Rank: B3 (High significance)

The Upper Medano Creek site harbors a good occurrence of a globally rare riparian shrubland, an excellent example of an alpine wetland, an introduced population of the globally rare Rio Grande sucker, and several unranked occurrences of the globally rare Rio Grande cutthroat.

Protection Urgency Rank: P4

This site falls entirely on public lands owned and managed by Rio Grande National Forest and Great Sand Dunes National Monument. The Forest Service lands are designated as wilderness area, which affords some protection against human-induced alterations, and the Park Service lands afford similar protection measures.

Management urgency Rank: M4

Management actions are not needed now. Currently, the streams are free from exotic fishes, but periodic monitoring will help to verify this through time.

Location: On upper Medano Creek, just northeast of Great Sand Dunes on Rio Grande National Forest land.

U.S.G.S. 7.5 minute quadrangles: Beck Mountain, Liberty, Medano Pass.

Legal Description: T25S, R72W S 4,5,6,7,8,9

T25S, R73W S 1,2,11,12

T26S, R72W S 16,17,18,19,20,21,28,29,30,31,32,33

T26S, R73W S 24,25,36

General Description: The Upper Medano Creek Site covers about 11,500 acres and spans an elevational range from 8,700 - 12,600 feet (2,600 – 3,800 meters). This site has some sand dunes at the lowest elevations, and grades through montane forests to subalpine areas at the crest of the Sangre De Cristo Mountains. Upper portions of the Medano Creek site lie in a glaciated cirque basin. Medano Lake, at the upper elevations, is surrounded by subalpine wetlands in excellent condition. These wetlands include shrublands, sedge meadows, and forblands. The dominant plants within these wetlands include short fruit willow (*Salix brachycarpa*), water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), bittercress (*Cardamine cordifolia*), mountain bluebells (*Mertensia ciliata*), and narrowleaf groundsel (*Senecio triangularis*).

Medano Creek steepens as it leaves the cirque basin and plunges through subalpine fir-Engelmann spruce forests (*Abies lasiocarpa*-*Picea engelmannii*), followed by aspen forests (*Populus tremuloides*) and finally Douglas-fir (*Pseudotsuga menziesii*) forests in the foothills before reaching the north-eastern edge of the sand dunes. When the stream lessens its gradient at the lower elevations, patches of alders (*Alnus incana*), and Drummond willow

(*Salix drummondii*) shrublands dominate the streamside. These shrublands are small in size but provide important nutrient and cover to the aquatic habitat.

Biodiversity Rank Justification: The Upper Medano Creek site supports six different elements of biodiversity, and a total of ten occurrences distributed among these elements. Three of these elements, thinleaf alder/mesic forb riparian shrubland (*Alnus incana*/mesic forb), Rio Grande sucker (*Catostomus plebeius*), and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*); are considered globally rare. The populations of Rio Grande cutthroat were introduced following an exotic fish removal project in the 1970's. The Rio Grande sucker was introduced to the site in 1996, and was still doing well in 1997 (Sue Swift pers. comm.).

The Rio Grande cutthroat trout's range once included the entire Rio Grande and Pecos River watersheds, and possibly the upper Canadian River as well (Trotter 1987). In Colorado, the species occupies less than 1% of its former range (Alves 1996), and wild, genetically pure stock populations are especially imperiled. Artificial habitat including wells, farm ponds, and extensive canal systems as well as human activities including dewatering, fishing and stocking, transbasin diversions, release of domestic sewage, stream channelization, and agricultural chemical applications have greatly modified the original aquatic ecosystem of the San Luis Valley (Zuckerman 1984). These modifications may have contributed directly to the decline in range of the native fishes of the Rio Grande drainage. Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout.

Natural Heritage element occurrences at the Upper Medano Creek site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Alnus incana</i>/mesic forb	thinleaf alder/mesic forb riparian shrubland	G3	S3		B 7/23/97
<i>Cardamine cordifolia-Caltha leptosepala</i> alpine wetland	alpine wetland	G4	S4		A 7/24/97
<i>Salix brachycarpa/Carex aquatilis-Carex utriculata</i>	subalpine willow carr	G3G4	S3S4		A 7/24/97
<i>Salix drummondiana</i> /mesic forb	montane riparian shrubland	G4	S4		C 7/22/97
Fish					
<i>Catostomus plebeius</i>	Rio Grande sucker	G3G4	S1	SE	I 1996
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked no date
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 10/12/87
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked no date

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 8/10/93

*EO=Element Occurrence

Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the creek and riparian ecosystem. Any activity within the boundary of this watershed has the potential to negatively affect the fishes and riparian communities by impacting water quality and quantity. The boundary was delineated using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:125,000.

North Sangre de Cristo Mountains-North Valley Floor Sub-Region








The North Sangre de Cristo Mountains-North Valley Floor-Sub-region lies in the northeastern part of Saguache County and includes sites along the foothills of the Sangre de Cristo Mountains and on the northern part of the San Luis Valley floor (Figure 7). This sub-region contains six proposed conservation sites (see following table). **Two of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County: Decker Creek and Villa Grove.** The Villa Grove site contains significant amounts of private land, while Decker Creek is owned and managed primarily by the Bureau of Land Management (See Appendix A for ownership maps). The following table summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the sub-region.

List of Saguache County, North Sangre de Cristo Mountains-North Valley Floor Sub-region Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Page number
Decker Creek	B 2	P 4	M 4	114
Villa Grove	B 2	P 3	M 3	117
Sangre's Alluvial Fan	B 3	P 4	M 4	120
Clayton Cone	B 4	P 4	M 4	124
Mineral Hot Springs	B 4	P 4	M 4	126
Moffat playas	B 4	P 2	M 2	128

NORTH SANGRE DE CRISTO MOUNTAINS-NORTH VALLEY FLOOR SUB-REGION

Decker Creek.....	.....	114
Sangre's Alluvial Fan.....	.....	117
Milla Grove.....	.....	120
Clayton Cone.....	.....	124
Mineral Hot Springs.....	.....	126
Moffat Playas.....	.....	128

-  Saguache county
-  Closed basin
-  Roatis
-  Streams
-  Suggested conservation sites

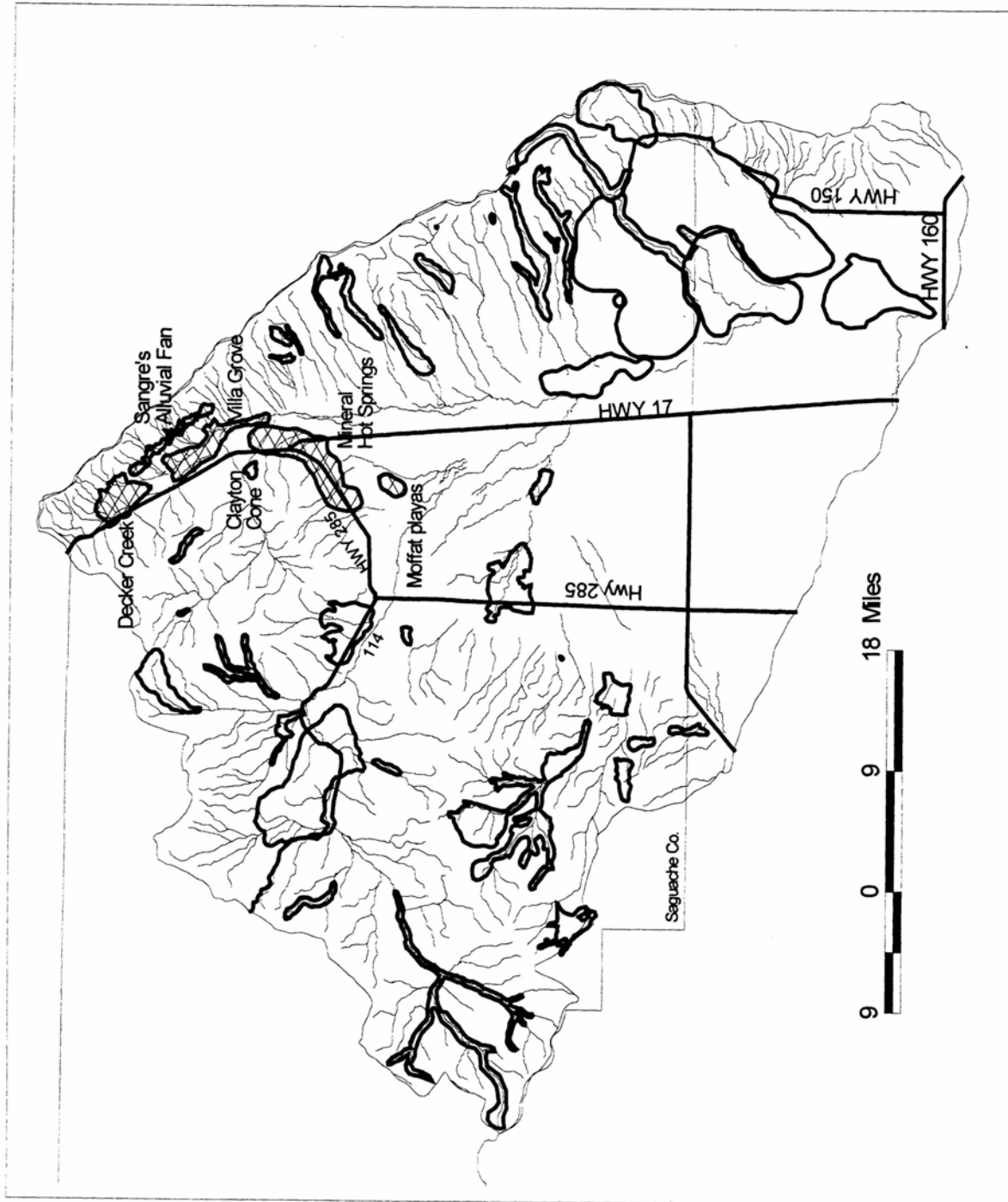


Figure 7. North Sangre de Cristo Mountains-North Valley Floor sub-region proposed conservation sites.

Decker Creek

Biodiversity Rank: B2 (Very high significance)

This site includes two fair occurrences of the globally rare and Colorado restricted Gunnison sage grouse. This population is one of five known.

Protection Urgency Rank: P4

The majority of this site is managed and owned by the Bureau of Land Management (see Appendix A for ownership map), with smaller state and private portions. This population has been in the area for many years, and recent local anecdotes suggest that “there used to be grouse all over, but they’re not seen as often anymore.” The Colorado Division of Wildlife is currently spearheading an effort to produce a habitat conservation plan for the area, so protection needs are already well underway. To address the needs for protection of the grouse on private lands within this site, a local working group was formed by biologists of the Colorado Division of Wildlife.

Management Urgency Rank: M4

The Colorado Division of Wildlife is currently addressing management needs for the population of grouse at this site, and all interested parties should be directed to the local working group associated with this population of grouse. Management needs are well on their way to being met via this working group.

Location: The Decker Creek site is centered on the confluence of Decker and San Luis creeks, near Poncha Pass, in northeastern Saguache County (Figure 7)

U.S.G.S. 7.5 minute quadrangles: Bushnell Peak, Poncha Pass, Wellsville, Whale Hill

Legal Description:	T47N, R8E	S 1
	T47N, R9E	S 5,6,7,8
	T48N, R8E	S 25,26,35,36
	T48N, R9E	S 29,30,31,32,33

General Description: The Decker Creek site is comprised of rolling hills dominated by a sagebrush shrubland (*Artemisia tridentata* ssp. *vaseyana*), and is part of the larger intact sagebrush habitat found around Poncha Pass. The sagebrush habitat in Saguache County is primarily limited to this area. This shrub rangeland exists on the western lower slopes of the northern Sangre de Cristo mountain range. San Luis Creek drains the area from the north, and Decker Creek drains from the east.

This site is important habitat for a small population of Gunnison sage grouse, which specialize on sagebrush lands. Although a natural population existed at this site, the Division of Wildlife has since augmented this population with approximately 150 individuals in 1971-72.

The primary use of this site is livestock grazing. Several two-track roads cross this site and Hwy 285 is near the western boundary.

Biodiversity Rank Justification: This site supports the only population of Gunnison sage grouse (*Centrocercus minimus gunnisonii*) in the San Luis Valley. This grouse is restricted to a small portion of west central Colorado in its global distribution (see following map), and will likely get petitioned for listing under the Endangered Species Act in the near future.

The population of Gunnison sage grouse at this site is small in terms of both numbers of grouse and area of occupied habitat when compared to occurrences in the Gunnison Valley. Because this occurrence represents a satellite population of this globally rare species, the biodiversity rank for this site is B2. Sites developed in the heart of the range for this species will more likely justify the higher B1 rank.

Natural Heritage element occurrences at the Decker Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Centrocercus minimus gunnisonii</i>	Gunnison sage grouse	G1	S1		C 5/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundaries drawn for this site were chosen to encompass the known nesting and lekking areas, as well as the surrounding sagebrush habitat. The boundaries were extended south to include some mesic lowlands that are important foraging areas for young grouse.

Lekking areas are described as openings in an expanse of sagebrush. Two of the more important factors in a good lek site are good visibility (for predator detection) and good acoustics (for carrying the sounds associated with breeding displays). Nesting areas are usually in taller, more dense sagebrush within 1.75-2.5 miles of the lek area (Working Draft Gunnison Sage Grouse Conservation Plan; Gunnison Basin - Colorado).

The surrounding sagebrush habitat is used by the hen and her chicks for foraging; in particular, areas where green forbs and associated insects are abundant. As the chicks mature, the family units move toward wet meadow or riparian areas adjacent to sagebrush shrublands. Again, areas where abundant green vegetation and associated insects are found, in conjunction with adequate cover from predators are most important (Working Draft Gunnison Sage Grouse Conservation Plan; Gunnison Basin - Colorado).

Seemingly suitable sagebrush habitat to the west of Hwy 285 was not included in the site because a powerline runs through the middle of this habitat. Powerline poles make good perches for raptors (hawks, eagles and owls) that prey on grouse. With proper mitigation measures (i.e., building obstructions on the poles to prevent perching by raptors), this sagebrush habitat west of the highway might provide additional habitat for sage grouse use in the future.



Sagebrush on Round Hill

Sangre's Alluvial Fan

Biodiversity Rank: B3 (High significance)

The Sangre's Alluvial Fan site supports an excellent and large occurrence of an unusual association of Gambel oak with needle-and-thread grass, the only documented occurrence in the world. In addition, the creeks that run through the savanna from the Sangre de Cristo mountains support excellent examples of common riparian communities.

Protection Urgency Rank: P3

The site is primarily owned and managed by the Bureau of Land Management (see Appendix A for ownership map). A private inholding with a residence occurs in the middle of this site. Another private inholding occurs at the southern end. Rio Grande National Forest abuts this site to the east. If fires are an important process necessary to maintain this site, the private inholdings may be of concern. We recommend that BLM consider the biological significance of this site when developing local and regional land use plans.

Management Urgency Rank: M4

This site, in general, is in excellent condition and does not require any immediate changes with management. It has been recorded that heavy spring or early summer grazing reduces abundance of needle and thread grass, therefore livestock grazing management plans should consider this impact. Current cattle stocking rates and timing of grazing should be maintained as is.

Fire may play an important role in maintaining this rare oak savanna. We recommend periodic monitoring of the condition and quality of the grassland, along with study of the historic fire regime.

Location: This site lies in northeast Saguache County (Figure 7), at the base of the Sangre de Cristo Mountains, approximately 5 miles north of the town of Villa Grove.

U.S.G.S. 7.5 min. quadrangle: Bushnell Peak

Legal Description: T47N R9E S 3, 4, 10-14, 23-25
T47N R10E S 19, 29-32

General Description: The western side of the Sangre de Cristo Mountains join the San Luis Valley with large undulating alluvial fans facing southwest. The Sangre's Alluvial Fan site occurs in the northern part of Saguache County. Numerous creeks, such as Raspberry, Butterfly, and Nieland, dissect the fan and create a mosaic of vegetation types. A rare oak savanna dominates, with strips of Gambel oak (*Quercus gambelii*) found along the small cobble drainages, surrounded by a needle and thread (*Stipa comata*) grassland. Northern pocket gophers (*Thomomys talpoides agrestis*) are common within the grassland. The Colorado Division of Wildlife report that the Gunnison sage grouse from the Decker Creek site (this report) forage amongst the oaks found at the Sangres Alluvial Fan Site. We also discovered the first Saguache County record for a tiger beetle (*Cicindela cimarrona purpurea*) within the oak savanna.

Larger streams found along the eastern edge of this site support excellent quality stands of aspen riparian forest, with few to no exotic plants, healthy banks, and clear and clean stream bottoms. Overall the site is relatively free of non-native plants with only a few patches of cheatgrass (*Bromus tectorum*) found near the roadsides.

This site is relatively unfragmented with only a few two-track roads crossing the site and one residence near the middle. The primary land use appears to be light to moderate cattle grazing.

The site is approximately 2,550 acres, ranging in elevation from 8,300 to 9,100 feet (2,525-2,775 meters).

Biodiversity Rank Justification: The Sangre’s Alluvial Fan site supports a large and rare oak savanna. This community has not been recorded elsewhere. In addition, the small creeks within this site exhibit unusually high quality occurrences of riparian forest dominated by either aspen or oak.

Natural Heritage element occurrences at the Sangre’s Alluvial Fan site. Multiple listings of the same element represent separate occurrences. Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus tremuloides/tall forb</i>	montane aspen forest	G5	S5		A 7/28/97
<i>Populus tremuloides/tall forb</i>	montane aspen forest	G5	S5		A 7/29/97
<i>Quercus gambelii-Symphoricarpos oreophilus</i>	mixed mountain shrubland	GU	S3S4		B 8/8/97
<i>Quercus gambelii/Stipa comata</i>	Gambel oak savanna	G2?	S2		A 7/27/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundaries drawn encompass all of the above occurrences and the extent of the Gambel oak savanna. 1992 NAPP infrared aerial photographs were used to assist with delineating these boundaries. The upper hydrologic boundaries for the streams are not included within this site. Consideration of land use in these headwater basins will enhance any site management plans.



Gambel oak and needle and thread grass at Raspberry Creek

Villa Grove

Biodiversity Rank: B2 (very high significance)

This extensive montane wetland supports an excellent example of the geographically restricted Rio Grande chub. In addition, a small population of the globally rare pale blue-eyed grass, and a large stand of the state-rare slender sedge is found here. The fen wetland found at this site is the most extensive and unfragmented wetland of its kind observed during the 1997 survey of the Closed Basin.

Protection Urgency Rank: P3

This site is primarily privately owned by three separate landowners (see Appendix A for detail map). Development is not anticipated in the near future, but none of the site is currently protected. Off-site land uses have the potential to impact elements at this site. The wetland elements at this site are adapted to a highly stable hydrologic environment. Therefore, protection of the hydrologic regime, including ground and surface water resources, is imperative. Possible impacts from upstream mining or toxic spills on Kerber Creek can directly affect the aquatic biota at this site.

Management Urgency Rank: M3

The entire site is used as pasture for domestic livestock. Although the site is generally in good condition, trampling impacts are evidenced by puncturing of wet peat soils, bank erosion along San Luis Creek, and altered species composition. Directing livestock away from the perennially wet stream and fen areas towards more resistant uplands, or limiting grazing to fall/winter when wetlands are drier, would lessen grazing impacts.

Location: This site is in northeastern Saguache County (Figure 7) approximately two miles east of the town of Villa Grove.

U.S.G.S. 7. minute quadrangles: Bushnell Peak, Villa Grove

Legal Description: T46N, R9E S 1, 2, 12
T46N, R10E S 6, 7, 18, 19, 20, 29, 30,
T47N, R9E S 21, 22, 26, 27, 28, 34, 35, 36

General Description: The Villa Grove site contains 5,868 acres of valley bottom wetlands between the northern Sangre de Cristo Mountains and the northeastern Cochetopa Hills. The site encompasses a complex of perennial springs which support extensive fen and meadow wetlands in an otherwise semi-arid sagebrush steppe. The site extends down San Luis Creek from approximately two miles north of the town of Villa Grove to four miles southeast and ranges from 7,780 to 8,100 feet (2,373-2,471 meters) in elevation. Rock and San Luis creeks flow southward and converge with east flowing Kerber Creek in the middle of the site.

This is the largest fen wetland complex in the Closed Basin, and the cold, peat soils and stable hydrology are unique on the San Luis Valley floor. Large sedge wetlands, dominated by beaked sedge (*Carex utriculata*), small flowered sedge (*Carex simulata*), water sedge (*Carex aquatilis*), and Nebraska sedge (*Carex nebrascensis*) occur at the northern end of the site, where the hydrology is most stable. In the fen areas, peat soils are well developed and

often exceed three feet in thickness. In places, exceptionally strong upwelling lifts the peat layer from the mineral substrate, producing “quaking fens”. Montane wet meadows occur downstream of the fens, where soils are moist to wet, but irrigated primarily by surface flow. Common species of the meadow portion include the state-rare slender sedge (*Carex lasiocarpa*), tufted hairgrass (*Deschampsia cespitosa*), and Canadian reedgrass (*Calamagrostis canadensis*). At drier margins of the wetlands, Baltic rush (*Juncus balticus*) meadows, with scattered small populations of the globally-rare pale blue-eyed grass (*Sisyrinchium pallidum*) and fringed gentian (*Gentianopsis thermalis*) occur.

Stream and pond habitats of the site support excellent populations of Rio Grande chub (*Gila pandora*), and several species of trout. Pronghorn (*Antilocapra americana*) are abundant, and apparently use the site for forage and water.

The site is presently used for livestock pasture and receives seasonal grazing. Trampling and erosion of the moist wetland soils are common. On the adjacent, drier Baltic rush meadows, Missouri iris (*Iris missouriensis*), a species known to increase with grazing, is very abundant. Other uses of the site are limited by private ownership.

Biodiversity Rank Justification: Of primary significance to this site is the excellent population of the Rio Grande chub (*Gila pandora*) found in San Luis Creek. This minnow-like fish is restricted to the Rio Grande watershed, including the Closed Basin. Although we do not clearly understand the status and trends for this species, we do know its distribution is limited to less than 20 occurrences in Colorado, its main center of distribution.

The northern part of this site is an important shelter from the effects of Bonanza Mine, which is located twenty miles upstream on Kerber Creek. The two northern creeks and their springfed tributaries provide off-channel refugia for aquatic elements such as the Rio Grande chub, which can flourish in low to moderately oxygenated waters which exclude predatory trout. In July of 1997, heavy rains caused upstream tailing ponds to overtop, resulting in toxic spills and fish mortality in Kerber Creek, and San Luis Creek downstream of their confluence. The off-channel aquatic habitats present at this site may be especially important biotic reservoirs for the recolonization of the San Luis Creek and Kerber Creek channels following such lethal spills.

In addition to the globally imperiled fish, this site supports excellent examples of short-beaked sedge (*Carex simulata*) and beaked sedge (*Carex utriculata*) fen wetlands, state rare slender sedge (*Carex lasiocarpa*) montane meadows, and the globally rare pale-blue eyed grass. The discovery of the slender sedge is a significant range extension, previously only known in Colorado from North Park and the Laramie River Valley (Weber pers. com.); it is more common in the northern Rocky Mountain states. Fen wetlands, which are formed by stable discharge of groundwater, are one of Colorado’s rarer wetland types, particularly at elevations below 9,000 feet. They require wet, anaerobic soils, carbon accumulation from vigorous plant growth, low soil temperatures, and thousands of years to form their characteristic peat soils. Once formed, these peat soils are essentially irreplaceable in any

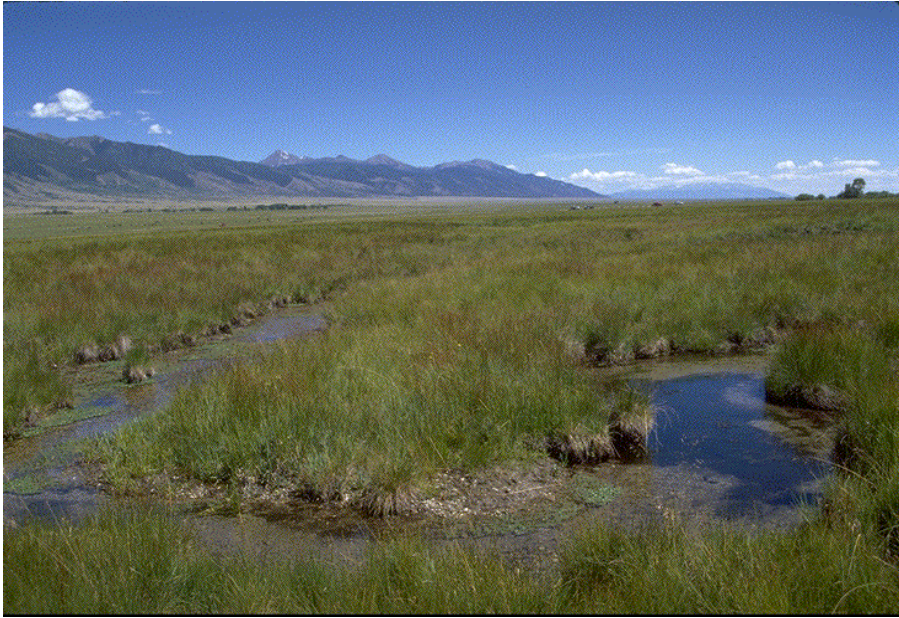
management time frame. The fen wetlands at the Villa Grove site are perhaps the largest relatively low elevation fens in Colorado.

Natural Heritage element occurrences at the Villa Grove site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and date
Plant communities					
<i>Carex simulata</i>	wet meadow	G3	S3		A 7/14/97
<i>Carex utriculata</i>	beaked sedge montane wet meadow	G5	S3		B 7/14/97
Plants					
<i>Carex lasiocarpa</i>	slim sedge	G5	S1		A 7/24/97
<i>Sisyrinchium pallidum</i>	pale blue-eyed grass	G3	S2		B 7/14/97
<i>Sisyrinchium pallidum</i>	pale blue-eyed grass	G3	S2		B 7/24/97
Birds					
<i>Circus cyaneus</i>	northern harrier	G5	S3B, SZ		unranked 1990
Fish					
<i>Gila pandora</i>	Rio Grande chub	G3	S1?		A 8/6/97
<i>Gila pandora</i>	Rio Grande chub	G3	S1?		A 8/6/97
<i>Gila pandora</i>	Rio Grande chub	G3	S1?		B 7/14/97
<i>Gila pandora</i>	Rio Grande chub	G3	S1?		historic 1983-08-25
<i>Gila pandora</i>	Rio Grande chub	G3	S1?		historic 1983-08-25

*EO=Element Occurrence; dates indicates date of last observation

Boundary Justification: This boundary is drawn to 1) protect the wetland elements from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time; and 3) encompass the full range of valley bottom habitats surrounding the springfed wetlands. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP scientists, and subsequent corroboration with satellite imagery.



Villa Grove wetland



Villa Grove wetland



Rio Grande chub

Clayton Cone

Biodiversity Rank: B4 (Moderate significance)

A small occurrence of a foothills pinyon-juniper woodland with Scribner's needle and thread grass is documented at this site.

Protection Urgency Rank: P4

Over 90% of this site is owned and managed by Bureau of Land Management and less than 10% is privately owned (see Appendix A for ownership map).

Management Urgency Rank: M4

Management needs for this site appear minimal at this time. One of the most important ecological processes necessary to maintain the open pinyon woodland is occasional fire. It may be necessary in the future to prescribe a burn for the site or institute a let-it-burn policy. The primary human impacts within the site are from the three two-track roads, which bisect and circumnavigate the site. These roads have a light weed invasion. This may warrant monitoring and control in the future.

Location: This site is in northeastern Saguache County (Figure 7), approximately one mile southwest of Villa Grove.

U.S.G.S. 7.5 minute quadrangle: Villa Grove

Legal Description: T46N R9E S 15, 16, 21, 22

General Description: The Clayton Cone site is at the base of the San Juan foothills on the northwestern edge of the San Luis Valley. This volcanic outcrop is surrounded by shortgrass prairie and abuts Kerber Creek to the north. The habitat is very rocky with lichen-covered bedrock and boulders. An open pinyon pine (*Pinus edulis*) woodland dominates most of the site with various dominant grasses, e.g. blue grama (*Bouteloua gracilis*) and Indian rice grass (*Oryzopsis hymenoides*). Most of the site is comprised of volcanically derived rocks, although a limestone rock outcrop exists in the southern portion of the site.

A two-track road bisects the site and also borders the east and west sides. The primary use of Clayton Cone is livestock grazing. This site is approximately 480 acres and ranges in elevation from approx. 8,150 to 8,660 feet (2,480-2,600 meters).

Biodiversity Rank Justification: The Clayton Cone site includes a small occurrence of foothills pinyon-juniper woodland (*Pinus edulis/Stipa scribneri*). The presence of Scribner’s needle and thread grass with pinyon pine is unusual, with less than 5 occurrences known for the state of Colorado, although more widespread in adjacent states.

Natural Heritage element occurrence at the Clayton Cone site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Pinus edulis-Stipa scribneri</i>	foothills pinyon-juniper woodland	G3	S1?		C 8/19/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to include the entire Clayton Cone outcrop. Although the element of concern is limited to a small area within this site, we believe it is necessary to include the immediate adjacent habitat to allow for movement in response to changing environmental factors. Although we did not find any rare plants, given the uncommon substrates, further investigation during the spring may find some unusual plants. The boundary was delineated using a 1988 NAPP 1:40,000 aerial photograph.

Mineral Hot Springs

Biodiversity Rank: B4 (High significance)

This site supports three globally imperiled subspecies of mammals, and one globally rare insect.

Protection Urgency Rank: P4

This site occurs on a mosaic of Bureau of Land Management, state, and private lands (see Appendix A for ownership map). There are no extensive land use pressures at this site, but the potential for development in the future always persists.

Management Urgency Rank: M4

Mowing the roadsides potentially provides the greatest threat to the mammals of concern; Kirsch (1997) reports that Schmidley and Wilkins (1977) demonstrated that rodent mortality from crossing roads increased significantly immediately following the mowing of roadside ditches. Mowing might best occur in the fall, after the dispersal of the majority of young rodents has occurred. In 1997 mowing occurred in August and appears to have had minimal effect.

Location: This site is in north-central Saguache County (Figure 7), approximately one mile south of Villa Grove along Colorado Highways 17 and 285.

U.S.G.S. 7.5 min. quadrangles: Graveyard Gulch, Villa Grove, Hickey Bridge,
Moffat North.

Legal Description: T45N, R9E S 1,2,10,11,12
T45N, R10E S 6,7
T46N, R9E S 23,24,25,26,35,36
T46N, R10E S 19,30,31

General Description: The Mineral Hot Springs site encompasses most of the contiguous expanse of shortgrass prairie in Saguache County. This prairie is dominated by blue grama (*Bouteloua gracilis*), fringed sage (*Artemisia frigida*), and *Hymenoxys richardsonii*. Soils are generally very loamy, and provide for easy digging by Gunnison's prairie dog (*Cynomys gunnisoni gunnisoni*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus blanca*), silky pocket mouse (*Perognathus flavus sanluisi*), least chipmunk (*Tamias minimus*) and Ord's kangaroo rat (*Dipodomys ordii montanus*). To the north, the habitat grades into sagebrush (*Artemisia tridentata* ssp. *vaseyana*) rangeland, and to the south it tends toward greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus* spp.) uplands. To the east is the Villa Grove fen site, and to the west, the prairie continues sporadically up Saguache Creek. This site covers approximately 13,000 acres, with minimal elevation relief, ranging from 7,700 – 8,000 feet (2,350 - 2,450 meters). Highways 285 and 17 bisect the site and the accompanying roadside ditches host exotic species such as yellow sweetclover (*Melilotus officinale*), crested wheatgrass (*Agropyron cristatum*), and kochia (*Kochia scoparia*).

The primary uses at this site include cattle grazing and big game hunting.

Biodiversity Rank Justification: This site is primarily designated for the diversity of small mammals present on site, although an unranked occurrence of the state rare hoary skimmer (*Libellula nodisticta*) also occurs here. Of all sites sampled for small mammals in the Closed Basin, this site produced the highest diversity (not richness), not only of those species tracked by the Colorado Natural Heritage Program, but of all species of small mammals present in the San Luis Valley.

Natural Heritage element occurrences at the Mineral Hot Springs site. Multiple listings of the same element represent suboccurrences.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Insects					
<i>Libellula nodisticta</i>	hoary skimmer	G5	S1		unranked 7/14/87
Mammals					
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3		A 8/8/97
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3		A 8/11/97
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		C 8/21/97
<i>Spermophilus tridecemlineatus blanca</i>	thirteen-lined ground squirrel subsp.	G5T3	S3		A 8/7/97
<i>Spermophilus tridecemlineatus blanca</i>	thirteen-lined ground squirrel subsp.	G5T3	S3		A 8/21/97
<i>Spermophilus tridecemlineatus blanca</i>	thirteen-lined ground squirrel subsp.	G5T3			B 8/21/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundary for this site was drawn at a scale of approximately 1:100,000 using a satellite image to help identify the most contiguous patch of shortgrass prairie surrounding the element occurrences. It was designed to include the prairie habitat as well as the roadsides that provide an extra food source for the small mammals found at the site (although the road and ditch might be as much a sink as a source, due to highway mortality).

Moffat Playas

Biodiversity Rank: B4 (Moderate significance)

The Moffat Playas site contains two globally significant wetland communities. A great plains salt meadow was found to be in good condition and a *Carex simulata* wet meadow was found to be in fair condition.

Protection Urgency Rank: P2

This site has a mixed ownership with approximately 75% private and 25% state (see Appendix A for ownership map). Numerous residences and roads are within and adjacent to this site. A conservation easement or county open space designation is recommended to protect this wetland for the future.

Management Urgency Rank: M2

The Moffat Playas site and the surrounding area has been subdivided. New roads, residences, and further subdivision threatens the integrity of the site. The hydrology of this site is extremely important. Any further water development or alterations in groundwater and above ground flow will affect this site.

Location: This site is in north-central Saguache County, approximately 6 miles northwest of Moffat.

U.S.G.S. 7.5 min. quadrangle: Moffat North

Legal Description: T44N R9E S 8, 9, 15, 16, 17

General Description: The Moffat Playas site is a small part of a large saline playa lake complex northwest of Moffat. It is characterized by alternating dry shrublands and wetlands. The more saline shrublands are dominated by greasewood (*Sarcobatus vermiculatus*) and the less saline by rabbitbrush (*Chrysothamnus nauseosus*). The understories of both of these shrubland types are similar and vary with any of the following dominants: Alkali sacaton grass (*Sporobolus airoides*), western wheat grass (*Pascopyrum smithii*), salt meadow grass (*Distichlis spicata*), Baltic rush (*Juncus balticus*), or barren ground. The low lands or small basins are dominated with ubiquitous stands of spike rush (*Eleocharis palustris*), Baltic rush, western wheat grass, salt meadow grass, and alkali sacaton grass.

We did not find the slender spiderflower at this site, but this annual species is known to vary in abundance with yearly moisture condition. We believe the numerous wetlands that are visible on the color infrared aerial photos indicate potential habitat for this globally rare plant.

Current land practices include cattle grazing, road building, and subdividing. The site is approximately 1,400 acres and ranges in elevation from 7,600-7,635 feet (2,315-2,330 meters).

Biodiversity Rank Justification: **The Moffat Playas support small occurrences of two globally rare wetland plant communities: Great plains salt meadow (*Sporobolus airoides*) and *Carex simulata* wet meadow. Larger and less fragmented occurrences of both of these communities are known from other sites in the Closed Basin.**

Natural Heritage elements at the Moffat Playas site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Carex simulata</i>	wet meadow	G3	S3		C 7/26/97
<i>Sporobolus airoides</i>	great plains salt meadow	G2?	SU		B 7/25/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundaries drawn encompass the elements and a small part of the surrounding playa complex. Further inventories may find these boundaries to be too small and that a better ecological boundary incorporates the entire playa/shrubland complex. We drew the boundaries using 1988 NAPP 1:40,000 color infrared aerial photos.

Cochetopa Hills Sub-Region



The Cochetopa Hills Sub-region lies in the northwest part of Saguache County and includes sites from the foothills to the subalpine zone of the Cochetopa Hills (Fig. 7). This sub-region contains 11 proposed conservation sites. **Two of these sites have a very high biodiversity significance rank (B2) and should be considered as top priorities in any protection plans for Saguache County: Jacks Creek Uplands and Trickle Mountain.** Both of these sites are owned and managed by the Bureau of Land Management (See Appendix A for ownership maps). The following table summarizes the biodiversity, protection, and management ranks for the proposed conservation sites of the Cochetopa Hills sub-region. See the following site descriptions for more detail.



List of Saguache County, Cochetopa Hills Sub-region Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Proteciton Urgency Rank	Management Urgency Rank	Identification number in Figure 8
Jacks Creek Uplands	B 2	P 2	M 3	33
Trickle Mountain	B 2	P 4	M 4	35
Findley Gulch	B 3	P 4	M 4	34
Ford Creek	B 3	P 3	M 3	31
Jacks Creek Cemetery	B 3	P 3	M 4	32
Kelley Creek	B 3	P 4	M 4	30
Devils Knob	B 4	P 4	M 4	36
Houselog Creek	B 4	P 4	M 4	37
Luder Creek	B 4	P 4	M 3	38
Slaughterhouse Creek	B 4	P 4	M 5	29
East Middle Creek	B 5	P 4	M 4	28

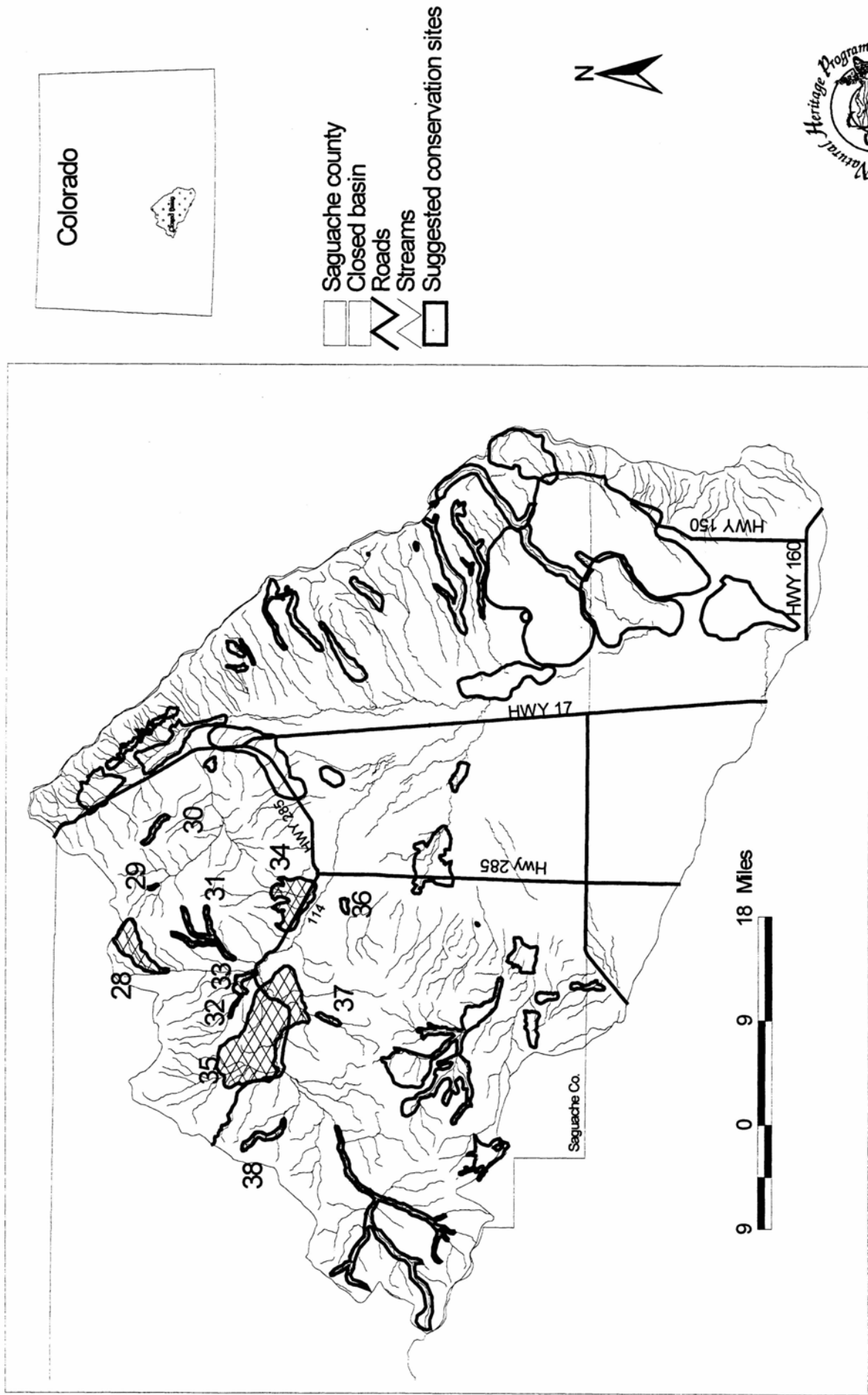


Figure 8. Cochetopa Hills sub-region proposed conservation sites. See following table for site names.

List of Saguache County, Cochetopa Hills Sub-region Proposed Conservation Sites by identification number in Figure 8.

SITENAME	Biodiversity Rank	Identification number in Figure 8
East Middle Creek	B 5	28
Slaughterhouse Creek	B 4	29
Kelley Creek	B 3	30
Ford Creek	B 3	31
Jacks Creek Cemetery	B 3	32
Jacks Creek Uplands	B 2	33
Findley Gulch	B 3	34
Trickle Mountain	B 2	35
Devils Knob	B 4	36
Houselog Creek	B 4	37
Luder Creek	B 4	38

The following site descriptions are geographically ordered beginning with the northern most site of East Middle Creek.

COCHETOPA HILLS SUB-REGION	73
<i>East Middle Creek</i>	134
<i>Slaughterhouse Creek</i>	135
<i>Kelley Creek</i>	137
<i>Ford Creek</i>	139
<i>Jacks Creek Cemetery</i>	142
<i>Jacks Creek Uplands</i>	144
<i>Findley Gulch</i>	147
<i>Trickle Mountain</i>	150
<i>Devils Knob</i>	155
<i>Houselog Creek</i>	157

East Middle Creek

Biodiversity Rank: B5 (General interest)

An unranked occurrence of the state rare Rio Grande cutthroat trout is included within this site.

Protection Urgency Rank: P4

The entire site is within Rio Grande National Forest and there is no need for further protection. See Appendix A for ownership map.

Management Urgency Rank: M4

The Rio Grande cutthroat trout at this site were introduced in 1991, and were still present in 1995. Trout populations should be periodically monitored to ascertain any deleterious changes in populations.

Location: This site lies in northern Saguache County (Figure 8, number 28), on East Middle Creek, approximately three miles south of Marshall Pass.

U.S.G.S. 7.5 minute quadrangle: Chester, Bonanza.

Legal Description: T47N, R6E S 1,2,11,12,13,14,22,23,24,26,27,28,33,34
T47N, R7E S 7,8,17,18,19

General Description: This site was not visited during the Colorado Natural Heritage Program's 1997 field inventories. It covers approximately 5,000 acres and ranges from 8,900 to 13,000 feet (2,700-3,950 meters) in elevation. It encompasses the immediate watershed of a high elevation stream in the eastern San Juan mountains. It is a high montane area with some subalpine influences.

Biodiversity Rank Justification: This site is of general significance in that it supports a transplanted population of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*).

Natural Heritage element occurrence at the East Middle Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	I 1995

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundary for this site was drawn in 1994 and includes the immediate watershed of East Middle Creek. This boundary is the area in which actions may have an effect on the trout at the site.

Slaughterhouse Creek

Biodiversity Rank: B4 (Moderate significance)

The Slaughterhouse Creek site supports a riparian area dominated by aspen and alder that is in excellent condition.

Protection Urgency Rank: P4

The site is managed and owned by Rio Grande National Forest and immediately upstream of private land and Bonanza Mine area (see Appendix A for ownership map). Protection is adequate at this time.

Management Urgency Rank: M4

Management does not need to be changed at this time. Given the proximity of this site to the heavily impacted Bonanza Mine, it is recommended that this site be maintained in its present condition and regarded as a biotic refuge for natural recolonization of the downstream degraded area. Logging, heavy livestock grazing, or water diversion are discouraged. Management is especially important to this watershed because extreme pulses of water or sediment passing through the toxic mine sites have been implicated in fish kills as much as 20 miles downstream on Kerber and San Luis creeks. Land uses in the upper watershed, such as heavy logging and roads, which increase the potential for high runoff or sediments loads, should be avoided.

Location: This site is located in northern Saguache County (Figure 8, number 29), approximately 18 miles west of the town of Villa Grove, using the Bonanza Mine road (Saguache County road LL36).

U.S.G.S. 7.5 minute quadrangle: Bonanza

Legal Description: T47N, R7E S 26

General Description: This site delineates a small canyon which drains the southern slope of Antora Peak and is tributary to Kerber Creek. The Slaughterhouse Creek site supports a near-pristine riparian corridor with a dense and lush riparian canopy. Dominant species include thinleaf alder (*Alnus incana*) along the stream margins, with an overstory of aspen (*Populus tremuloides*) growing on the canyon bottom and moist toeslopes. The undergrowth is intact and dominated by horsetails (*Equisetum arvense*) and *Conioselinum scopulorum* with few non-native plants, and many downed aspen logs. Surrounding uplands slopes are covered with dense mixed conifer forests of Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta* ssp. *latifolia*). Downstream of this site is the Bonanza Mine Superfund site. However, this site is a roadless canyon upstream of any mine impacts, recent or historic.

The site covers approximately 130 acres and ranges in elevation from 9,600 to 10,000 feet (2,925-3,050 meters).

Biodiversity Rank Justification: The Slaughterhouse Creek site supports an excellent quality riparian area dominated by aspen and alder. The quaking aspen/thinleaf alder (*Populus tremuloides/Alnus incana*) montane riparian forest community is located in narrow ravines and along first and second-order streams where upland aspen forests intermix with riparian shrub vegetation. The presence of obligate riparian shrub species distinguish this association from upland aspen communities. This plant community has only been documented from Colorado, although it is probably more widespread.

Natural Heritage elements at the Slaughterhouse Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Populus tremuloides/Alnus incana</i>	montane riparian forest	GU	S3		A 8/5/97

*EO=Element Occurrence

Boundary Justification: This boundary is drawn to include the canyon that support the element of biodiversity found at the site. It is designed to 1) protect the riparian occurrence from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the riparian forest. The boundary was delineated using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

Kelley Creek

Biodiversity Rank: B3 (High significance)

The Kelley Creek site supports an excellent example of the globally rare thinleaf alder/mesic graminoid montane riparian shrubland.

Protection Urgency Rank: P4

This site is managed and owned by Rio Grande National Forest (see Appendix A for ownership maps), but the site receives no special protection status.

Management Urgency Rank: M4

This site exhibits few stresses on the elements of concern and affords a natural hydrologic regime. Current management practices should be continued in order to preserve the excellent condition of this site. In particular, preservation of the natural hydrologic regime is essential to support the riparian community at this site.

Location: The Kelley Creek site is located in northern Saguache County (Figure 8, number 30), approximately 6 mile northwest of the town of Villa Grove.

U.S.G.S. 7.5 minute quadrangle: Whale Hill

Legal Description: T47N, R8E S 21, 26, 27, 28, 35

General Description: The Kelley Creek site is a moderately wide valley with a long, highly sinuous creek and a nearly continuous canopy of thinleaf alder (*Alnus incana*). The undergrowth is dominated by a thick stand of native grasses such as Canadian reedgrass (*Calamagrostis canadensis*), and aside from a few dandelions (*Taraxacum officinale*) is free from non-native plants. A faint pack trail traverses the valley, but it appears to get little use. The slopes are dominated by dense aspen (*Populus tremuloides*) stands. The site is in excellent condition, with few to no anthropogenic changes to the riparian and valley floor habitats. Beaver (*Castor canadensis*) are present in the valley and are important in maintaining the health of this ecosystem. Their ponds expand the wet floodplain habitat and capture fine textured sediment, facilitating meadow formation.

The Kelley Creek site delimits a drainage in the Cochetopa Hills east of Antora Peak. The site covers nearly 900 acres and ranges from 9,600 to 11,600 feet (2,925-3,535 meters) in elevation.

Biodiversity Rank Justification: The Kelley Creek site supports an excellent example of a globally imperiled montane riparian shrubland. This is a fairly common plant community with over 100 occurrences throughout the Rocky Mountains. Stands of this type occur in Routt and San Juan National Forests, the Rio Grande Basin, and the upper Arkansas River Basin (Kettler and McMullen 1996, Kittel *et al.* 1996, Richard *et al.* 1996, Colorado Natural Heritage Program 1997). It is rare, however, to find stands dominated by native species in the undergrowth. This association usually occurs at relatively low elevations in Colorado,

where floodplain habitats are often impacted by water diversion, improper livestock grazing, invasive plant species, or agricultural conversion.

Natural Heritage element at the Kelley Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Alnus incana</i> /mesic graminoid	montane riparian shrubland	G2G3	S3		A 7/26/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the riparian occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the riparian wetlands. Stream flow alterations, other than those made by beaver, would be detrimental to this community. The boundary was delineated after 1997 field visits, using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

Ford Creek

Biodiversity Rank: B3 (High significance)

This creek supports a healthy population of the Rio Grande cutthroat trout and a good example of a thinleaf alder/mesic forb riparian shrubland.

Protection Urgency Rank: P3

This site is approximately 95% federal land, with ownership split between Rio Grande National Forest and the Bureau of Land Management (see Appendix A for ownership map). There are two private inholdings near the center of the site. There are no known development threats foreseen for this site, but changes in the hydrological regime due to water diversion could impact the elements of concern.

Management Urgency Rank: M3

Although the lower portion of this site is a BLM riparian study area, livestock grazing impacts are evidenced by channel incision, heavy shrub browsing, and non-native grass species. Monitoring is warranted to ensure that stocking levels do not compromise riparian or aquatic habitat quality. Thinleaf alder is not particularly palatable to livestock, but can be trampled as animals search for more palatable forb species (Hansen *et al.* 1995). Invasive species are getting a hold at this site, and care should be taken to avoid introduction of non-native seed, or disturbance.

The Rio Grande cutthroat trout is dependent upon cold, well oxygenated water and ample cover. Livestock can impact riparian communities and cause geomorphologic alterations, leading to a decrease in cover, which increases the water temperature and sediment load (Schulz and Leininger 1990; Skovlin 1984). Platts (1982) recognizes all of these adverse changes as detrimental to trout populations. Interactions of livestock grazing with habitat for Rio Grande cutthroat remain poorly described (Rinne 1995), and further research in this field is recommended.

Location: The Ford Creek site is located in northern Saguache County (Figure 8, number 31), approximately one air mile southwest of the Ford and Baxter Creek confluence along Ford Creek.

U.S.G.S. 7.5 minute quadrangles: Chester, Klondike Mine, Lake Mountain NE, Bonanza

Legal Description: T46N, R6E S 12, 13, 24, 25, 35
T46N, R7E S 7, 8, 9, 18, 19, 20, 21

General Description: Ford Creek site includes several confluent streams, and their riparian areas, which pass through semi-arid rangeland north of Saguache Creek. Within the site, the riparian shrub canopy is continuous and stands of thin-leaf alder/mesic forb (*Alnus incana*/mesic forb) occur along the creek at lower elevations; willows (*Salix* spp.) are also common on the creek floodplain. Part of this site is included in the Bureau of Land Management riparian study area established in 1988, and appears to be recovering from past

heavy livestock grazing. The historical grazing regime has caused channel entrenchment and stands of non-native grasses, such as Kentucky bluegrass and bromes (*Poa pratensis*, *Bromus* spp.). Beaver (*Castor canadensis*) are present and are an important component of this ecosystem. Their ponds expand the wet floodplain habitat and capture fine textured sediment which facilitates meadow formation. Dry shortgrass meadow dominated by blue grama (*Bouteloua gracilis*) occur on surrounding toeslopes and thick stands of Douglas-fir (*Pseudotsuga menzeisii*), pinyon pine (*Pinus edulis*) and juniper (*Juniperis monosperma*) occur on the higher slopes of the valley. The stream channel is comprised largely of fine textured substrates in the lower reaches, and banks are armored with dense herbaceous vegetation. The upper reaches increase in gradient and cobbly substrates are present.

The site is approximately 3,000 acres in size and ranges in elevation from 8,450 to 11,225 feet (2,575-3,425 m).

Biodiversity Rank Justification: This site supports a healthy population of the Rio Grande cutthroat trout and a good example of a thinleaf alder/mesic forb riparian shrubland. This plant association occurs throughout the Rocky Mountains of Colorado (Cooper and Cottrell 1990, Johnston 1987, Kittel and Lederer 1993, Kittel *et al.* 1994, Kittel *et al.* 1995, Kittel *et al.* 1996, Kettler and McMullen 1996, Richard *et al.* 1996, Colorado Natural Heritage Program 1997). This association was once common and widespread, but is now declining. This type is rarely found in good condition without non-native species in the undergrowth. There are only 10 documented occurrences of this plant association in Colorado. A total of 60 occurrences are estimated for the entire state.

The Rio Grande cutthroat trout's range once included the entire Rio Grande and Pecos River watersheds, and possibly the upper Canadian River as well (Trotter 1987). In Colorado, the species occupies less than 1% of its former range (Alves 1996), and wild, genetically pure stock populations are especially imperiled. Artificial habitat including wells, farm ponds, and extensive canal systems as well as human activities including dewatering, fishing and stocking, transbasin diversions, release of domestic sewage, stream channelization, and agricultural chemical applications have greatly modified the original aquatic ecosystem of the San Luis Valley (Zuckerman 1984). These modifications may have contributed directly to the decline in range of the native fishes of the Rio Grande drainage. Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout.

Natural Heritage elements at the Ford Creek site. Multiple listings of the same element represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Alnus incana</i>/mesic forb	thinleaf alder/mesic forb riparian shrubland	G3	S3		B 7/13/97
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 9/25/87
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3	(3C), SC, FS	unranked 1980

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the creek and riparian ecosystem. The boundary was delineated after 1997 field visits, using 1988 NAPP 1:40,000 aerial photograph and satellite imagery at a scale of approximately 1:100,000.

Jacks Creek Cemetery

Biodiversity Rank: B3 (High significance)

The Jacks Creek Cemetery site contains a narrowleaf cottonwood forest and a montane wet meadow in good to excellent condition. It is one of the best examples of a riverine wetland complex observed on private lands in Saguache County.

Protection Urgency Rank: P3

This site is primarily privately owned with some Rio Grande National Forest Service land in the upper end of the site (see Appendix A for ownership map). Future management or development plans for these private lands are unknown. A conservation easement or open space designation is recommended to protect the site.

Management Urgency Rank: M4

The site is in good condition under the current landowners management practices.

Location: This site is located in northern Saguache County (Figure 8, number 32), approximately 14 air mile northwest of the town of Saguache, accessed via Rio Grande National Forest road 855.

U.S.G.S. 7.5 minute quadrangle: Lake Mountain NE

Legal Description: T46N, R5E S 36
T46N, R6E S 31
T45N, R6E S 5,6

General Description: The Jack's Cemetery site is centered around the old Cordova Homestead on Jacks Creek. The riparian community is a narrow strip right along the creek and consists of a very dense occurrence of narrowleaf cottonwood (*Populus angustifolia*) with a dense shrub cover comprised of alder (*Alnus incana*), currant (*Ribes montigenum*) and willows (*Salix monticola* and *S. geyeriana*). Although the woody community covers most of the corridor, open meadows of Baltic rush (*Juncus balticus*) and beaked sedge (*Carex utriculata*) occur on both sides of the creek. The surrounding hillslopes are covered in a dry shortgrass prairie and pinyon pine-juniper (*Pinus edulis-Juniperus monosperma*) woodlands. The site is approximately 280 acres in size and ranges in elevation from 8400 to 8600 feet (2560-2620 meters).

The land is grazed with an appropriate regime for this riparian community, as little soil compaction, stream bank erosion, or species compositional shifts were observed. Details of this management regime should be obtained for future application to similar riparian areas.

Biodiversity Rank Justification: The Jacks Creek Cemetery site contains a narrowleaf cottonwood forest and a montane wet meadow in good to excellent condition. The narrowleaf cottonwood with alder plant association is known from the West Slope of Colorado in the Yampa and Gunnison River Basins, and the San Juan National Forest (Kittel

et al. 1993, Kittel *et al.* 1994, Richard *et al.* 1996). It also occurs along the Front Range in the Arkansas and South Platte river basins (Kittel *et al.* 1996, Kittel *et al.* 1997). Although this community is considered a common riparian forest type for the lower montane zone of the Rocky Mountain region, excellent examples of this association which are structurally diverse, self-perpetuating, and contain a native understory, are uncommon. This site is one of the best examples of a montane riverine wetland observed on private lands in Saguache County.

Natural Heritage elements at the Jacks Creek Cemetery site. Element responsible for the high biodiversity rank is in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Carex utriculata</i>	beaked sedge montane wet meadow	G5	S3		A 7/11/97
<i>Populus angustifolia/Alnus incana</i>	montane riparian forest	G3	S3		B 7/11/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to include the riparian complex that supports the elements of biodiversity found at the site. It is designed to protect the riparian occurrences from direct impacts such as trampling or other surface disturbances; and to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated, using 1988 NAPP 1:40,000 aerial photographs and satellite imagery at a scale of approximately 1:100,000.

Jacks Creek Uplands

Biodiversity Rank: B2 (Very high significance)

This site supports one of the largest populations known for rock-loving neoparrya, a south-central Colorado endemic plant. This species is only known from ten sites in five counties.

Protection Urgency Rank: P2

This site is primarily owned and managed by the Bureau of Land Management, with less than 10% privately owned (see Appendix A for ownership map). An ACEC (Area of Critical Environmental Concern) for BLM lands may be a useful conservation tool to help ensure habitat protection.

Management Urgency Rank: M3

Current land use practices at this site are not endangering the rare plant. If present land uses continue, it should be sufficient to monitor the abundance of the population every 5-10 years. We recommend developing a research plan to identify the specific requirements of rock-loving neoparrya, especially for pollination, seed dispersal, predators, seed germination, and longevity. As the natural history of the plant becomes known, management plans for this site should be refined.

Location: This site is located in northern Saguache County (Figure 8, number 33), approximately 10 miles northwest of the town of Saguache and immediately north of Saguache Creek between Jacks and Middle creeks.

U.S.G.S. 7.5 min. quadrangle: Lake Mountain NE

Legal Description: T45N R6E S 3, 4, 5, 9, 10
T46N R6E S 32, 33, 34

General Description: The Jacks Creek Upland site is comprised of volcanic ridges with a north-south orientation. The vegetation is primarily dominated by a short to mid grass prairie with ring muhly (*Muhlenbergia filiculmis*), Arizona fescue (*Festuca arizonica*), mountain muhly (*Muhlenbergia montana*), and blue grama (*Bouteloua gracilis*). Lichens dominate the rock outcrops.

The rare rock-loving neoparrya (*Neoparrya lithophila*), a forb in the carrot family, is most numerous in rock crevices on ridges above north-facing slopes. The neoparrya is also found below the ridges of the west-facing slopes, but the numbers are lower. The majority of the site is free from invasive weeds, although Jacks Creek road, just outside of the site, has a healthy population of henbane (*Hyoscyamus niger*), one of the few places in Saguache County where we found this exotic plant. The primary use of this area is light to moderate livestock grazing. We also observed numerous pronghorn (*Antilocapra americana*) and a mountain lion (*Felis concolor*).

The site is approximately 1,100 acres in size, ranging in elevation from 8,200 to 8,600 feet (2,500-2,620 meters).

Biodiversity Rank Justification: The Jacks Creek Uplands site supports one of the largest recorded occurrences of the rock-loving neoparrya. This forb is restricted to south-central Colorado and known from 10 sites in five counties. The Jacks Creek Uplands site is one of the largest of these occurrences, with over 3,000 plants estimated, whereas many of the other known locations have hundreds. This site and the 660 Road site are the two best known sites for the rock-loving neoparrya.

Natural Heritage element occurrences at the Jacks Creek Uplands site. The multiple listings represent suboccurrences.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	A 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	A 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	A 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	A 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	B 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	B 7/29/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	B+ no date

*EO=Element Occurrence; date indicates the date of last observation

Future Research Needs: We know that this plant requires soils of volcanic origin and that it thrives on north-facing slopes within the a 7,000 to 9,000 foot elevation band. These criteria are met throughout the San Juan foothills, yet the plant is rarely present. Future studies are needed to help understand what other factors are limiting this plant to these few sites.

Boundary Justification: The boundary is drawn to encompass the extent of the metapopulation of the rock-loving neoparrya. We used a 7.5 minute quadrangle and a 1990 NAPP infrared aerial photography to assess the placement of the boundary.



Rock-loving neoparrya and its habitat

meadows of Saguache Creek. For the most part, the entire site is free from non-native plants, although several two track roads cross the site and provide habitat for some non-natives, e.g., henbane (*Hyoscyamus niger*) at Garcia Spring.

The Findley Gulch site is very dry for much of the year, and there are a few springs that have been developed to help support the cattle that use the area in the summer. Moderate levels of cattle grazing have helped keep the grass in the site very short in areas, and maintain a good portion of bare ground. Both these characteristics are favored by the mountain plovers that nest here (Fritz Knopf, pers. comm.).

This site extends for approximately 7,000 acres, and ranges in elevation from 7,800 to 8,600 feet (2,400 – 2,600 meters).

Biodiversity Rank Justification: This site supports a small population (2 adults, and 2 juvenile), and the only documented occurrence, of breeding mountain plovers in Saguache County. The presence of Mountain plovers at this site have been reported for several years (CNHP 1997). The mountain plover is globally rare, and has been petitioned for listing under the Endangered Species Act. The winterfat grassland community present at this site is the largest known for Colorado. This grassland is more common in New Mexico, although seldom forms 7,000 acre stands (Esteban Muldavin, pers. comm.).

Natural Heritage element occurrences at the Findley Gulch site. Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Krascheninnikovia lanata/Bouteloua gracilis</i>	winterfat grassland	G4	S1?		A 7/9/97
<i>Charadrius montanus</i>	mountain plover	G2	S2B,SZN	C, SC, FS	C 7/9/97
<i>Charadrius montanus</i>	mountain plover	G2	S2B,SZN	C, SC, FS	unranked 5/1/91

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The majority of the basin area that supports the winterfat grasslands which in turn support the nesting plovers is encompassed within the site. There is a strong possibility that plovers nest in other areas of similar habitat nearby, in which case the site boundaries could expand to include those other areas. A more thorough inventory would help to validate or discredit this hypothesis. The boundaries were drawn using 1:40,000 infrared aerial photos and a satellite image at a scale of 1:100,000.



Findley Gulch



Mountain plover

Trickle Mountain

Biodiversity Rank: B2 (Very high significance)

This site includes numerous globally rare grassland and woodland plant communities and associated rare plant and animal occurrences.

Protection Urgency Rank: P4

This site is primarily owned and managed by the Bureau of Land Management (see Appendix A for ownership map). Trickle Mountain and the adjacent area is managed as the Trickle Mountain Wildlife Area. We suggest that parts of this site may benefit from an ACEC (Area of Critical Environmental Concern). Immediate stresses to this site appear low.

Management Urgency Rank: M4

The ecological processes necessary to maintain this diverse mosaic of grasslands and woodlands include occasional fires, grazing, and probably winter storms. Parts of this area exhibit signs of heavy livestock grazing, (i.e. increasers are more abundant on the more heavily grazed areas). For the most part though, most of the area exhibits an adequate grazing regime. No immediate changes in management are needed. We recommend periodic monitoring of the occurrences at this site to ensure that existing management remains adequate.

Location: This site is located in north-western Saguache County (Figure 8, number 35), centered around Trickle Mountain, approximately 14 air miles northwest of the town of Saguache.

U.S.G.S. 7.5 minute quadrangles: Trickle Mountain; Lake Mountain NE;
Laughlin Gulch; Lake Mountain

Legal Description: T4S R75W S 29, 31, 32
T5S R75W S 4-9

General Description: The Trickle Mountain site includes the plateaus on the north and south sides of Saguache Creek. The site is best described as scenic mesa tops, small mountains, and dissecting canyons with a mosaic of montane woodlands and grasslands. This geologic landscape is unusual within Colorado. The vegetation reflects this unusual setting, with the plateaus dominated by a ring muhly (*Muhlenbergia filiculmis*)/lichen shortgrass prairie. The site is centered around Trickle Mountain, the highest point within the site. Bristle cone pine (*Pinus aristata*) with Arizona fescue (*Festuca arizonica*) dominates the peak while ponderosa pine (*Pinus ponderosa*) with Arizona fescue or grasslands of mountain muhly (*Muhlenbergia montana*), ring muhly, and Arizona fescue dominate the lower slopes. The valleys between the plateaus are mostly a winterfat/blue grama (*Krascheninnikovia lanata/Bouteloua gracilis*) short grass prairie, which provides good habitat for Gunnison prairie dogs (*Cynomys gunnisoni gunnisoni*). All of these communities are free from non-native or invasive weed problems.

Historical use of the area is varied, beginning with Ute Indians using some of the plateaus for tool making, followed by logging on Trickle Mountain in the early 1900's (several old mill sites are still visible). Current uses include livestock grazing and recreational hunting. Many two-track roads occur in the area, mostly limited to the valley bottoms, while the plateaus and mountains are mostly roadless.

Many of the plateaus are hard to access and are potential mountain plover habitat (*Charadrius montanus*). These plateaus are heavily used by antelope (*Antilocapra americana*) in both winter and summer, and heavy browsing on the sparse mountain mahogany shrubs suggest mule deer (*Odocoileus hemionus*) use this area as well.

Biodiversity Rank Justification: The Trickle Mountain site contains a plethora of globally and state rare foothills and grassland plant communities. There are 22 occurrences of communities, plants, and animals within this site, of which many are globally rare. The rarity, quality, and condition of these short and midgrass prairies makes this landscape stand out within Saguache County. Refer to the following table for the complete list.

Natural Heritage element occurrences at the Trickle Mountain site. Multiple listings of the same element represent separate occurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plant communities					
<i>Festuca arizonica-Muhlenbergia filiculmis</i>	montane grassland	G3	S2		unranked 1975
<i>Festuca arizonica-Muhlenbergia filiculmis</i>	montane grassland	G3	S2		unranked 1975
<i>Festuca arizonica-Muhlenbergia filiculmis</i>	montane grassland	G3	S2		unranked 1975
<i>Festuca arizonica-Muhlenbergia montana</i>	montane grassland	G3	S3?		unranked 1975
<i>Festuca arizonica-Muhlenbergia montana</i>	montane grassland	G3	S3?		unranked 1975
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		A 8/22/97
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		A 8/20/97
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		A 7/10/97
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		B 8/23/97
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		unranked 1975
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		unranked 1975
<i>Muhlenbergia filiculmis</i>	montane grassland	G2	S2		unranked 1975
<i>Pinus aristata/Festuca arizonica</i>	montane woodland	G4	S3		B 8/20/97
<i>Pinus ponderosa/Festuca arizonica</i>	lower montane forest	G4G5	S4		B 7/29/97

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Pinus ponderosa/Festuca arizonica</i>	lower montane forest	G4G5	S4		unranked 1975
<i>Pinus ponderosa/Festuca arizonica</i>	lower montane forest	G4G5	S4		unranked 1975
Plants					
<i>Cryptantha weberi</i>	Weber's catseye	G2	S2	(3C)	B 8/20/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	C 8/15/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	C 8/22/97
Mammals					
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3		A 8/21/97
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3		B 8/22/97

EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to encompass all of the above occurrences and the habitat between. Further studies into the significance and extent of these unusual plateaus may eventually supply reason to extend the boundaries. Meanwhile, these boundaries should 1) protect the occurrences from direct impacts, and 2) provide suitable habitat where additional individuals and plant communities can become established over time. The boundaries were drawn with the assistance of approximately 1:200,000 satellite imagery and 7.5 minute topographic maps.

Future Research Needs: There is some concern about the significance of the abundance of ring muhly. The Forest Service and Soil Conservation manual denote this species as an increaser following grazing activity. We found the ring muhly more abundant on the harder to access plateaus which suggest a more natural situation. Further investigation into the history of livestock grazing and fires of this area may shed light on this issue.



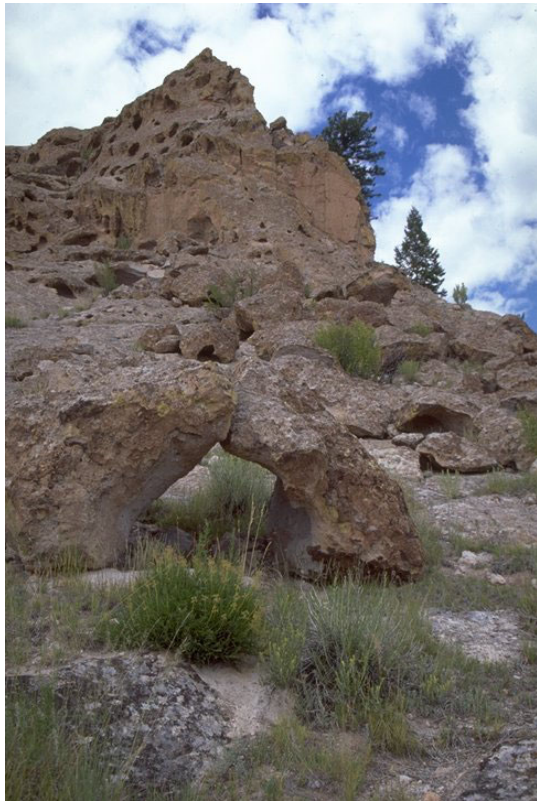
View from Trickle Mountain



Grasslands of Trickle Mountain



Prairie dog



Rock-loving neoparrya and habitat

Devils Knob

Biodiversity Rank: B4 (General biodiversity interest)

A small occurrence of the globally rare pinyon pine/Scribner's needle and thread grass community is located within this site.

Protection Urgency Rank: P4

This entire site is managed and owned by the Bureau of Land Management, (see Appendix A for ownership map) and no further protection is needed at this time.

Management Urgency Rank: M4

Consideration of the importance of fire in maintaining the pinyon-pine woodland would benefit management plans for the site. Closing some or all of several two-track roads would help reduce problems of weed invasion and erosion.

This site is within the Bureau of Land Management Tracy Canyon allotment, where a holistic resource management (HRM) plan is practiced. The primary uses of the area are cattle grazing and light recreation, including hunting.

Location: This site is located near central Saguache County (Figure 8, number 36), approximately 2 miles southwest of the town of Saguache, north of Tracy Canyon on the hills of Devils Knob.

U.S.G.S. 7.5 minute quadrangle: Saguache

Legal Description: T44N R7E S 21, 22, 23

General Description: This site is composed of a volcanic hill on the western edge of the San Luis Valley. The vegetation is a mosaic of short grass prairie dominated by blue grama (*Bouteloua gracilis*), valley bottoms with a small degraded occurrence of four wing saltbush (*Atriplex canescens/Bouteloua gracilis*), and hilltops and ridges of pinyon pine (*Pinus edulis*) with Scribner's needle and thread grass (*Stipa scribneri*). James buckwheat (*Eriogonum jamesii*) is a common forb and has been identified as the host plant for Spaldings' blue butterfly (*Euphilotes spaldingi*). Although we did not find the butterfly, we believe it may be here.

This site is within the Bureau of Land Management Tracy Canyon allotment, where a holistic resource management (HRM) plan is practiced. The primary uses of the area are cattle grazing and light recreation, including hunting. Several two-tracks roads cross through this site. The only non-native plants found at this site are along the roads.

This site is approximately 420 acres with an elevation range of 8,300 to 8,800 feet (2,500-2,675 meters).

Biodiversity Rank Justification: This site includes a small occurrence of a pinyon-pine/Scribner's needle and thread grass community. Less than 10 occurrences of this type have been documented for Colorado. It is also known from adjacent states.

Natural Heritage element occurrence at the Devils Knob site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Pinus edulis-Stipa scribneri</i>	foothills pinyon-juniper woodland	G3	S1?		C 7/10/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The site includes the rare plant community occurrence and adjacent potential habitat. This boundary will allow for some natural migration. Consideration of a larger area would help to protect the adjacent pinyon-pine woodland. A 1989 NAPP 1:40,000 infrared aerial photograph was referenced while delineating the boundary.

Houselog Creek

Biodiversity Rank: B4 (Moderate significance)

This site contains two montane riparian shrubland communities, both globally imperiled.

Protection Urgency Rank: P4

This site is owned and managed by Rio Grande National Forest. Management, rather than further protection, is the primary concern at this site.

Management Urgency Rank: M4

Although this site presently shows few livestock impacts, monitoring is warranted, and management adjustments may be needed in the future to maintain the quality of the elements. Thinleaf alder is not particularly palatable to livestock, but can be trampled as animals search for more palatable herbaceous species (Hansen *et al.* 1995). Season-long grazing can reduce the native forb cover in the understory and allow non-native grasses to increase. With proper rotation and rest, the thinleaf alder/mesic forb plant association (Padgett *et al.* 1989, Hansen *et al.* 1995) is moderately tolerant of livestock grazing. Bebb willow is highly palatable to livestock and wildlife and is more sensitive to grazing. With continued browsing, regeneration of this willow species will be impaired and may eventually be eliminated from the site. In particular, late-summer browsing reduces willow density and vigor since cattle prefer the more nutritious willows over sedges and grasses at that time of year (Kovalchik and Elmore 1992). Short duration or winter grazing are recommended to maintain this element.

Location: The site occurs in northwestern Saguache County (Figure 8, number 37), approximately 2.5 miles south of highway 114 adjacent to Rio Grande National Forest road 41G, or approximately 20 air miles west of the town of Saguache.

U.S.G.S. 7.5 minute quadrangles: Lake Mountain, Laughlin Gulch

Legal Description: T44N, R5E S 1, 11, 12, 13, 14

General Description: The Houselog Creek site includes 578 acres of riparian and valley bottom wetlands in a narrow canyon in the middle reaches of Houselog Creek. Site elevations range from 8770 to 9411 feet (2673 to 2870 meters). The canyon harbors excellent quality Bebb's willow (*Salix bebbiana*) and thin-leaf alder (*Alnus incana*) riparian shrublands which form a nearly continuous canopy approaching 20 feet in height. A subcanopy of several species of willows (*Salix* spp.), shrubby cinquefoil (*Pentaphylloides floribunda*), common juniper (*Juniperus communis*), wild rose (*Rosa woodsii*), and gooseberry (*Ribes inerme*) is also present. The understory is composed of a very species rich assemblage of native forbs, sedges, and grasses. Particularly abundant species include beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), meadow rue (*Thalictrum fendleri*), shooting star (*Dodecatheon pulchellum*), and bluebells (*Mertensia ciliata*). Moist canyon toeslopes support a mesic forest of aspen (*Populus tremuloides*) and blue spruce (*Picea pungens*), which further increases the habitat diversity of the floodplain area.

Grazing impacts appear minor, possibly because the steep walls of the canyon or dense alder thickets inhibit livestock access. Upstream and downstream areas of the watershed, however, are severely impacted. Forest road 41G abuts the site on the western margin.

Biodiversity Rank Justification: This site supports excellent examples of a Bebb’s willow (*Salix bebbiana*) montane willow carr and a thin-leaf alder/mesic forb (*Alnus incana*/mesic forb) riparian shrubland. These communities are contiguous and often form a diverse mosaic of habitats along Houselog Creek. The herbaceous understory accompanying these associations is among the most species-rich in the Closed Basin watershed.

The thinleaf alder/mesic forb plant association is widely distributed in the cordillera of the Western U.S. Similar types occur in Alaska (Viereck *et al.* 1992), Oregon (Kovalchik 1987), Nevada (Manning and Padgett 1995), Utah (Padgett *et al.* 1989), Montana (Hansen *et al.* 1995), Idaho, Wyoming (Youngblood *et al.* 1985, Jones 1992), and Colorado (Cooper and Cottrel 1990, Johnston 1987, Colorado Natural Heritage Program 1997). It is rare, however, to find stands dominated by native species in the undergrowth. The *Salix bebbiana* plant association is less common and occurs as a minor type in the canyonlands of southwestern Utah (Padgett *et al.* 1989) and at mid- to low-elevations in southwestern Montana (Hansen *et al.* 1988) and Colorado (Colorado Natural Heritage Program). Similar types occur in eastern Wyoming (Girard *et al.* 1995). In Colorado, this association occurs in canyon country at lower elevations in the San Juan National Forest (Richard *et al.* 1996), the Rio Grande River Basin (Kittel *et al.*, in preparation), and in foothill canyons of the South Platte River Basin (Kittel *et al.* 1997).

Both of these associations occur at relatively low elevations in Colorado, where floodplain habitats are often impacted by water diversion, improper livestock grazing, invasive plant species, or agricultural conversion. This site harbors stands which are in excellent condition with regards to species composition, regeneration, and canopy structure. The rather small size of this site, and poor condition of the riparian areas upstream and downstream, require a good rather than excellent ranking for both of these communities.

Natural Heritage elements at the Houselog Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Alnus incana</i> /mesic forb	thinleaf alder/mesic forb riparian shrubland	G3	S3		B 7/11/97
<i>Salix bebbiana</i>	montane willow carr	G3	SU		B 7/11/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to 1) protect the riparian occurrences from direct impacts such as trampling, overuse, or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. Upstream portions of Houselog creek were excluded because no CNHP elements had been recorded there as of the conclusion of the 1997 field survey. Although not contained in the present site boundary, the contributory upper watershed has the potential to affect this site as well as the Saguache Creek site located just downstream. The site boundary was based on initial aerial photo analysis, a field visit by a CNHP wetland ecologist, and subsequent validation with satellite imagery.

Luder Creek

Biodiversity Rank: B4 (moderate biological significance)

This site contains a good occurrence of a montane riparian shrubland and one of the largest occurrences of beaked sedge-tufted hairgrass wet meadow known for Saguache County.

Protection Urgency Rank: P4

This site is owned and managed by Rio Grande National Forest (See Appendix A for ownership map). Protecting the natural hydrologic regime is important. Current threats appear minimal although any future changes in water use or road building could affect this site.

Management Urgency Rank: M3

Management changes may be necessary within five years to maintain the health of the willow community at this site. Livestock use of this site was heavy at the time of the field survey for this report. Many willows showed signs of browsing, and some 'mushroom' shaped adults were evident. There are also high densities of non-native meadow grasses in adjacent habitats which may invade the riparian corridor with excessive surface disturbance. Monitoring livestock impacts would help, as would occasionally resting the site to allow for adequate regeneration of willow species. The management responses of this plant association are likely to be similar to other tall-willow shrublands dominated by Geyer's willow or mountain willow. The wet and often saturated soils of this plant association are vulnerable to compaction by livestock and heavy equipment. Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of willow root structure. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until after soils dry, and be of short duration.

Location: This site is located in northwestern Saguache County (Figure 8, number 38), approximately 24 air miles west of the town of Saguache or 2 miles east of Cochetopa Pass.

U.S.G.S. 7.5 minute quadrangle: North Pass

Legal Description: T45N, R4E S 7,8,17,18,20,28,29

General Description: This site includes an extensive montane riparian shrubland on Luder Creek floodplain in the upper montane life zone approximately 2 air miles east of the continental divide. The site includes over 1500 acres of floodplain and toeslope habitats extending for 5 miles along Luder Creek from 8,800 to 10,150 feet (2,684-3096 meters) in elevation. The community is rich in plant species and willow age classes. Dominant willows include Geyer's willow (*Salix geyeriana*), mountain willow (*Salix monticola*), and planeleaf willow (*Salix planifolia*). The riparian soils are perennially wet and support an understory of wetland species, including beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), and Canadian reedgrass (*Calamagrostis canadensis*). Drier margins of the floodplain support stands of shrubby cinquefoil (*Pentaphylloides floribunda*) with Thurber's fescue (*Festuca thurberi*) and occasional patches of the non-native Kentucky bluegrass (*Poa pratensis*). Adjoining upland vegetation

is spruce-fir (*Picea engelmannii*-*Abies lasiocarpa*) and aspen (*Populus tremuloides*) forest on northern aspects and bristlecone pine/ fescue (*Pinus aristata*/*Festuca* spp.) woodlands on southern exposures.

This site is heavily used as a car camping area, particularly at Luder Creek campground, with fishing and hunting in season. Livestock graze the site seasonally and tend to congregate in the floodplain wetlands along Luder Creek. Cochetopa Pass road borders the site on the north and bisects it just east of the entrance to Luder Creek campground.

Biodiversity Rank Justification: This site contains a good occurrence of Geyer's willow-mountain willow/ mesic graminoid (*Salix geyeriana*-*Salix monticola* / mesic graminoid) montane riparian shrubland, a CNHP community of special concern, and an excellent example of a beaked sedge montane wetland. In addition, the site harbors aspen forests and shrubby cinquefoil shrublands on terraces adjacent to the riparian zone, enhancing the habitat of the floodplain. As a whole, the site contains a structurally and floristically diverse assemblage of riparian and moist toeslope plant communities.

The Geyer willow-mountain willow /mesic forb) plant association and similar types occur in eastern Utah, Idaho (Padgett *et al.* 1989), Wyoming, and Colorado (Johnston 1987, Baker 1989, Bourgeron and Engelking 1994, Colorado Natural Heritage Program 1997). This community type is geographically widespread but occurs only in areas with suitable environmental conditions of medium to fine textured alluvial soils, perennial soil moisture, and abundant light. The low gradient meadows where this community occurs are favored as summer pasture for domestic livestock. Livestock herbivory of seedlings can lead to losses of stands by attrition, and many known stands in Colorado are severely impacted by livestock grazing (Kittel 1997, personal communication). This association is threatened by livestock grazing and invasive species throughout its range.

The beaked sedge wetland at this site is in excellent condition and quite large for this region, extending several miles along the valley of Luder Creek. The beaked sedge wetland type is relatively common at middle and upper elevation through the ranges of the Western U.S., occurring in riparian, lakeside, and fen wetlands. Large fen wetlands, which are formed by stable discharge of groundwater, are one of Colorado's rarer wetland types. They require wet, anaerobic soils, carbon accumulation from vigorous plant growth, low soil temperatures, and long periods of time to form their characteristic peat soils. Once formed, these peat soils are essentially irreplaceable in any management time frame.

Natural Heritage element occurrences at the Luder Creek site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Carex utriculata</i>	beaked sedge montane wetland	G5	S4		A 8/27/97
<i>Salix geyeriana-Salix monticola</i> /mesic graminoid	montane riparian willow carr	GU	S3		B 9/8/97

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: This boundary is drawn to 1) protect the riparian occurrences from direct impacts such as trampling, overuse, or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The site boundary was based on initial aerial photo analysis, a 1997 field visit by a CNHP wetland ecologist, and subsequent corroboration with satellite imagery.



Luder Creek wetland

San Juan and Upper Saguache Creek Sub-Region



The San Juan and Upper Saguache Creek Sub-region lies in the southwest part of Saguache County and includes sites from the foothills to the subalpine zone of the San Juan Mountains (Figure 9). This sub-region contains eight proposed conservation sites. **Two of these sites have a very high biodiversity significance (B2) and should be considered as top priorities in any protection plans for Saguache County: 660 Road and Elephant Rocks.** The 660 Road site is primarily privately owned, while the Elephant Rocks site includes both private and public lands (see Appendix A for ownership maps). The following table summarizes the biodiversity, protection, and management ranks for proposed conservation sites in the San Juan and Upper Saguache Creek sub-region.

List of Saguache County, San Juan and Upper Saguache Creek Sub-region, Proposed Conservation Sites by Biodiversity Significance, as of 1997 (CNHP).

SITENAME	Biodiversity Rank	Protection Urgency Rank	Management Urgency Rank	Page number
660 Road Site	B 2	P 3	M 4	166
Elephant Rocks	B 2	P 3	M 4	171
Carnero Creek	B 3	P 4	M 2	173
Cottonwood Creek Hills	B 3	P 4	M 4	177
Saguache Creek	B 3	P 4	M 3	179
Eagle Mountain	B 5	P 4	M 3	180
Groundhog Park	B 5	P 4	M 3	182
La Garita	B 5	P 4	M 4	186

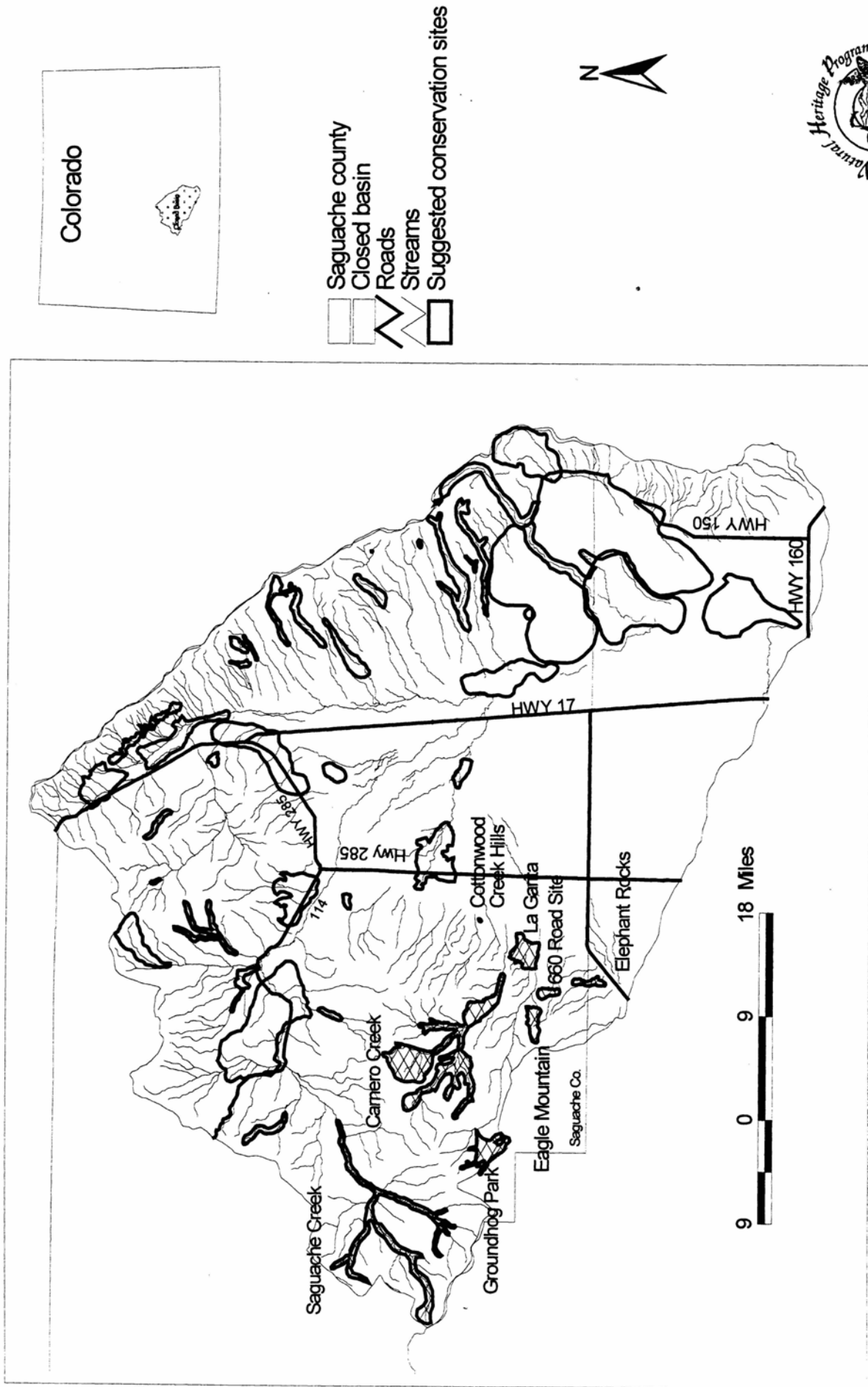


Figure 9. San Juans and Upper Saguache Creek sub-region proposed conservation sites.

Upper Saguache Creek

Biodiversity Rank: B3 (high significance)

This site contains eight elements of concern: five different montane and subalpine willow communities, one herbaceous wetland, and three vertebrate species, the Rio Grande cutthroat trout, northern harrier, and Gunnison's prairie dog.

Protection Urgency Rank: P4

Over 95% of this site is managed and owned by Rio Grande National Forest (see Appendix A for ownership map). The primary conservation issue is management, rather than further protection.

Management Urgency Rank: M3

Management changes may be required to maintain the current quality of the element occurrences. The site is heavily used for livestock grazing, camping, hunting, and off road vehicle recreation. Given the abundance of potentially damaging uses, the site is in good condition.

There is abundant upland forage, but the livestock appear to be using the wetland areas of the site preferentially. The soils supporting the wetland plant associations at this site are highly susceptible to compaction by livestock due to saturated conditions throughout the growing season. Management efforts should direct livestock away from the perennially wet stream and fen areas towards more resistant uplands. In particular, the administrative pasture immediately upstream of the Stone Cellar campground exhibits signs of overuse. Many of the adult Geyer's willows at that location show the 'mushroom' shape characteristic of overbrowsing and regeneration is poor. Rest is recommended at that location.

The upper watershed of Saguache creek supports a broad diversity of aquatic and terrestrial habitats and maintains a largely undisturbed hydrological regime. This site provides a valuable headwater refuge for species which have been impacted by land use in the lower watershed, such as the Rio Grande cutthroat trout, which occupies less than 1% of its former range in Colorado (Alves 1996). Free-flowing streams with good quality water, healthy banks, and streamside vegetation within the upper Rio Grande watershed are vital habitat for this subspecies of trout. Livestock can decrease riparian cover and induce geomorphologic alterations, which can cause local and cumulative increases water temperature and sediment load (Schulz and Leininger 1990; Skovlin 1984). Platts (1982) recognizes all of these adverse changes as detrimental to trout populations. Interactions of livestock grazing with habitat for Rio Grande cutthroat remain poorly described (Rinne 1995), and further research in this field is recommended. Monitoring and adaptive management to improve quality and quantity of critical aquatic habitat in the upper Saguache drainage are warranted, and would be a significant contribution to the conservation of Rio Grande cutthroat trout and other imperiled aquatic biota in the Closed Basin.

Location: This site is located in west-central Saguache County (Figure 9), on the upper reaches of the Saguache Creek watershed approximately 22 miles west of the town of Saguache.

U.S.G.S. 7.5 minute quadrangles: Elk Park, Saguache Park, Grouse Creek,
Half Moon Pass, Mesa Mountain,

Bowers Peak

Legal Description: T42N, R2E S 1, 3
T43N, R1E S 25-27, 34-36,
T43N, R2E S 1, 11-12, 14-15, 20-22, 29-31
T43N, R3E S 4-8, 17, 19, 20, 29-31
T44N, R2E S 20, 21, 27-31, 35, 36
T44N, R3E S 24-27, 33, 34
T44N, R4E S 16-18

General Description: This site encompasses approximately 12,053 acres of riparian, valley bottom, and slope communities along the upper reaches of Saguache Creek. Elevation extends from 8,991 feet on lower Saguache Creek to 12,940 feet (2,742-3,947 meters) at the western margin near the Continental Divide. The creek floodplains are well vegetated with willows (*Salix* spp.) and a dense understory of native grasses, sedges, and forbs. At higher elevations herbaceous riparian communities become increasingly common, usually dominated by Canadian reedgrass (*Calamagrostis canadensis*), tufted hairgrass (*Deschampsia cespitosa*), and several species of sedges (*Carex* spp.). The upper reaches of the stream traverse the semi-arid Saguache Park region which contains extensive montane grasslands. The grasslands support populations of Gunnison's prairie dog (*Cynomys gunnisoni gunnisoni*). Adjacent uplands are vegetated with patchy spruce (*Picea engelmannii*) and aspen (*Populus tremuloides*) forests on north-facing slopes and bristlecone pine/fescue (*Pinus aristata*/*Festuca* spp.) woodlands on southern exposures.

The site includes Saguache and its major tributaries, all free flowing streams, which harbor populations of Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*). The headwater basins within the La Garita wilderness contain among the highest concentrations of alpine lakes and wetlands in the Closed Basin.

The Upper Saguache Creek site is heavily used by for a wide variety of extractive and recreational uses. The entire site is used as summer range for domestic livestock. Grazing by tethered packstock is common within the heavily used trail corridors of the La Garita Wilderness. This site is a popular destination for off-road vehicle campers and two-track roads are abundant. Hunting and fishing are common in season.

Biodiversity Rank Justification: This site contains nine elements of concern. In particular, the site supports five different montane and supalpine willow carr associations: Bebb's willow (*Salix bebbiana*), Geyer's willow/mesic forb (*Salix geyeriana*/mesic forb), Geyer's willow-Rocky Mountain willow/mesic graminoid (*Salix geyeriana*-*Salix monticola*/mesic graminoid), Rocky Mountain willow/Canadian reedgrass (*Salix monticola*/*Calamagrostis canadensis*), and planeleaf willow/Canadian reedgrass (*Salix planifolia*/*Calamagrostis canadensis*). A good stand of beaked sedge (*Carex utriculata*) wetland occurs along the

middle fork of Saguache Creek and numerous smaller wetlands occur in the upper watershed. Occurrences of three imperiled vertebrate species or subspecies have been recorded at the site, an occurrence of a nesting northern harrier (*Circus cyaneus*), Rio Grande cutthroat trout, and Gunnison's prairie dog subspecies. The upper watershed of Saguache Creek supports a broad diversity of aquatic and terrestrial habitats and maintains a largely undisturbed hydrological regime. This site is a valuable headwater refuge for species which have been impacted by land use in the lower watershed, such as the Rio Grande cutthroat trout.

Natural Heritage element occurrences at the Saguache Creek site. Elements responsible for the biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	Rank
Plant communities					
<i>Carex utriculata</i>	beaked sedge wetland		S4		B 9/07/97
<i>Salix bebbiana</i>		G3	SU		B 7/9/97
<i>Salix geyeriana-Salix monticola</i> /mesic graminoid	montane riparian willow carr	GU	S3		
<i>Salix geyeriana</i> /mesic forb	montane willow carr	G3	SU		B 9/8/97
<i>Salix monticola/ Calamagrostis canadensis</i>	montane willow carr	G3	S3		A 7/8/97
<i>Salix planifolia/ Calamagrostis canadensis</i>	subalpine willow carr	G4			B 9/6/97
Birds					
<i>Circus cyaneus</i>	northern harrier	G5	S3B, SZ		7/24/1988
Mammals					
<i>Cynomys gunnisoni gunnisoni</i>	Gunnison's prairie dog subsp.	G5T3	S3		B 8/25/97
Fish					
<i>Oncorhynchus clarki virginalis</i>		G4T3	S3		unranked 1994

*EO=Element Occurrence; date indicates date of last observation

Boundary Justification: The site boundaries are drawn to envelope the floodplain of Saguache Creek, its major tributaries, and valley toeslopes within 1/8 mile of the stream which contribute surface runoff to the stream channel. In glaciated basins, such as those on the headwaters of the middle fork of Saguache Creek, all valley bottom wetlands were included. The boundary was extended to include occurrences of non-wetland elements (e.g. Gunnison's prairie dog) where such occurrences were contiguous to the wetland boundary. Although not contained in the present site boundary, contributory watersheds should be managed to avoid downstream impacts in the Saguache Creek site.

Further research on the grasslands of Saguache Park may warrant including these within this site boundary.



Saguache Creek willow plant community



Middle Fork Saguache Creek in Saguache Park



Prairie dog

Groundhog Park

Biodiversity Rank: B5 (General biodiversity interest)

The Groundhog Park site contains one of the best examples of subalpine fen wetlands in the Closed Basin watershed, including good stands of the planeleaf willow/tufted hairgrass and planeleaf willow/marsh marigold plant communities.

Protection Urgency Rank: P4

This site is publicly owned and managed by Rio Grande National Forest (see Appendix A for close-up map). The primary conservation issue is one of management, rather than direct protection.

Management Urgency Rank: M3

The entire site is used as seasonal pasture for domestic livestock. Although the site is generally in good condition, trampling impacts are evidenced by puncturing of wet peat soils and bank erosion along Groundhog Creek. There is abundant upland forage, but the livestock appear to be using the wetland areas of the site preferentially. The soils supporting these plant associations are highly susceptible to compaction by livestock due to saturated conditions throughout the growing season. Management efforts should direct livestock away from the perennially wet stream and fen areas towards more resistant uplands. This would be an excellent site for enclosure fencing.

Some two track roads extend into the park from the main road and encourage traffic on the moist meadow soils. These side roads should be closed.

Location: This site is located in west-central Saguache County (Figure 9), at the headwaters of La Garita Creek about 20 air miles northeast of Southfork, Colorado.

U.S.G.S. 7.5 minute quadrangle: Pine Cone Knob

Legal Description: T42N, R4E S 17, 18, 19, 29, 30, 31
T42N, R3E S 13, 14, 23, 24

General Description: The Groundhog Park site delineates a gently undulating subalpine basin in the southwest portion of the Closed Basin. The site covers over 3500 acres ranging from 10,400 to 12,470 feet in elevation. The basin supports numerous riparian willow (*Salix* spp.) carrs, fen wetlands, and montane grasslands. The fen wetlands along Benino and Groundhog creeks are fed by perennial discharge of cold groundwater from the surrounding uplands and support extensive stands of beaked sedge (*Carex utriculata*), tufted hairgrass (*Deschampsia cespitosa*), planeleaf willow (*Salix planifolia*), and marsh marigold (*Caltha leptosepala*). Other notable wetland associates include rose crown (*Sedum rhodanthum*), elephantella (*Pedicularis groenlandica*), and hoary sedge (*Carex canescens*). The fen soils are peats with numerous hummocks overlaying gleyed sands. The montane grasslands are comprised of several species of fescue (*Festuca* spp.), Junegrass (*Koeleria macrantha*), spiked trisetum (*Trisetum spicatum*), and oatgrass (*Danthonia intermedia*). This site is in a

region of high precipitation and surrounding uplands support excellent stands of spruce-fir (*Picea engelmannii*-*Abies lasiocarpa*) and aspen (*Populus tremuloides*) forests.

This site is very scenic and heavily used as a car camping area, with fishing and hunting in season. A major forest road skirts the western and northern margins of this site with small two track roads branching off. Livestock graze the site seasonally and tend to congregate in the open wetland and grassland areas.

Biodiversity Rank Justification: The Groundhog Park site contains the best examples of subalpine fen wetlands in the Closed Basin watershed. Specifically, the site supports good stands of the planeleaf willow/tufted hairgrass (*Salix planifolia/Deschampsia cespitosa*) and planeleaf willow/hoary sedge (*Salix planifolia/Caltha leptosepala*) plant communities. These plant associations typically occur in wide, glaciated valleys adjacent to streams. They occur in swales, depressions, and on slopes where snow melt runoff saturates soils for much of the growing season. Both of these communities are relatively common in Colorado where the proper environmental conditions are met. This is the largest wetland complex of its type in the Closed Basin and is in excellent condition.

Natural Heritage elements at the Groundhog Park site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>leptosepala</i>	subalpine willow carr	G4	S4		B 8/2/97
<i>Salix planifolia/Deschampsia cespitosa</i>	montane willow carr	G2G3	S3		B 8/2/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: This boundary is drawn to include the wetland complex that supports the elements of biodiversity found at the site. It is designed to 1) protect the wetland occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. The boundary was delineated after 1997 field visits by a CNHP wetland ecologist, and corroboration with satellite imagery.

Carnero Creek

Biodiversity Rank: B3 (Moderate significance)

The Carnero Creek site supports a bristle cone pine woodland, a montane grassland, a Rio Grande cutthroat trout population, all of which are state rare.

Protection Urgency Rank: P4

The upper portions of the site is owned and managed by the Rio Grande National Forest, (see Appendix A for ownership map) where the primary conservation issue is one of management, rather than direct protection. The lower portions of this site are privately owned and are subject to high residential development pressures.

Management Urgency Rank: M2

Current management of the hydrology at the lower elevations results in the loss of many cutthroat trout each spring; when water is diverted to flood adjacent hay meadows, many fish go with it, resulting in an artificially high mortality rate. The property owner on this portion of the site is aware of the problem and thoroughly concerned about it. Fish grates are expensive to maintain, but may be an appropriate alternative to cessation of flood irrigation. In addition, the fish community at the lower elevations is degraded by the presence of white sucker (*Catostomus commersoni*), a species introduced from the eastern slope of Colorado as bait fish.

Along the lower portions of the riparian corridor, invasive exotic grasses have degraded the natural vegetation. Restoration of this area would improve the native vegetation.

Location: This site is located south-western Saguache County (Figure 9), approximately 1 mile northwest of La Garita on Carnero Creek, continuing into the La Garita Mountains.

U.S.G.S. 7.5 minute quadrangle: Bowers Peak, Lookout Mountain, Lime Creek,
Twin Mountains SE.

Legal description: T42N, R4E S

General Description: The Carnero Creek site covers approximately 13,000 acres and ranges in elevation from 8,300-11,300 feet (2,535-3,450 meters). “Carnero” means ram in english, which is appropriate for this site, since it is an important foraging and breeding ground for bighorn sheep (). The lower portions of this site are primarily a mosaic of pinyon pine-juniper woodlands (*Pinus edulis-Juniperus monosperma*), mountain mahogany shrublands (*Cercocarpus montanus*) with some currant (*Ribes* sp.), Yucca (*Yucca glauca*), and rabbitbrush (*Chrysothamnus nauseosus*). A blue grama (*Bouteloua gracilis*) shortgrass prairie and a montane grassland comprised of mountain muhly and Arizona fescue (*Muhlenbergia montana-Festuca arizonica*) dominate the lower south-facing slopes.

The riparian area in the lower portion of the site has been managed for livestock production, and primarily used for hay meadows. This has resulted in a high number of non-native

grasses and an eroding streambank. A narrow strip of native vegetation dominated by alder (*Alnus incana*) borders this portion.

The higher elevation areas to the northwest include U. S. Forest Service lands where bristle cone pine (*Pinus aristata*) communities occur. The native trout populations get healthier with elevation in this site. White sucker (*Catostomus commersoni*) do not occur at the higher elevations. The hydrology of this upper portion is kept intact by a local population of American beaver (*Castor canadensis*), but the riparian areas and roadsides host exotic annuals.

The surface and ground water of Carnero Creek is a major contributor to Russell and Mishak Lakes, both proposed conservation sites listed in this document. The Carnero Creek site is also an important hunting ground for American peregrine falcons (*Falco peregrinus anatum*).

Biodiversity Rank Justification: The Carnero Creek site supports a healthy population of a subspecies of native trout. This population of Rio Grande cutthroat (*Oncorhynchus clarki virginalis*) progresses in quality as one continues up the stream. At the lower elevations, the fish community is degraded by the presence of white sucker (*Catostomus commersoni*), a species introduced from the eastern slope of Colorado as bait fish. Also present at this site are community occurrences of globally rare montane grasslands (*Festuca arizonica-Muhlenbergia montana*), shrublands (*Alnus incana/mesic graminoid*), and woodlands (*Pinus aristata/Festuca thurberi*).

Natural Heritage element occurrences at the Carnero Creek site. Multiple listings of elements represent suboccurrences. Elements responsible for the high biodiversity rank are in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Alnus incana/mesic graminoid</i>	montane riparian shrubland	G2G3	S3		
<i>Festuca arizonica-Muhlenbergia montana</i>	montane grassland	G3	S3		B 10/23/97
<i>Pinus aristata/Festuca arizonica</i>	montane woodland		S3		B 7/8/94
<i>Pinus aristata/Festuca thurberi</i>	lower montane woodland	G3	S2		C 7/9/94
<i>Salix monticola/mesic graminoid</i>	montane riparian willow carr		S3		
Fish					
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3	S3		A 7/10/97
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat	G4T3		(3C), SC, FS	B 8/9/97
<i>Oncorhynchus clarki virginalis</i>	Rio Grande cutthroat		S3	(3C), SC, FS	unranked no date

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justifications: This boundary is drawn to include the wetland complex and uplands that supports the elements of biodiversity found at the site. It is designed to 1) protect the element occurrences from direct impacts such as trampling or other surface disturbances; and 2) to include the immediate slopes which contribute surface and groundwater flow to the wetlands. When considering potential effects on this site, the watershed scale is the appropriate level for consideration. Activities anywhere within the entire watershed surrounding this site have the potential to benefit or injure the integrity of the elements present. The boundaries for this site were drawn using satellite imagery at scales ranging from 1:60,000 to 1:200,000.



Grassland uplands of Carnero Creek



Ponderosa pine uplands of Carneo Creek

Cottonwood Creek Hills

Biodiversity Rank: B3 (High significance)

This site supports a small population of the rock-loving neoparrya, a south-central Colorado endemic plant. This species is only known from ten locations in five counties.

Protection Urgency Rank: P4

The site is both state land and Bureau of Land Management, with no known stresses. Both agencies should be notified regarding the biological significance of this site and manage for its biological integrity.

Management Urgency Rank: M4

Current land use practices at this site are not endangering the rare plant. Although this site does not appear to have any stresses this could change if substantial recreational impacts or development occurs. If present land uses continue, monitoring the abundance of the population every 5-10 years would suffice. Research on pollination, seed dispersal, predators, seed germination, and longevity is needed. As the natural history of the plants become known, management plans for this species will be refined.

Location: This site is located in southern Saguache County (Figure 9), approximately 4 miles west of Russell Lakes

U.S.G.S. 7.5 minute quadrangle: Swede Corners

Legal Description: T43N R7E S 28, 29, 32, 33

General Description: The Cottonwood Creek Hills site is located approx. 4 miles west of Russell Lakes at the base of the San Juan foothills. This site encompasses a precipitous volcanic outcrop dominated by current (*Ribes* sp.) needle and thread grass (*Stipa comata*), blue grama (*Bouteloua gracilis*), June grass (*Koeleria micrantha*), and buckwheat (*Eriogonum* sp.). A small population of the rare rock-loving neoparrya (*Neoparrya lithophila*) occurs along a west-facing slope and the adjacent ridge tops. This forb, in the carrot family, is found in soil pockets and in cracks among the rocks, from the cliff base to cliff face. It favors stable areas and does not occur on moving scree. A globally rare milkvetch (*Astragalus cerussatus*) was found near the ridge top.

The Cottonwood Creek drainage bounds the north and west part of this site. The site is covers approximately 100 acres and ranges in elevation from 7,800 to 8,200 feet.

Biodiversity Rank Justification: The Cottonwood Creek Hills site includes the globally rare rock-loving neoparrya and milkvetch. The neoparrya is restricted to south-central Colorado and known from 10 sites in five counties. The Cottonwood Creek Hills site has less than 500 plants (the 660 Road site has over 5000 plants). The milkvetch has a slightly larger range, but occurrences are still very limited.

Natural Heritage element occurrences at the Cottonwood Creek Hills site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Astragalus cerussatus</i>	milkvetch	G2	S2		
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2		(3C), FS	C 10/21/97

*EO=Element Occurrence; date indicates the date of last observation

Future Research Needs: We know that the rock-loving neoparrya requires soils of volcanic origin and that it thrives on north-facing slopes within the 7 to 9,000 foot elevation band. These criteria are met throughout the San Juan foothills, yet the plant is rarely present. Future studies are needed to help understand what other factors are limiting this plant to these few sites.

Boundary Justification: The boundaries drawn include the elements found within the site. Cottonwood Creek Hills site includes the known occurrences of the two globally rare plants. In addition, immediate potential habitat for both of these plants have been included within this boundary. We used 1990 1:40,000 color infrared aerial photos and a 7.5 minute topographic map to draw the boundaries.

La Garita

Biodiversity Rank: B5 (General biodiversity interest)

This site contains an occurrence of a short-eared owl, a globally common, but state rare bird.

Protection Urgency Rank: P4

Some of this site is agricultural land, where short-eared owls often hunt. The creek where the nest occurs would be the area of most immediate protection concerns, however, this area is on public land, and perhaps requires no specific protection measures. This site is a mosaic of private, state, and Bureau of Land Management lands (see Appendix A for ownership map). No specific active protection measures are required although any upstream water development may negatively effect this site if water quality and quantity are altered

Management Urgency Rank: M4

Current management practices appear adequate. The riparian area that supports the nest would be best left as is. The agricultural practices in this site may actually benefit the short-eared owl by providing easier hunting, and the short-eared owl is no stranger to farmland nor arid steppes (Clark 1975, Johnsgard 1988).

Location: This site is located in south-western Saguache County (Figure 9), approximately 0.5 miles southwest of La Garita.

U.S.G.S. 7.5 minute quadrangle: Twin Mountains SE

Legal Description: T41N, R6E S 1,2,11,12

T41R, R7E S 6,7

T42N, R6E S 35,36

General Description: The La Garita site was not assessed during the 1997 Colorado Natural Heritage Program inventories. It generally encompasses a mosaic of montane shrublands, grasslands, and some agricultural areas. It covers an area of approximately 3,000 acres with very little elevational relief, ranging from 7,800 – 8,000 feet (2,400 – 2,450 meters).

Biodiversity Rank Justification: This site is of general biodiversity interest as it contains a nesting occurrence of the state-rare short-eared owl.

Natural Heritage element occurrence at the La Garita site.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Asio flammeus</i>		G5	S2B,SZN		unranked 1/7/97

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The boundary for this site was drawn prior to 1997, and was not modified.

Eagle Mountain

Biodiversity Rank: B5 (General interest)

This site includes nesting habitat for the federally listed American peregrine falcon.

Protection Urgency Rank: P4

This site falls entirely on Rio Grande National Forest . The primary conservation issue with this site is one of management.

Management Urgency Rank: M3

As rock climbing has become increasingly popular and this site profiled within the climbing community, nest site fidelity by falcons has decreased. Management guidelines that address seasonal use restrictions in the area might help keep potential conflicts between sport climbers and nesting falcons to a minimum. Seasonal use restrictions need only apply during the breeding season (April – July).

Location: The Eagle Mountain site is located in south-western Saguache County (Figure 9), in the “north forty” area of the Rio Grande National Forest.

U.S.G.S. 7.5 minute quadrangles: Twin Mountains, Twin Mountains SE.

Legal Description:

General Description: The Eagle Mountain site encompasses the cliff region around Eagle Mountain and Eagle Rock in an arid lower montane zone. Pinyon pine-juniper (*Pinus edulis-Juniperus monosperma*) woodlands dominate the area below the cliffs. Scattered throughout the forest are pockets of blue grama (*Bouteloua gracilis*) grasslands. This site ranges in elevation from 8,400 – 10,400 feet (2,500 – 3,200 meters) and covers an area of approximately 1,700 acres.

Biodiversity Rank Justification: The American peregrine falcon is federally listed as threatened, and is afforded the legal protection governed by the Endangered Species Act. However, the overall condition and activity of the occurrences at this site are unknown, and nesting appears to be sporadic. With the help of the Peregrine Fund, the populations of the American peregrine falcon have made a dramatic comeback in western North America. By all indications, populations should continue to grow, and this subspecies may be delisted in the future.

Natural Heritage element occurrences at the Eagle Mountain site. Multiple listings represent suboccurrences.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Falco peregrinus anatum</i>		G4T4	S2B,SZN	LE, T	unranked 7/13/94
<i>Falco peregrinus anatum</i>	American peregrine falcon	G4T4	S2B,SZN	LE, T	unranked 5/26/95

*EO=Element Occurrence; date indicates the date of last observation

Boundary Justification: The planning boundary for the Eagle Mountain site was drawn to accommodate the nesting habitat for the local falcons. American peregrine falcons can range up to thirty miles in a day's forage for food (D. Lovell, pers. comm.). To draw a site that encompasses this much area may not be practical for planning purposes, but projects within this radius should consider the potential effect on these falcons, particularly those projects that occur in riparian and wetland areas, as these habitats are favorite foraging areas for American peregrine falcons.

660 Road

Biodiversity Rank: B2 (Very high significance)

This site supports one of the largest populations known for the rock-loving neoparrya, a south-central Colorado endemic plant. This species is only known from ten sites in five counties.

Protection Urgency Rank: P3

The site is over 75% privately owned with National Forest land in the southern quarter (see Appendix A for ownership map). The immediate threats to the rock-loving neoparrya and site are unknown. A conservation easement may be a useful strategy to ensure protection of this site. Discouraging any development on the ridge-tops and north-facing slopes would help protect the most critical habitat.

Management Urgency Rank: M4

Current land use practices at this site are not endangering the rare plant. If present land uses continue, it should be sufficient to monitor the abundance of the population every 5-10 years. We recommend developing a research plan to identify the specific requirements of rock-loving neoparrya, especially for pollination, seed dispersal, predators, seed germination, and longevity. As the natural history of the plant becomes known, management plans for this species should be refined.

Location: This site is located in south-western Saguache County (Figure 9), approximately 3 air miles southwest of La Garita, on the north and south sides of Road 660.

U.S.G.S. 7.5 minute quadrangle: Twin Mountains SE

Legal Description: T41N R6E Sections 8, 9, 16, 17, 20, 21, 28

General Description: The 660 Road site lies at the base of the San Juan foothills in the southern part of Saguache County (see following map). It is characterized by steep and rocky hills oriented on an east/west line. Sparse vegetation of scattered pinyon pines (*Pinus edulis*), one-seeded junipers (*Juniperus monosperma*), skunk bush (*Rhus trilobata*), and mountain mahogany (*Cercocarpus montanus*) dominate. The understory is also sparse and comprised of native grasses and forbs growing in shallow soil depressions and cracks of the black volcanic rock. Blue grama (*Bouteloua gracilis*), needle and thread (*Stipa comata*), Indian rice grass (*Oryzopsis hymenoides*), and mountain muhly (*Muhlenbergia montana*) are the most common grasses. Along the north-facing slopes and the ridge tops the rare rock-loving neoparrya (*Neoparrya lithophila*), a forb in the carrot family, was abundant. While on the south-facing slopes the neoparrya was rarely encountered.

The southern part of the site is within Rio Grande National Forest and gets occasional recreation use, including camping and hunting. Road 660, a maintained dirt road, is at the northern boundary of the forest service land. A small residence and associated disturbance is along road 660, the rest of the site is roadless and privately owned.

The local landowner reports the area to be excellent bighorn sheep calving grounds and also frequently used by other large mammals, including mountain lion (*Felis concolor*), pronghorn antelope (*Antilocapra americana*), and mule deer (*Odocoileus hemionus*). Nearby nesting peregrine falcons (*Falco peregrinus anatum*) and golden eagles (*Aquila chrysaetos*) probably use this site as hunting grounds.

The site is approximately 800 acres in size and ranges in elevation from 8,200 to 8,600 feet (2,500-2,620 meters).

Biodiversity Rank Justification: The 660 Road site supports one of the largest recorded occurrences of the rock-loving neoparrya. This herb is restricted to south-central Colorado and known from 10 sites in five counties. The 660 Road site is one of the largest of these occurrences, with over 5,000 plants estimated, whereas many of the other known locations have hundreds.

The state rare, simius roadside skipper (*Amblyscirtes simius*) was also found in this site. The skipper inhabits relatively undisturbed shortgrass prairies and open pinyon-juniper woodlands containing its host plant, blue grama (*Bouteloua gracilis*). It may be used as a bioindicator for the health of grassland habitats.

Natural Heritage elements at the 660 Road site. Element responsible for the high biodiversity rank is in bold type face.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
<i>Neoparrya lithophila</i>		G2	S2	(3C), FS	A 6/30/97
<i>Amblyscirtes simius</i>	simius roadside skipper	G4	S3		A 6/30/97

*EO=Element Occurrence; date indicates the date of last observation

Future Research Needs: We know that this plant requires soils of volcanic origin and that it thrives on north-facing slopes within the 7,000 to 9,000 foot elevation band. These criteria are met throughout the San Juan foothills, yet the plant is rarely present. Future studies are needed to help understand what other factors are limiting this plant to these few sites.

Boundary Justification: The boundary was drawn to encompass the occurrence of the rock-loving neoparrya and adjacent potential habitat. The northern quarter of this site was not surveyed but has high potential for continuing the neoparrya occurrence. The site was drawn by referencing the 1988 1:40,000 NAPP color infrared photograph and the 7.5 minute topographic map as well as satellite imagery.

Further Management Considerations: There is some recreational use of the area but it is primarily concentrated on the National Forest part of the site. Although this site does not appear to be threatened at this time, this could change if substantial recreational impacts or development occurred. If present land uses continue, it should be sufficient to monitor the abundance of the population every 5-10 years. Research on pollination, seed dispersal, predators, seed germination, and longevity is needed. As we learn more of the natural history of this plant, management plans will be refined.



Rock-loving neoparrya habitat at the 660 road site.

Elephant Rocks

Biodiversity Rank: B2 (Very high significance)

This site supports a medium-sized population of the rock-loving neoparrya, a south-central Colorado endemic plant. This species is only known from ten sites in five counties. In addition there is a globally rare milkvetch an uncommon fern, and the San Luis Valley endemic subspecies of silky pocket mouse at this site.

Protection Urgency Rank: P3

The majority of this site is owned and managed by either the Bureau of Land Management or Rio Grande National Forest (see Appendix A for ownership map), of which part is a State Natural Area. Consideration of the private inholdings is beneficial to any protection plan. The immediate stresses on the elements of concern are unknown. A conservation easement may be a useful tool to ensure long-term protection.

Management Urgency Rank: M4

There are no current stresses but management may be needed in the future, especially with regard to recreation. Current land use practices at this site do not appear to be endangering the elements of concern. We recommend periodic monitoring and developing a research plan to identify the specific requirements of rock-loving neoparrya and the milkvetch, especially for pollination, seed dispersal, predators, seed germination, and longevity.

Location: The Elephant Rocks site is located in south-western Saguache County (Figure 9), approximately 3.5 miles northeast of the town of Del Norte on Rio Grande National Forest, Bureau of Land Management and private lands.

U.S.G.S. 7.5 minute quadrangles: Twin Mountains SE, Del Norte

Legal Description: T40N R6E S 3, 4, 9, 10
T41N R6E S 33, 34

General Description: The Elephant Rocks site lies at the base of the San Juan foothills on the Saguache-Rio Grande County line. It is comprised of a complex of volcanic boulders, rock outcrops, and shrublands separating the short grass prairie of the valley floor from the more formidable San Juan mountains. The vegetation among the boulders is a sparse pinyon pine-juniper open woodland (*Pinus edulis-Juniperus monosperma*). Numerous native grasses and forbs occupy pockets of soil between the boulders and in crevices, including blue grama (*Bouteloua gracilis*), Fendler's poa (*Poa fendleriana*), and mountain muhly (*Muhlenbergia montana*). The intermittent streams that separate the boulder outcrops are usually dominated by these grasses as well.

The rare rock-loving neoparrya, a forb in the carrot family, is found between crevices in rocks and on small flat pockets of soils between boulders. It is often protected by overhanging boulders.

The area surrounding the boulders are dominated by rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and a grassland of blue grama, indian rice grass (*Oryzopsis hymenoides*), and squirrel tail (*Elymus elymoides*). The silky pocket mouse (*Perognathus flavus sanluisi*), a San Luis Valley endemic, was found in the shrub and grassland habitat.

Much of this site is part of a state-designated natural area. It receives some recreation, including hunting and camping. Certain areas have trash piles at the base of the rocks.

This site is approximately 850 acres and ranges from about 7,800 to 8,000 feet (2,400-2,440 meters) in elevation.

Biodiversity Rank Justification: The Elephant Rocks site supports a medium-sized population of the rock-loving neoparrya. This herb is restricted to south-central Colorado and known from 10 sites in five counties. This population has an estimated 2000 individuals.

In addition to the rock-loving neoparrya, a rare milkvetch (*Astragalus cerussatus*) and a silky pocket mouse subspecies population are found here. The milkvetch occurs in northern New Mexico and southern Colorado on rocky slopes. Less than 20 occurrences have been located throughout its range. The silky pocket mouse is a subspecies restricted to the San Luis Valley and is rare within its range.

A small occurrence of the grass fern (*Asplenium septentrionale*) at this site represents the southern most extension of this uncommon fern, and is a new county record for Saguache.

Natural Heritage element occurrences at the Elephant Rocks site. Bolded elements are driving the biodiversity rank.

Element	Common Name	Global Rank	State Rank	Federal and State Status	EO* Rank and Date
Plants					
<i>Asplenium septentrionale</i>	grass fern	G3G4	S3S4		C 6/30/97
<i>Astragalus cerussatus</i>	milk-vetch	G2	S2		C 6/30/97
<i>Neoparrya lithophila</i>	rock-loving neoparrya	G2	S2	(3C), FS	B 6/30/97
Mammals					
<i>Perognathus flavus sanluisi</i>	silky pocket mouse subsp.	G5T3	S3		A 6/16/97

*EO=Element Occurrence; date indicates the date of last observation

Future Research Needs: We know that the rock-loving neoparrya requires soils of volcanic origin and that it thrives on north-facing slopes within the 7 to 9,000 foot elevation band. These criteria are met throughout the San Juan foothills, yet the plant is rarely present. Future studies are needed to help understand what other factors are limiting this plant to these few sites.

John Schwarz of the BLM has been performing inventory and status checks on the Elephant Rocks population of *neoparrya*.

Boundary Justification: This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; and 2) provide suitable habitat where additional individuals can become established over time. The site was drawn by referencing the 1988 1:40,000 NAPP color infrared photograph, the 7.5 min. quadrangles and satellite imagery.

Further Management Considerations: Recreation appears to be the primary use for this area. Without understanding more about the life history of the elements of concern, especially the rock-loving *neoparrya*, it is difficult to understand what impacts recreation may have. This site should be monitored at least every five years to detect changes in overall quality or condition of the rare plant occurrences and/or the associated plant communities. Research on pollination, seed dispersal, predators, seed germination, and longevity is needed. As we learn more of the natural history of these plants, management plans will be refined.

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APPENDIX A

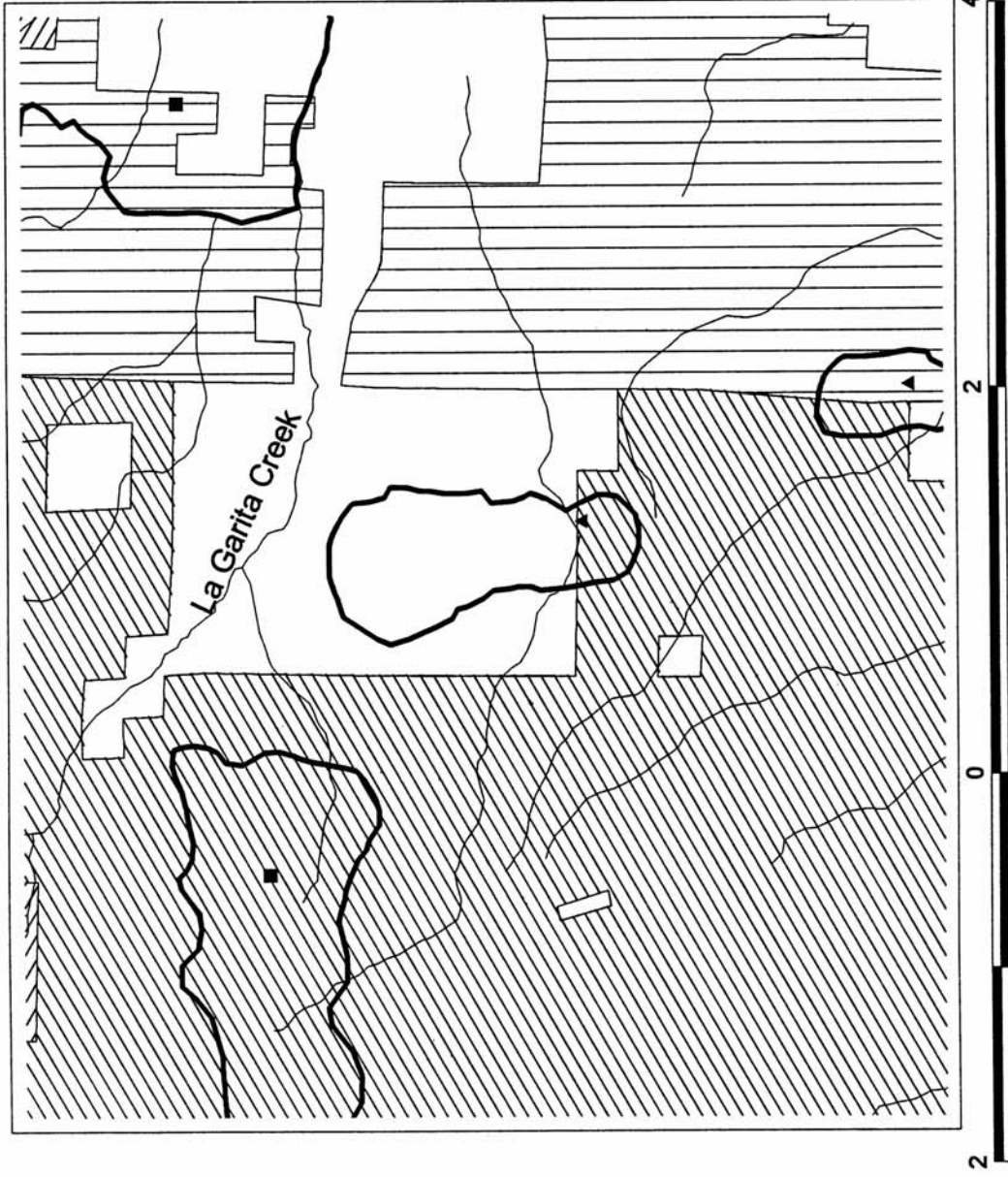
Appendix A includes a GIS generated map for each site. The approximate location of the occurrences discussed in the site profile are noted, although all private land occurrences are not shown.

The maps are ordered alphabetically by site name



660 Road Site

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▬ Roads
 - ▬ Streams
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private

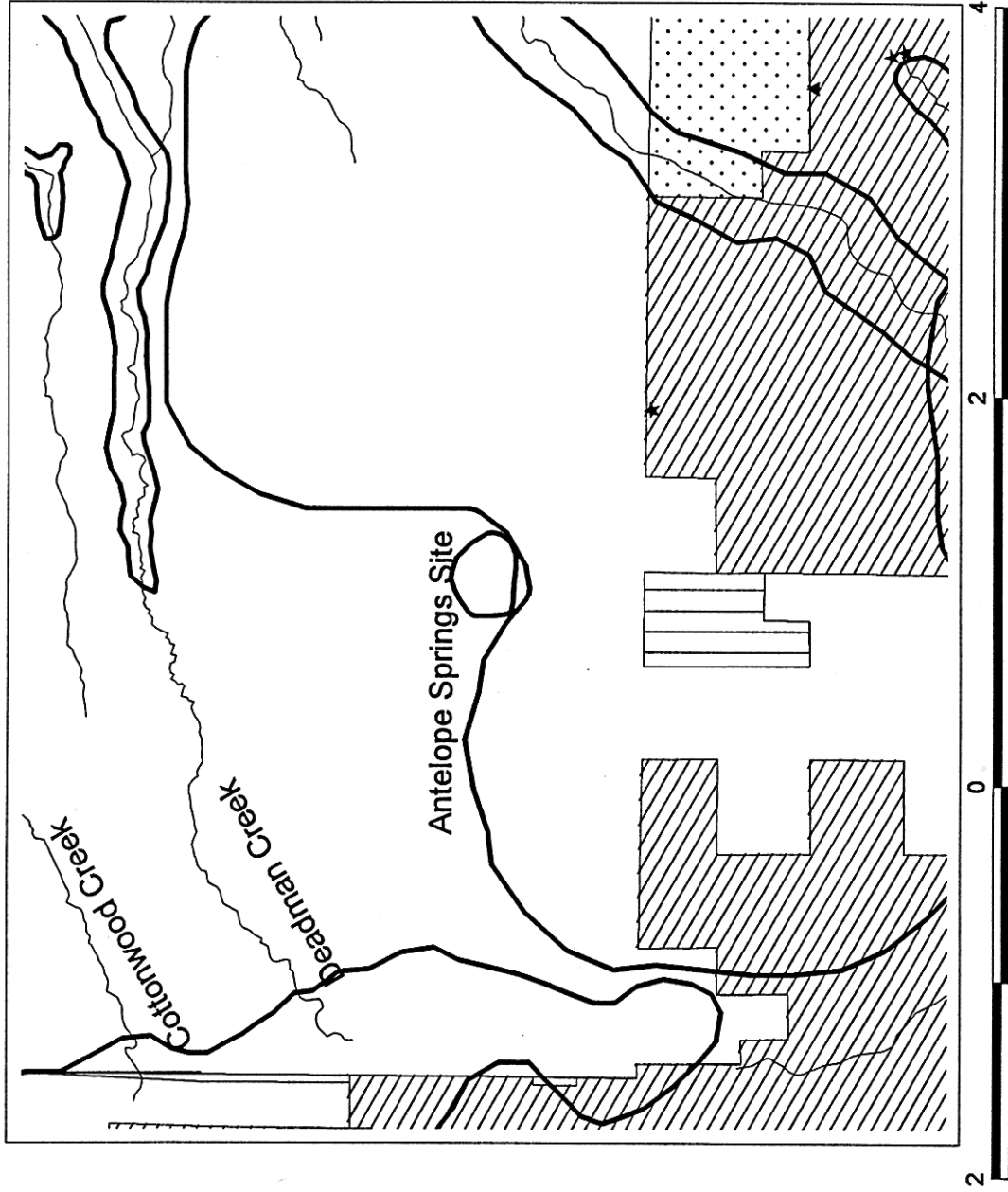
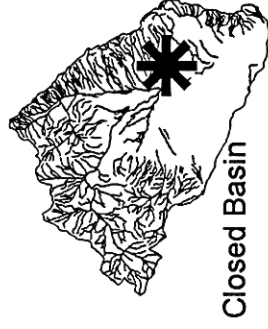
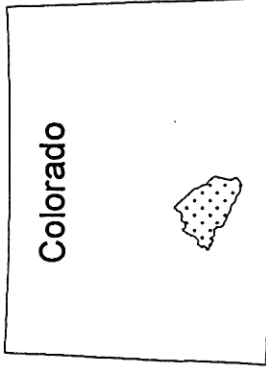
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Antelope Springs

(ownership status)



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
- Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



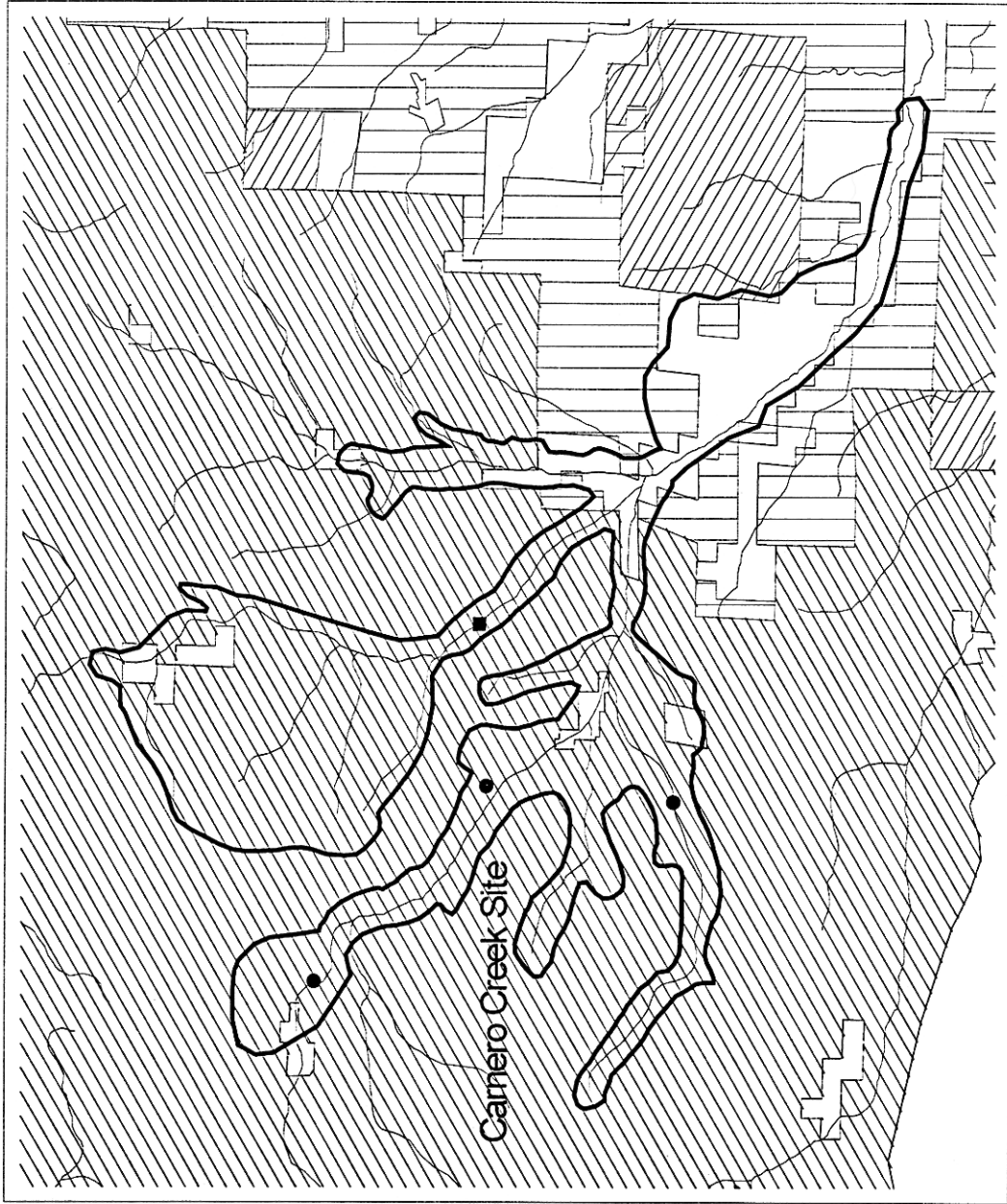
Carnero Creek

(ownership status)



Closed Basin

- Public land element occurrences
- vertebrate
 - * invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
 Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

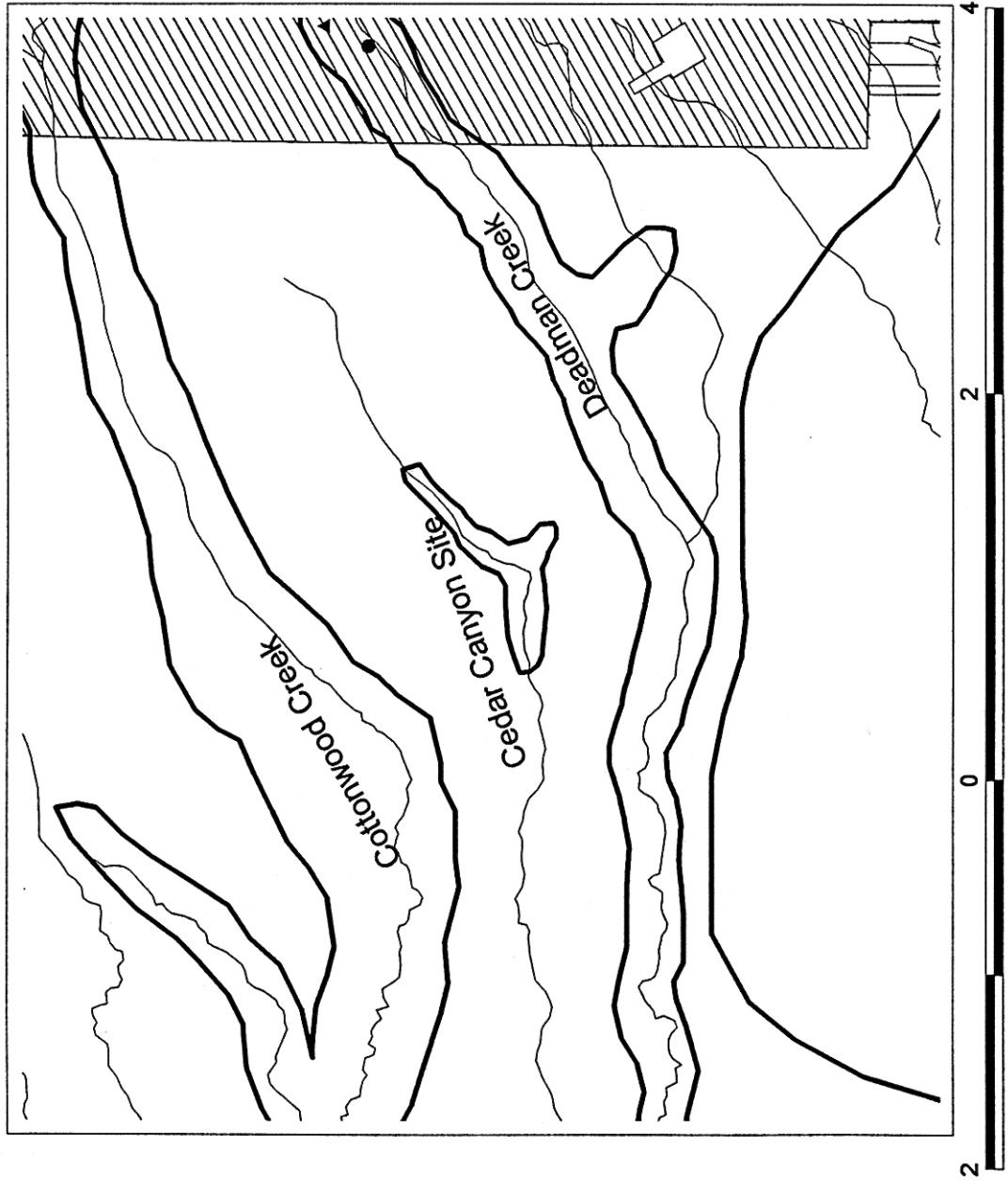
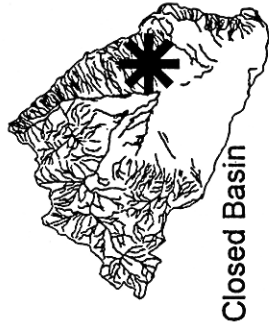
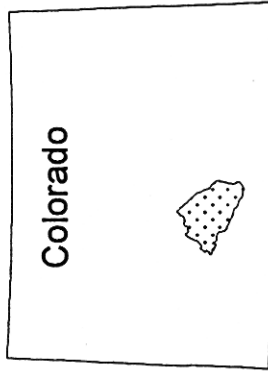


Occurrence data and site boundaries are current as of 9 January, 1998. Map created by Anne Ochs.



Cedar Canyon

(ownership status)



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



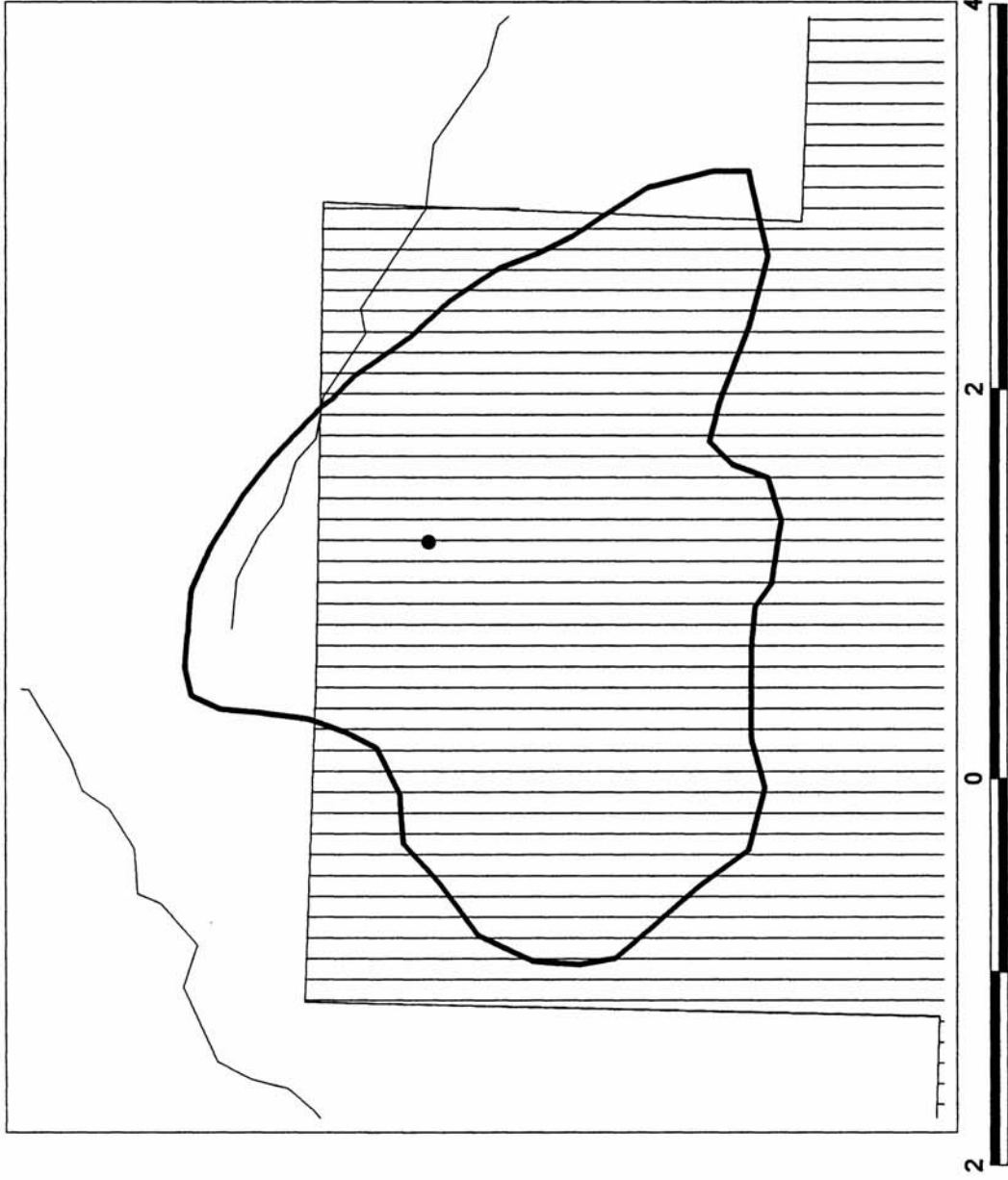
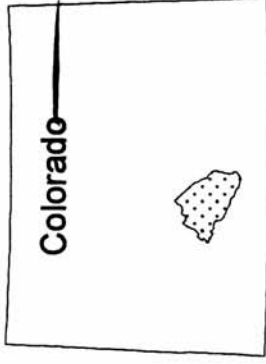
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



Clayton Cone

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▤ Roads
 - ▥ Streams
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - NPS
 - CDOW
 - ▬ State
 - ▮ Private

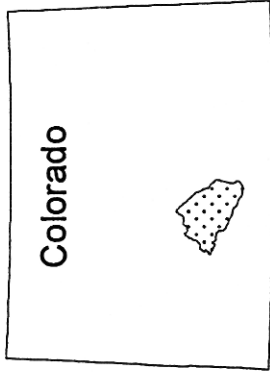
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

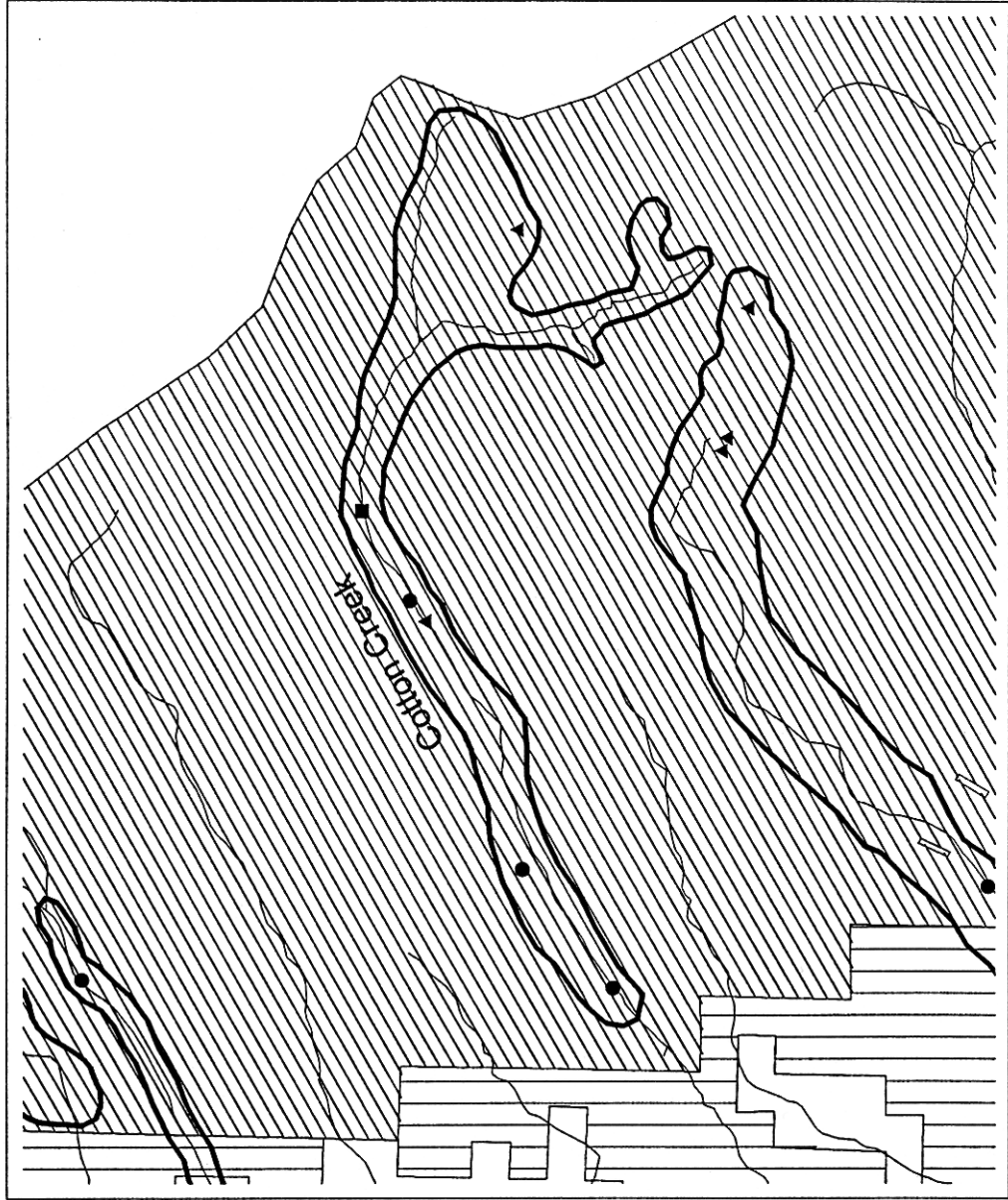


Cotton Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
- Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

4 Miles

2

0

2

4 Miles



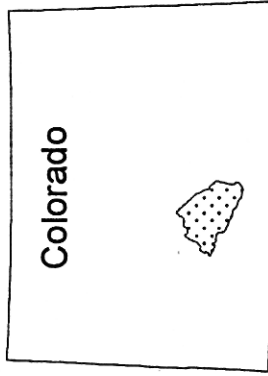
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

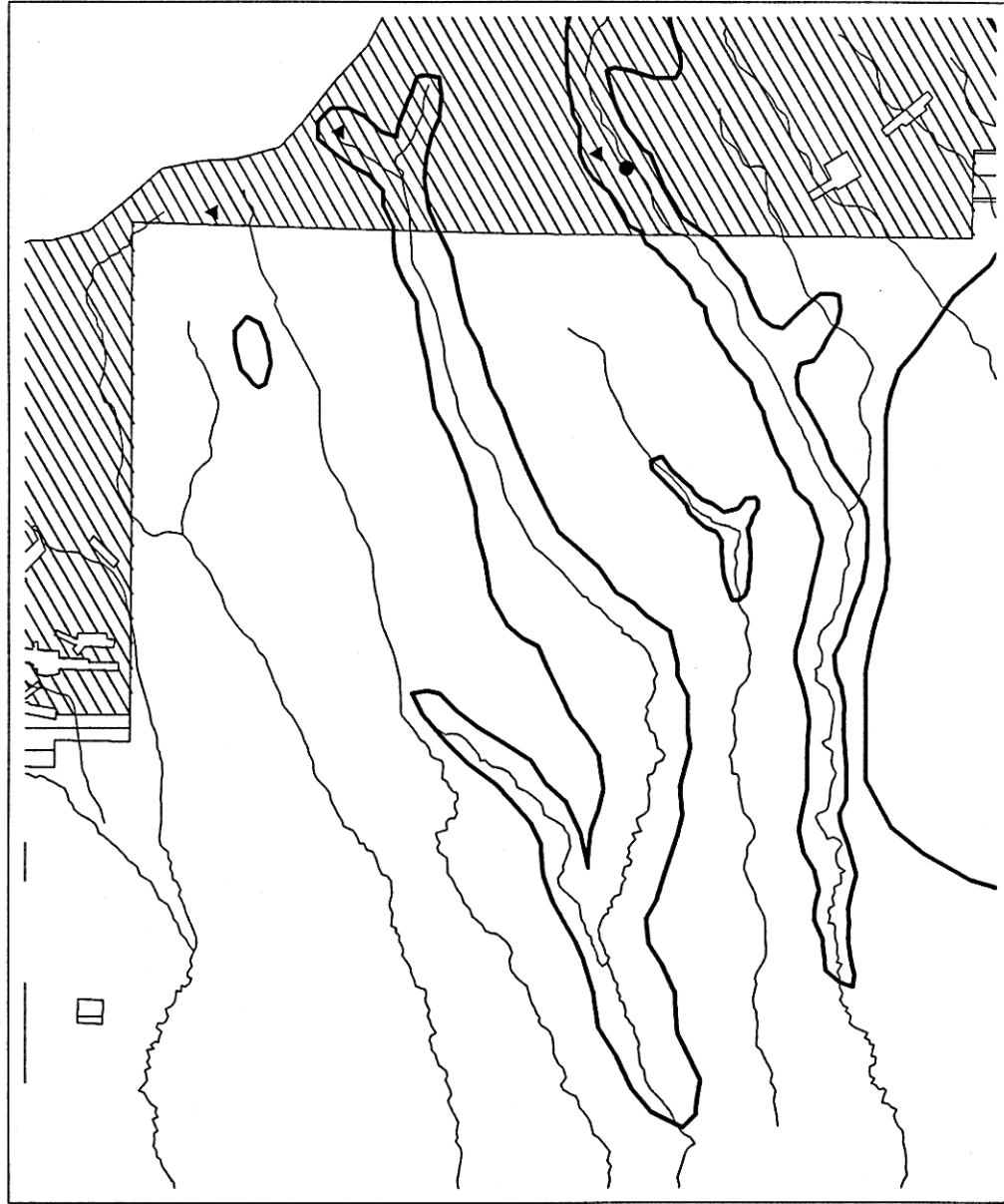


Cottonwood Creek

(ownership status)



Closed Basin



4 Miles

2

0

2



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▭ Roads
 - ▭ Streams
- Land ownership**
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

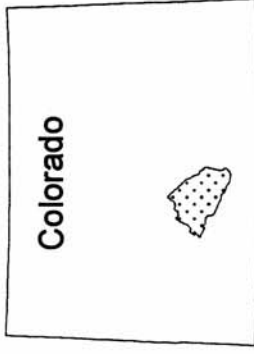
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

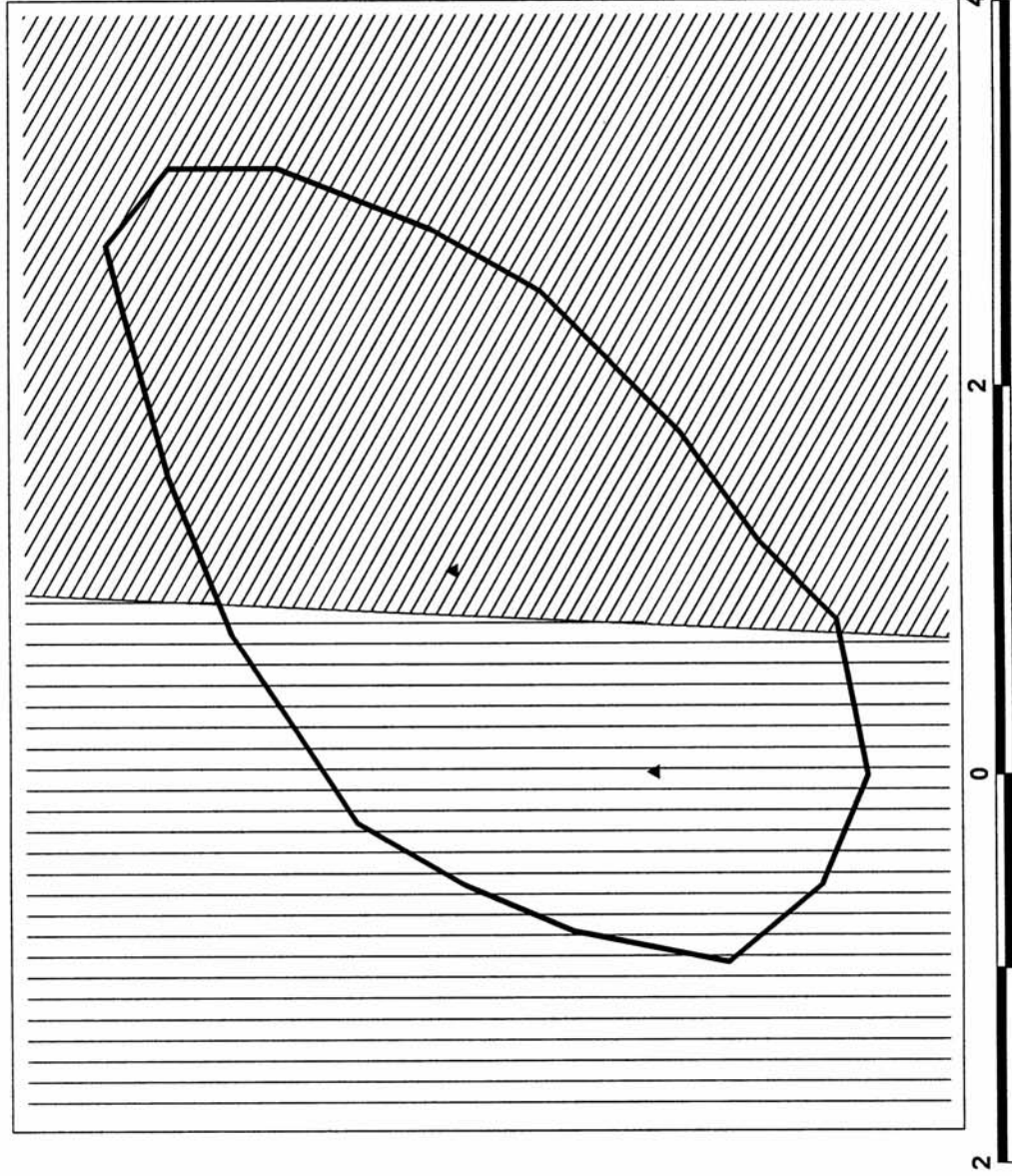


Cottonwood Creek Hills

(ownership status)



Closed Basin



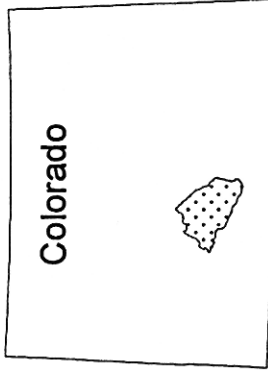
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Deadman Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▬ Streams
- Suggested conservation sites
- Land ownership
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private

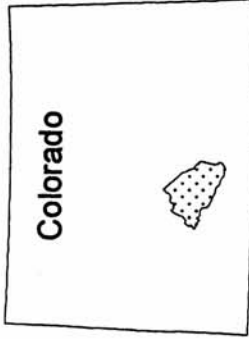
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

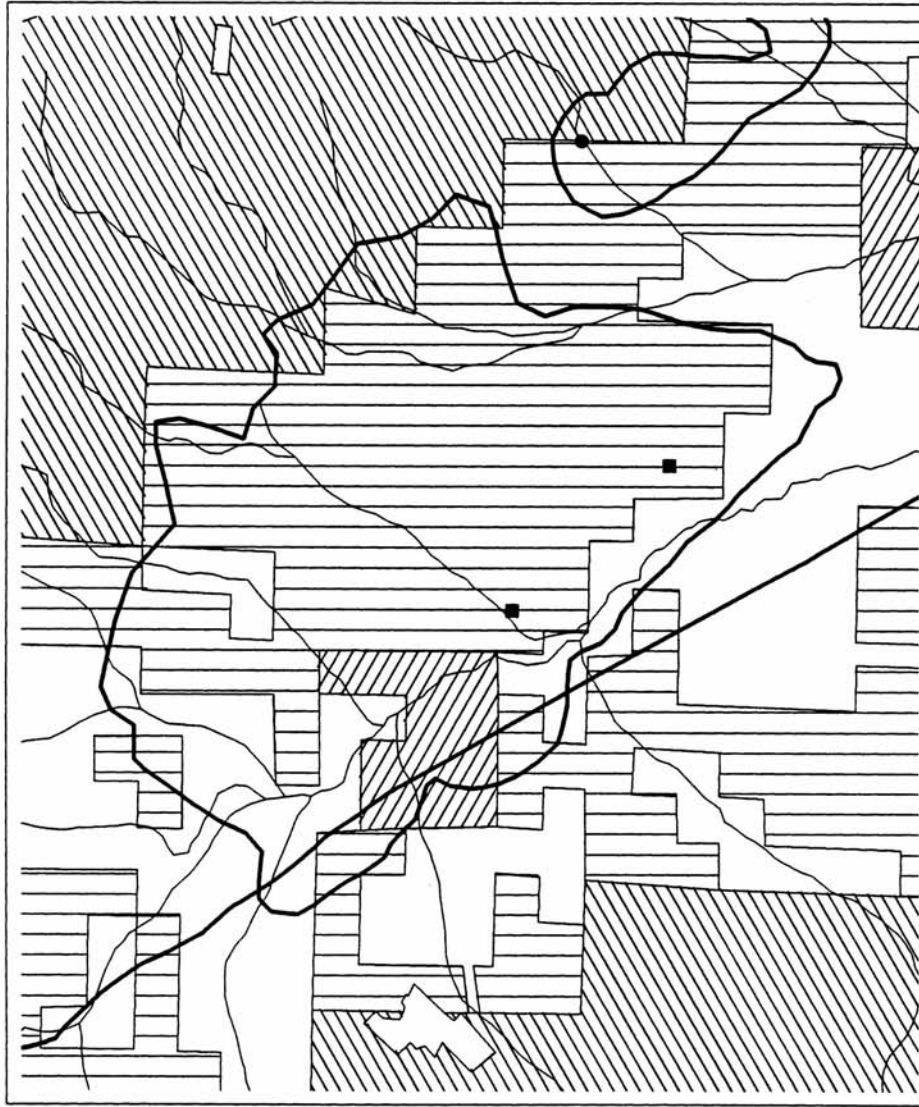


Decker Creek

(ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed Basin**
- Roads
 - ▤ Streams
- Suggested conservation sites**
- Land ownership**
- ▨ USFS
 - ▧ BLM
 - ▩ NPS
 - ▦ CDOW
 - ▧ State
 - ▨ Private



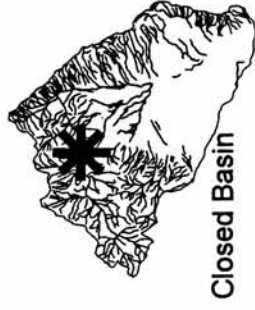
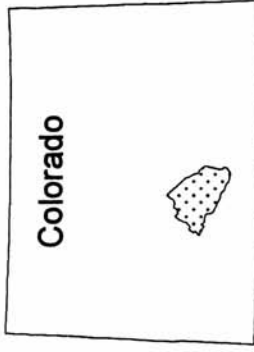
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

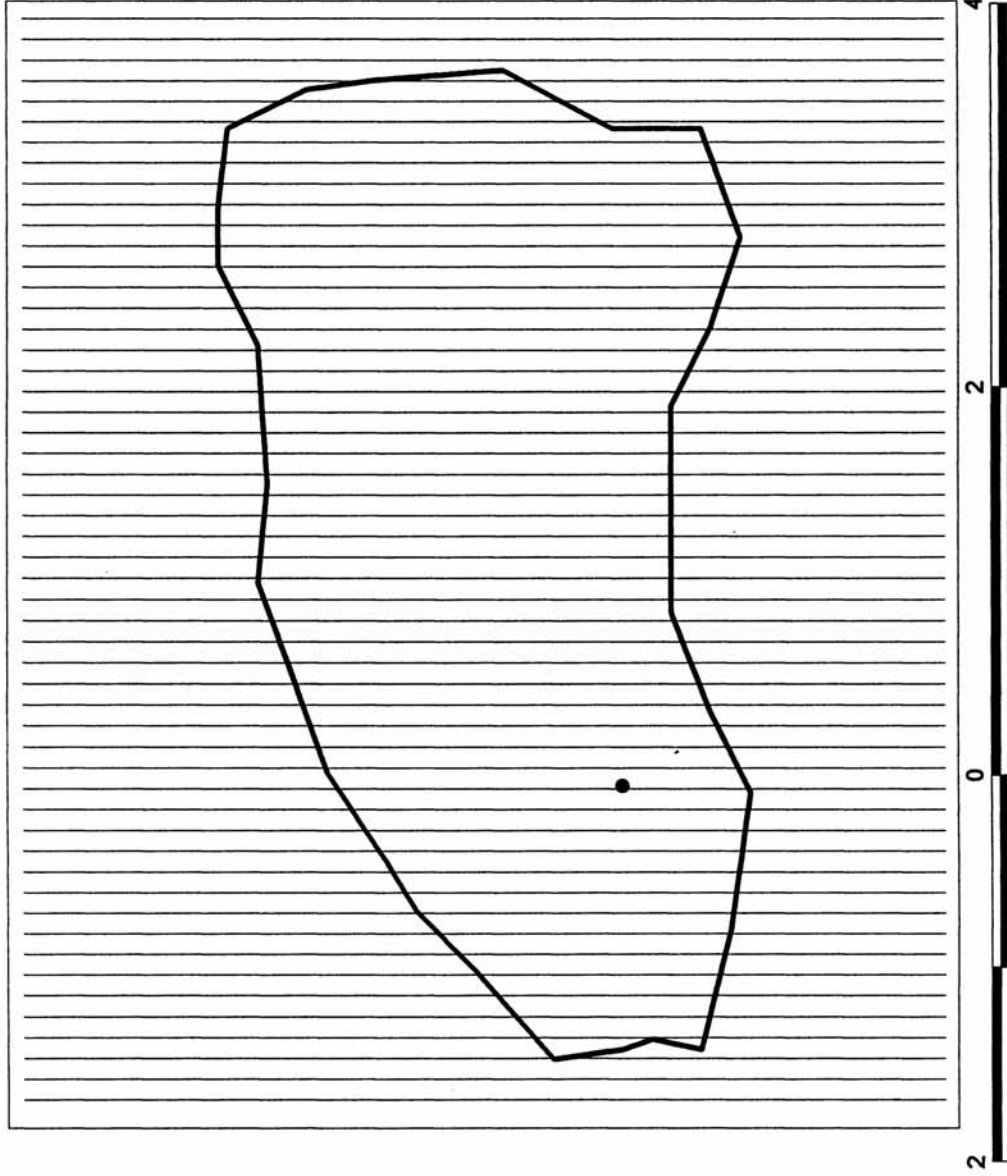


Devils Knob

(ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
- Roads**
- Streams**
- Suggested conservation sites**
- Land ownership**
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

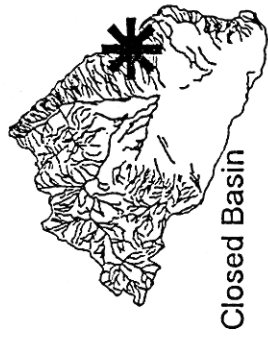
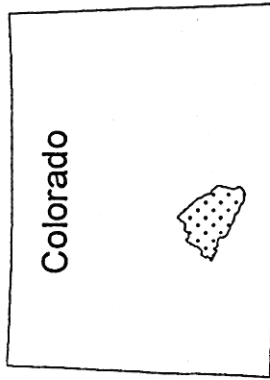
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

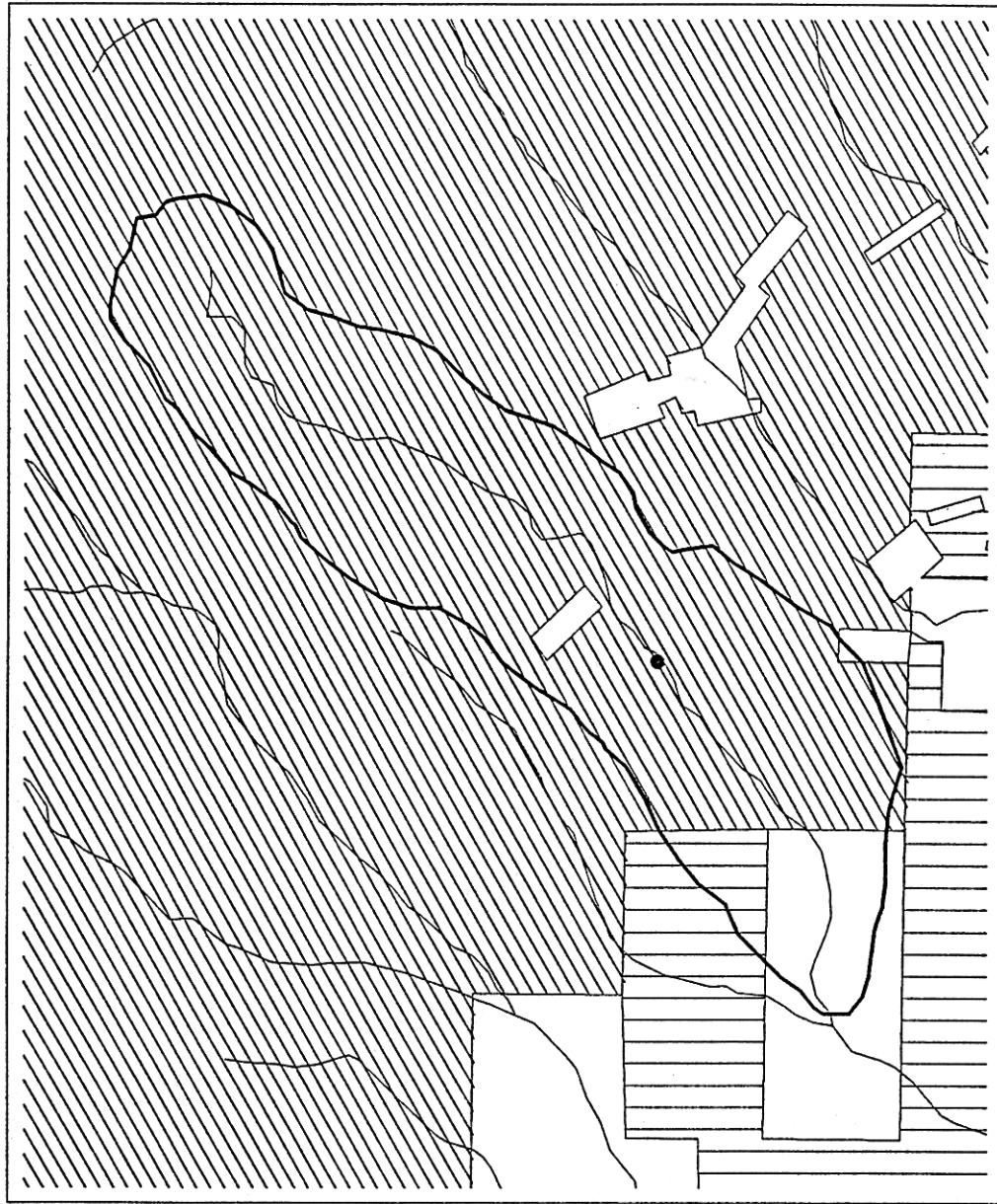


Dimick Gulch

(ownership status)



Closed Basin



2 0 2 4 Miles

- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▭ Streams
 - ▭ Suggested conservation sites
- Land ownership
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private



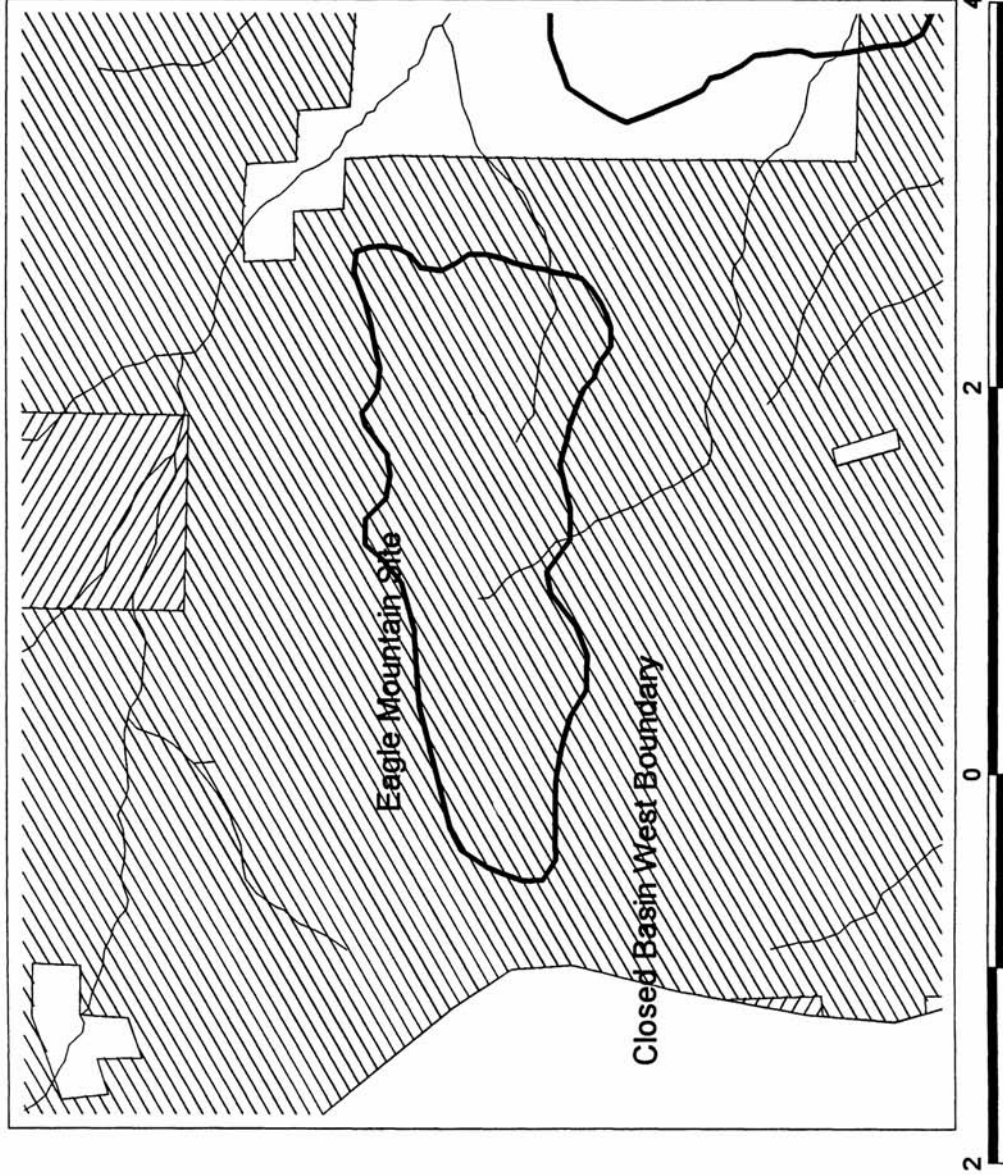
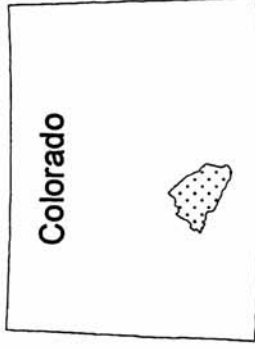
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.



Eagle Mountain

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▭ Roads
 - ▭ Streams
 - ▭ Suggested conservation sites
- Land ownership**
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

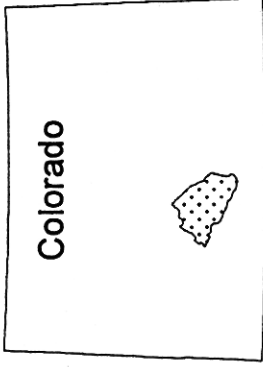
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

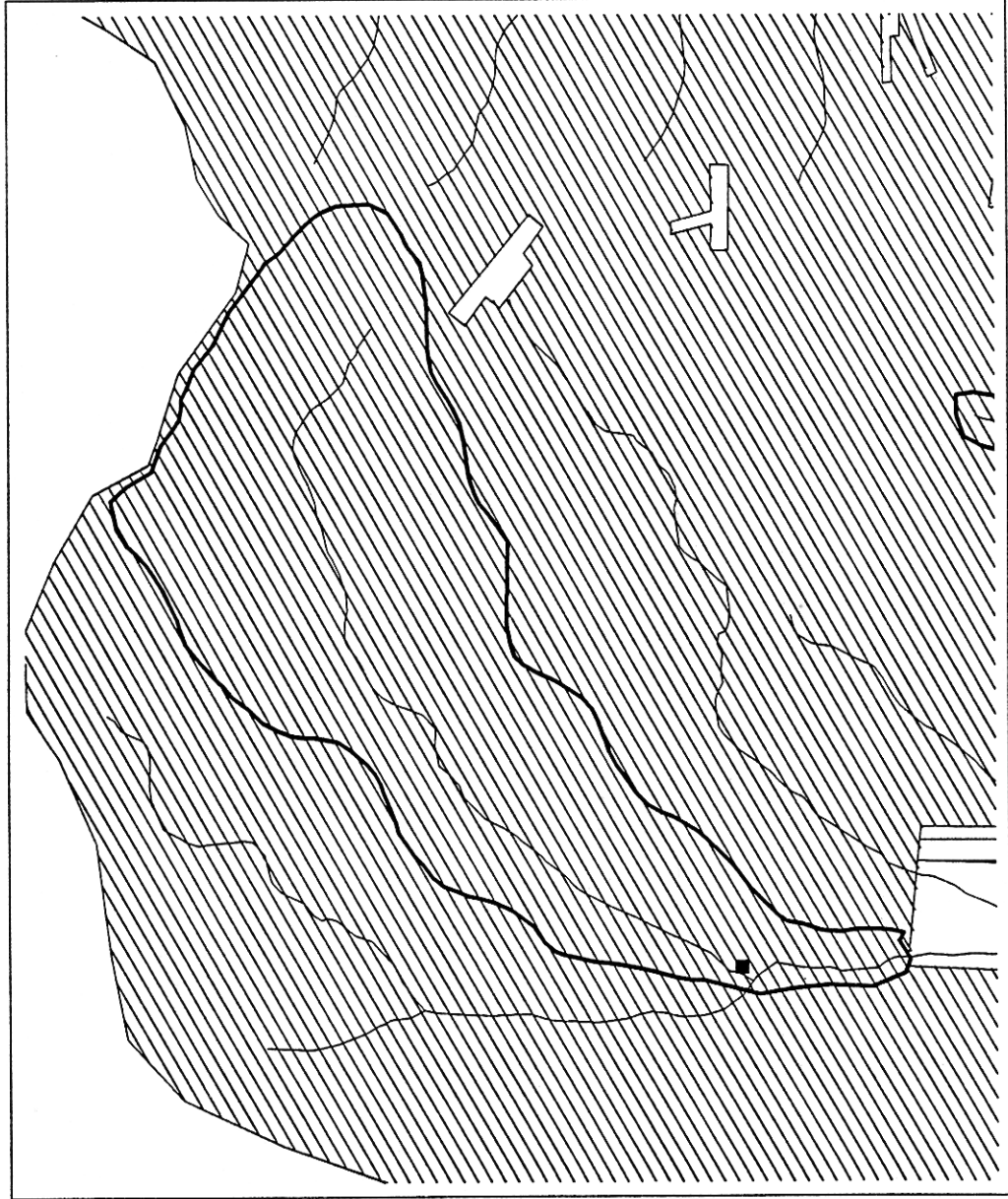


East Middle Creek

(ownership status)



Closed Basin



4 Miles



Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

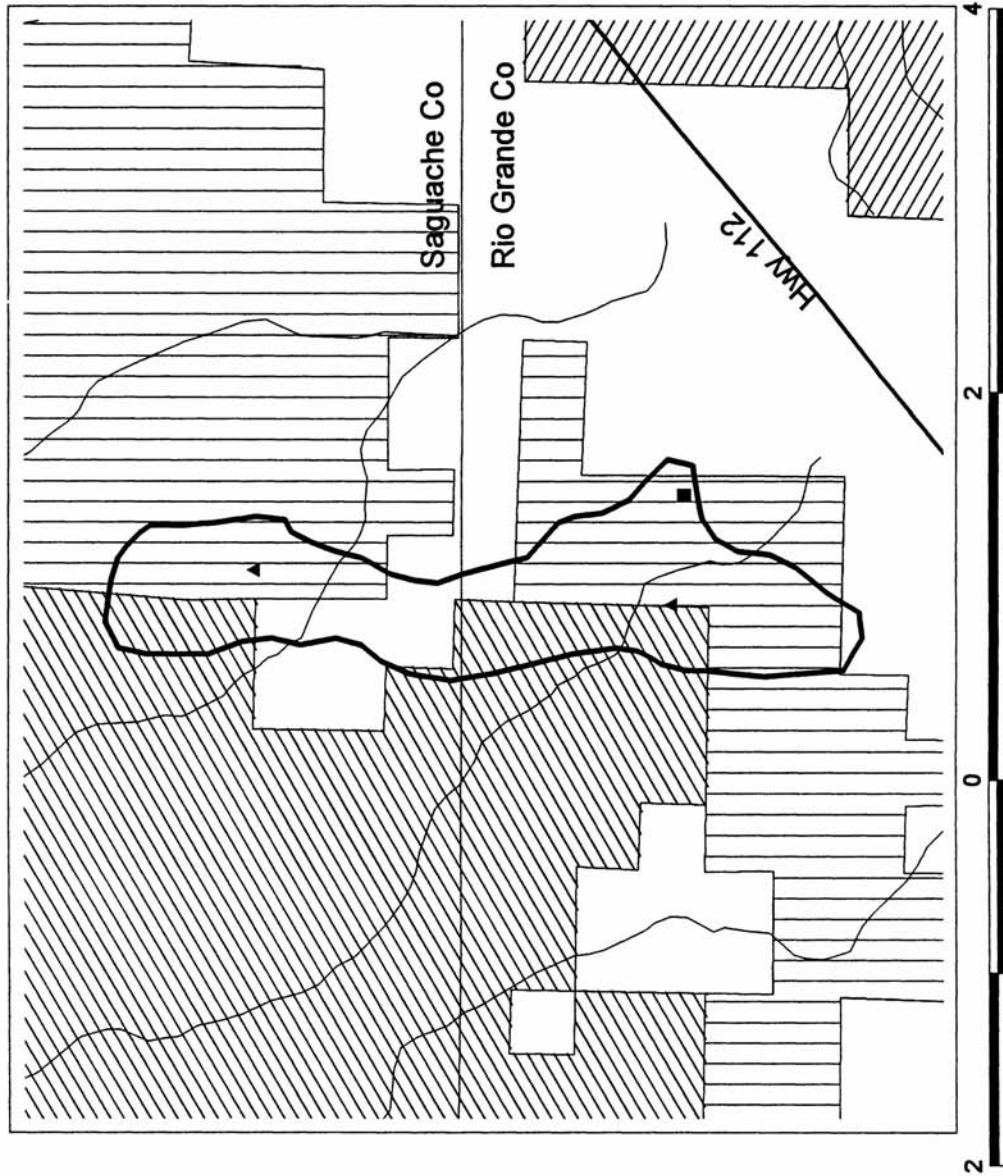
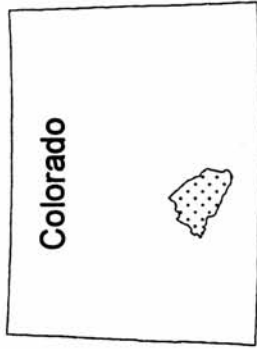
- All element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
- ▭ Roads
 - ▭ Streams
- Suggested conservation sites
- ▭ Land ownership
 - ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private





Elephant Rocks

(ownership status)



Closed Basin

- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Saguache county
 - ▨ Closed basin
 - ▧ Roads
 - ▩ Streams
 - ▭ Suggested conservation sites
- Land ownership
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private



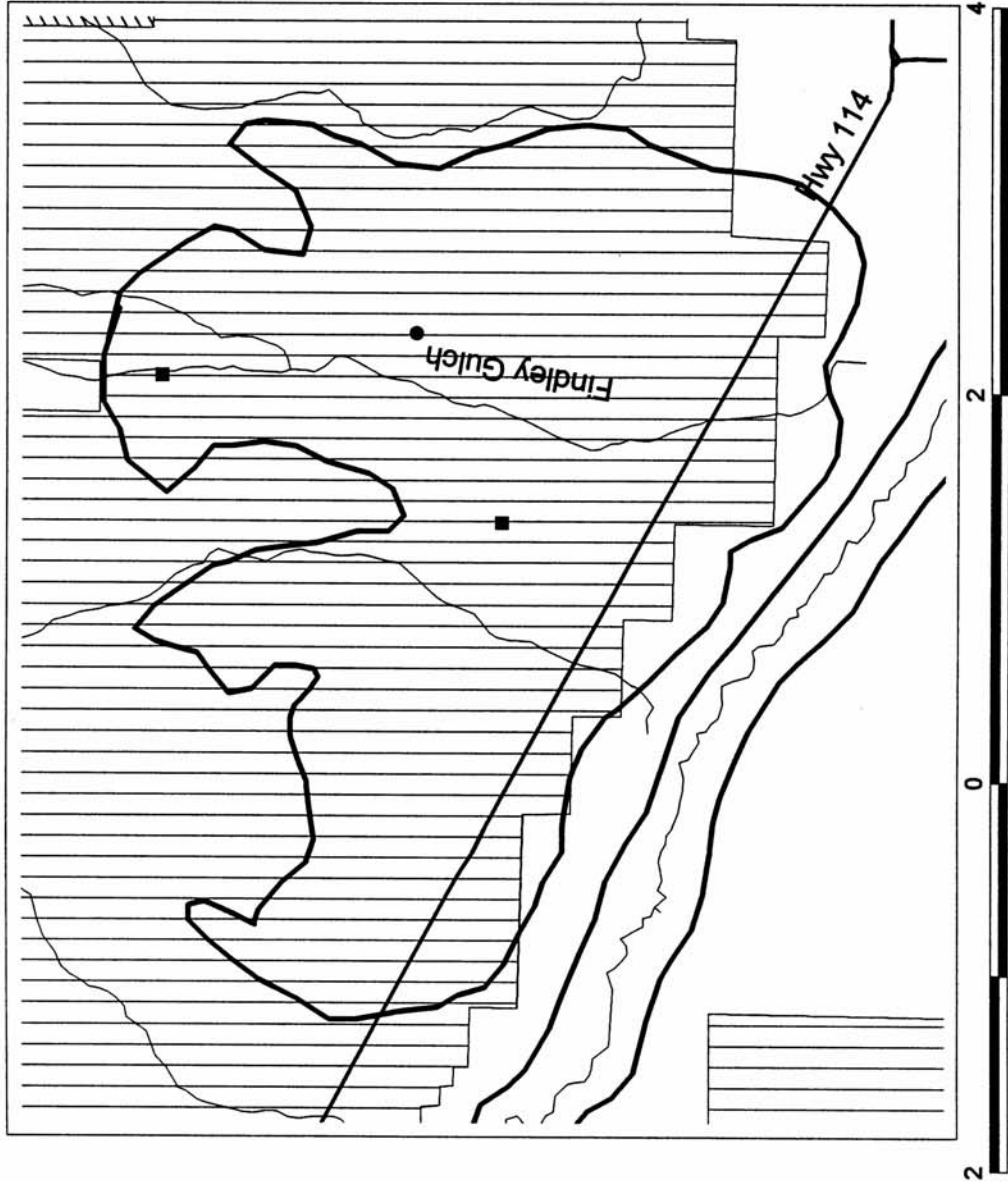
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Findley Gulch

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- ▭ Closed basin
 - ▭ Roads
 - ▭ Streams
- Land ownership**
- ▭ USFS
 - ▭ BLM
 - ▭ NPS
 - ▭ CDOW
 - ▭ State
 - ▭ Private

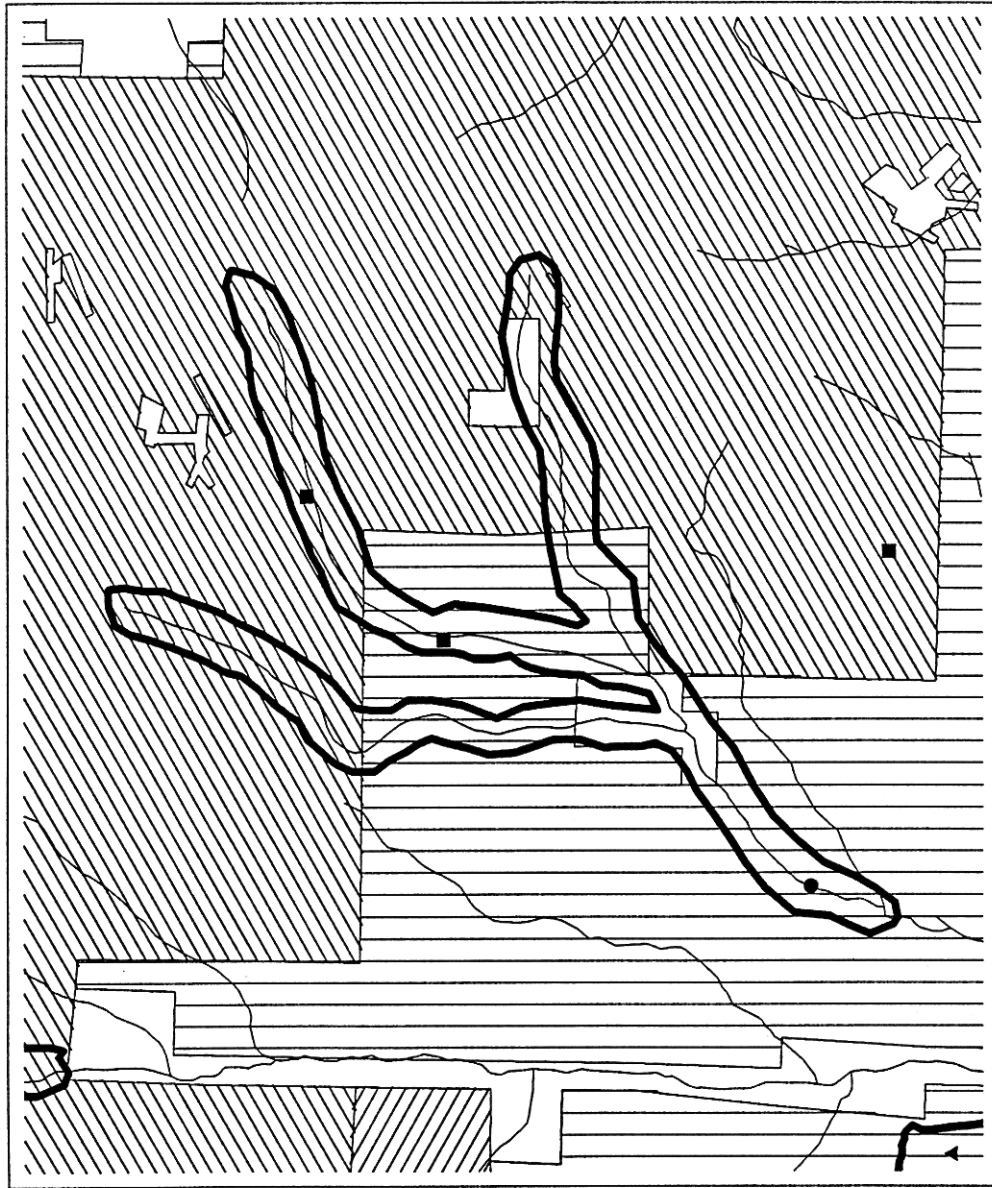
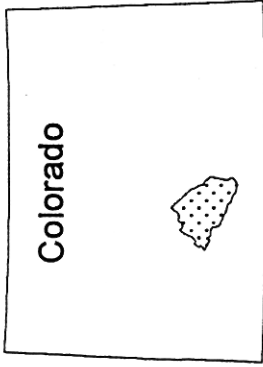
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Ford Creek

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- ▭ Closed basin
 - ▭ Roads
 - ▭ Streams
 - ▭ Land ownership
 - ▭ USFS
 - ▭ BLM
 - ▭ NPS
 - ▭ CDOW
 - ▭ State
 - ▭ Private

Miles



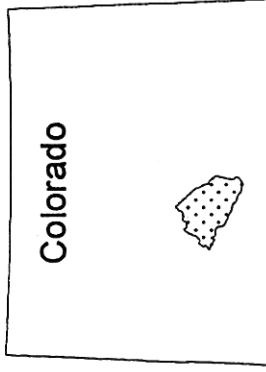
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

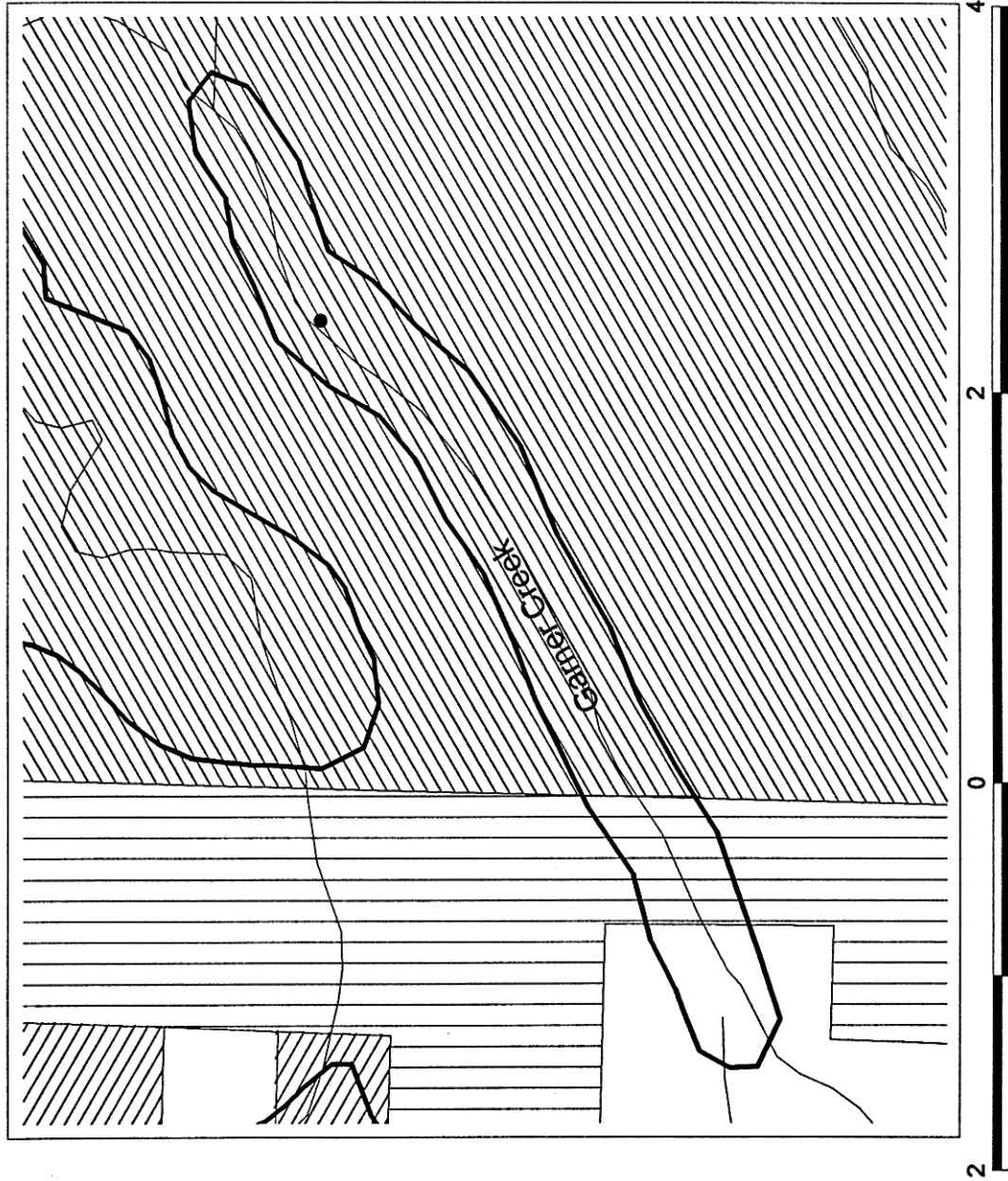


Garner Creek

(ownership status)



Closed Basin



Public land element occurrences

- vertebrate
- ★ invertebrate
- ▲ plant
- community

- Closed basin
- ▬ Roads
- ▬ Streams

Suggested conservation sites

- Land ownership
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

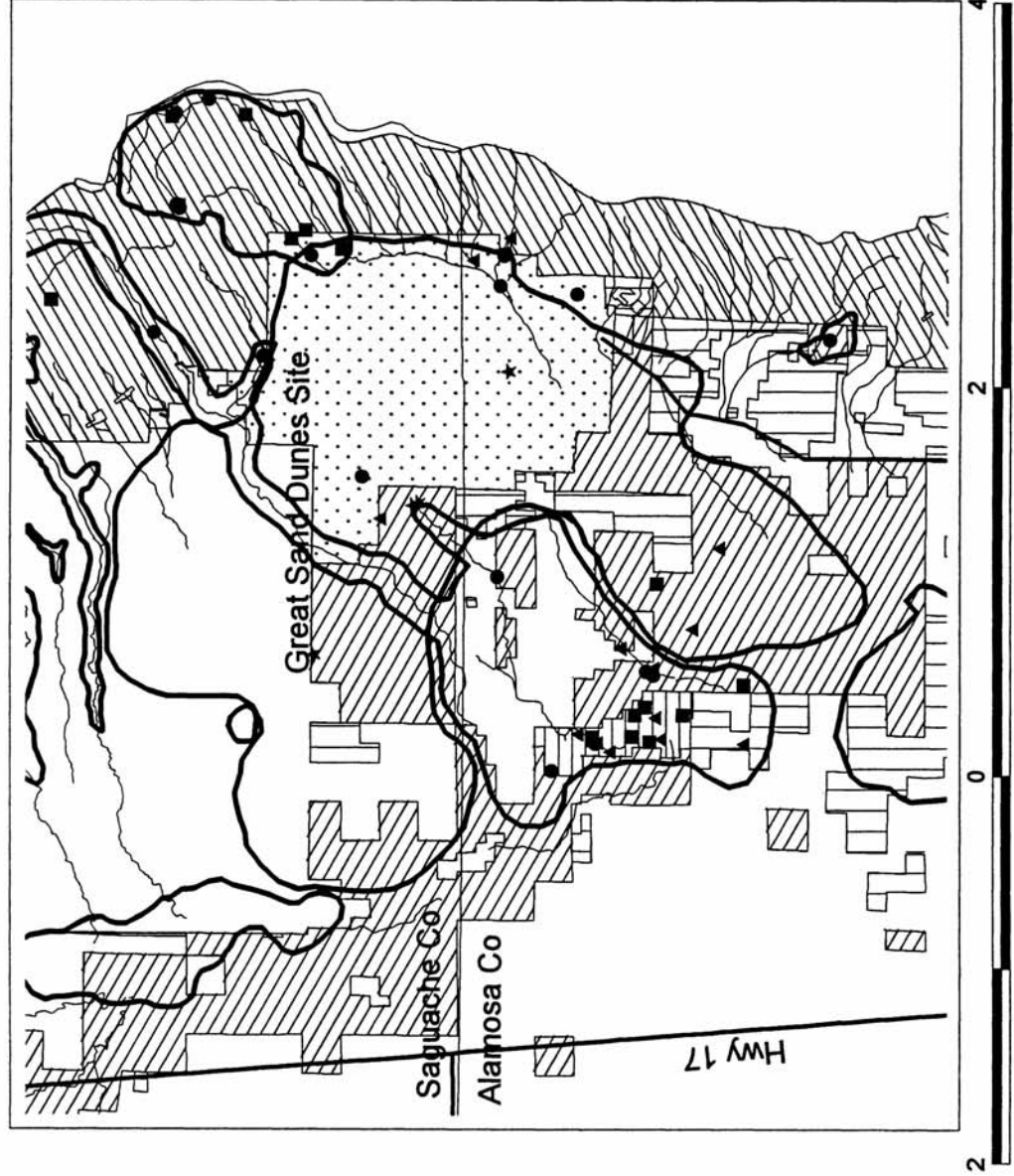
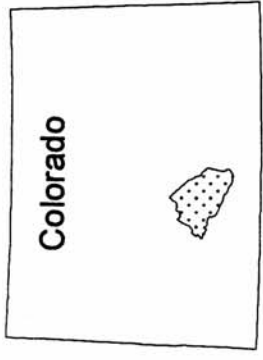
4 Miles

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Great Sand Dunes (ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Land ownership**
- Saguache county
 - Closed basin
 - ▤ Roads
 - ▥ Streams
 - ▧ Suggested conservation sites
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - NPS
 - CDOW
 - ▬ State
 - ▭ Private



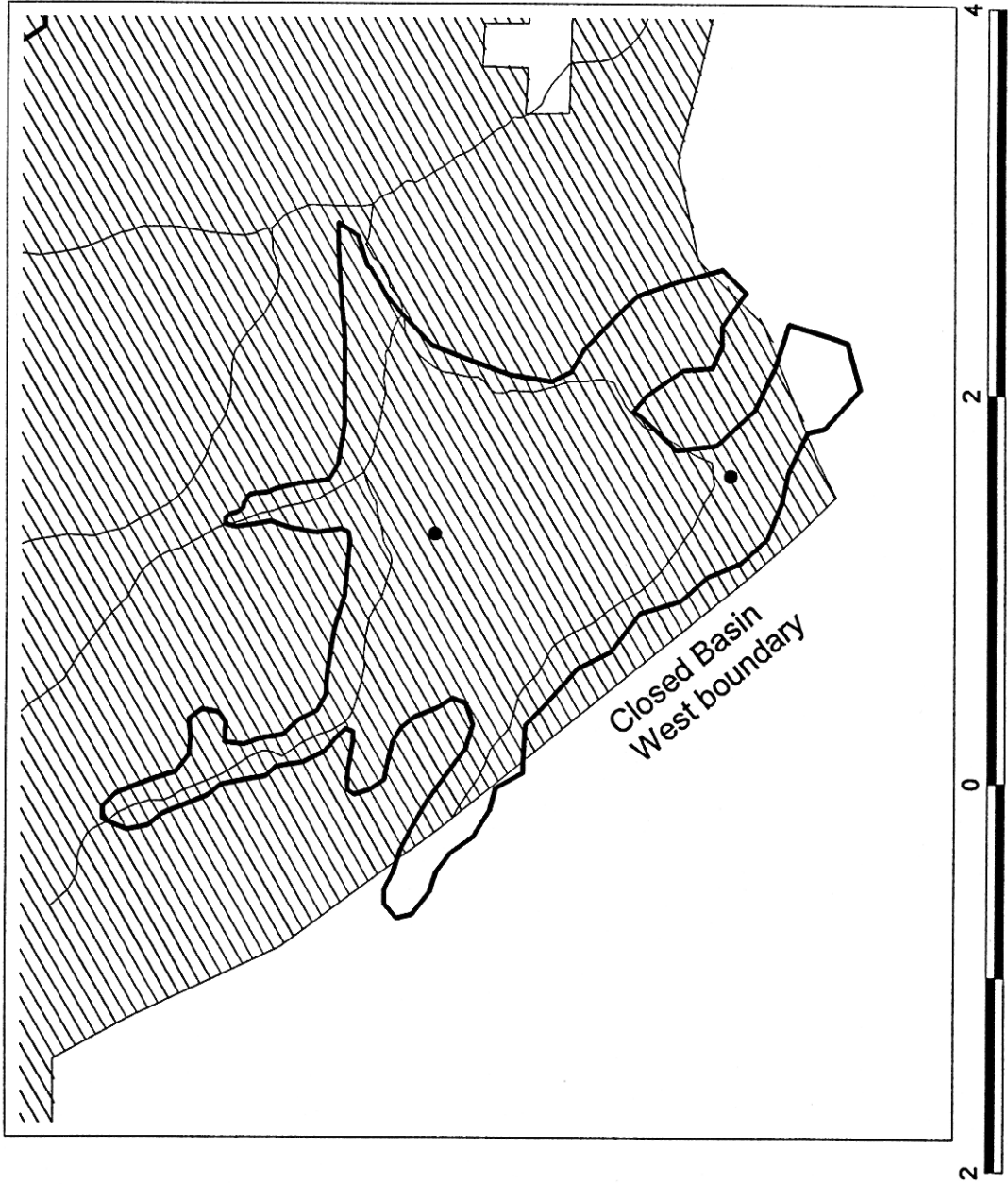
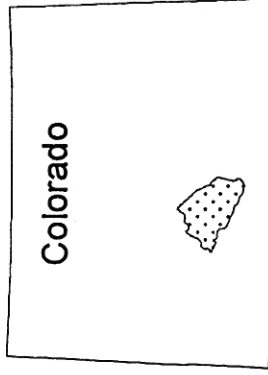
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



Groundhog Park

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Conservation sites**
- Closed basin
 - ▤ Roads
 - ▥ Streams
- Suggested conservation sites**
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private

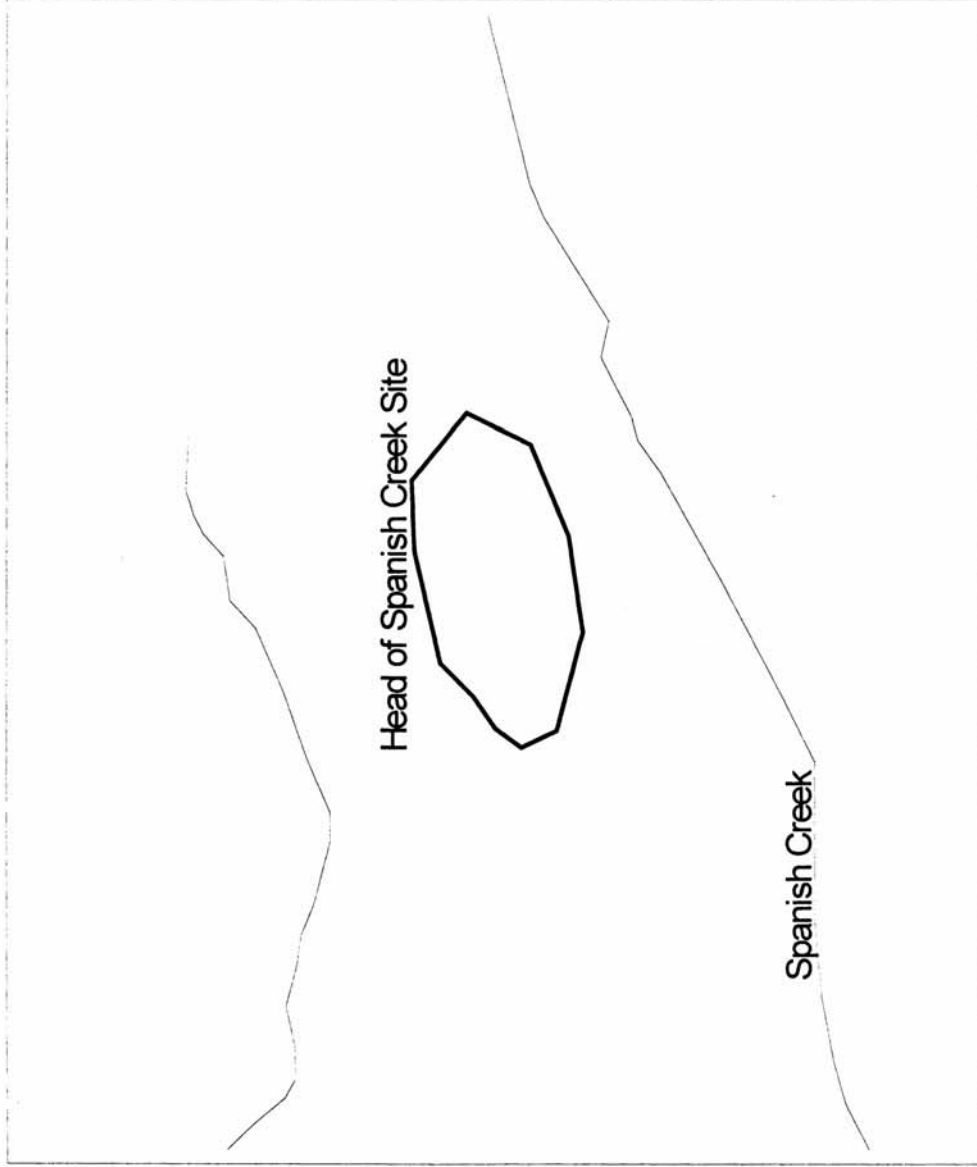
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Head of Spanish Creek

(ownership status)



- Public land element occurrences
- vertebrate
 - * invertebrate
 - ▲ plant
 - community
 - Closed basin
- Roads
- Streams
- Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

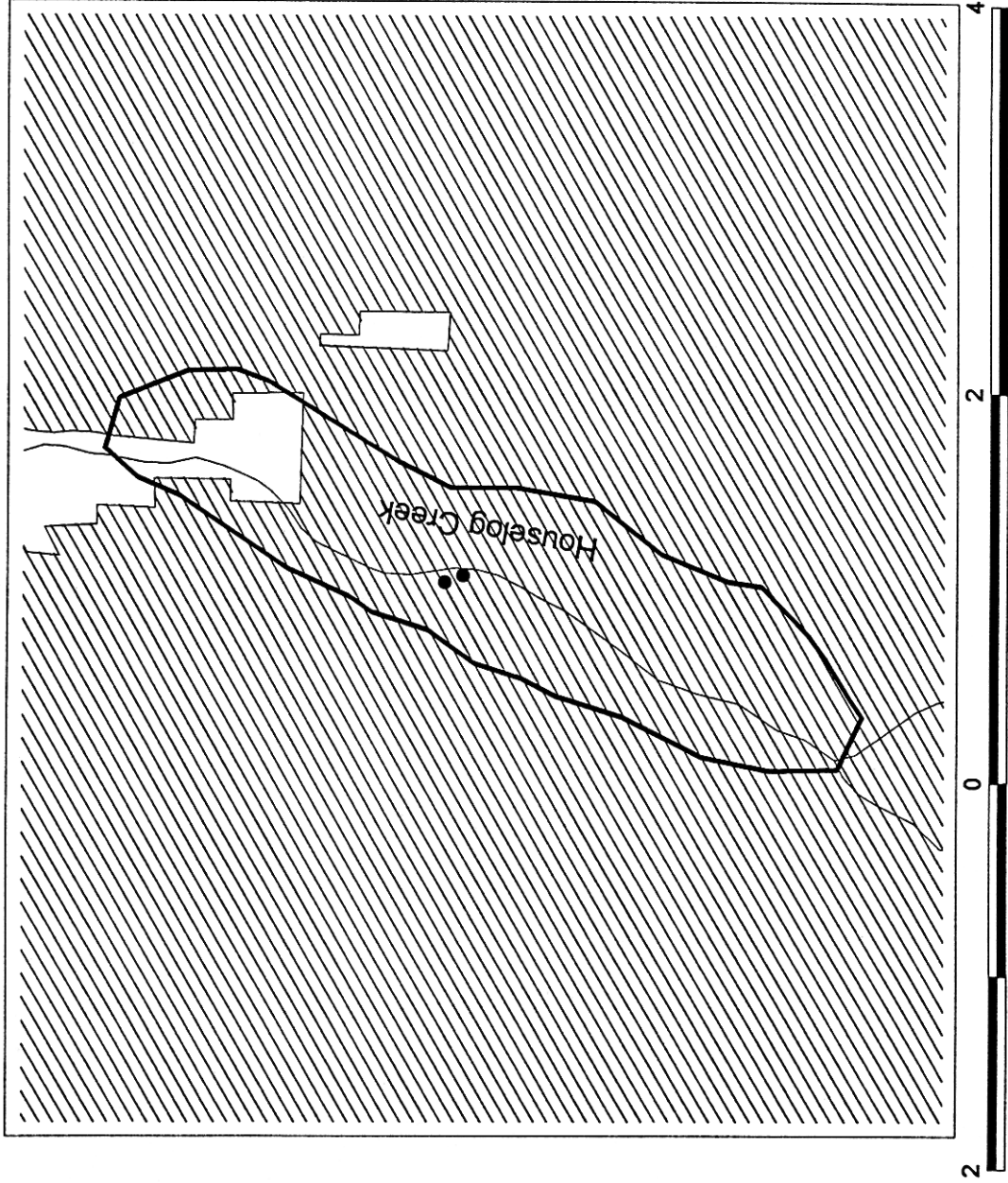
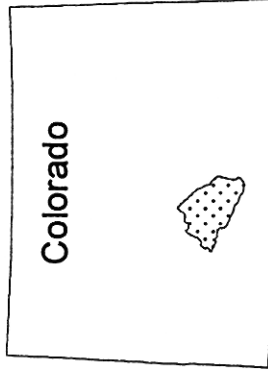


Occurrence data and site boundaries are current as of 9 January, 1998. Map created by Anne Ochs.



Houselog Creek

(ownership status)



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▬ Streams
 - Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



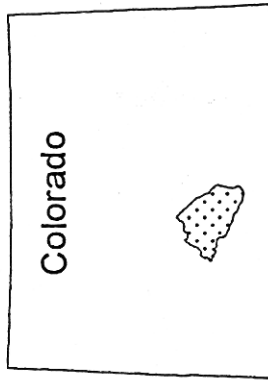
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

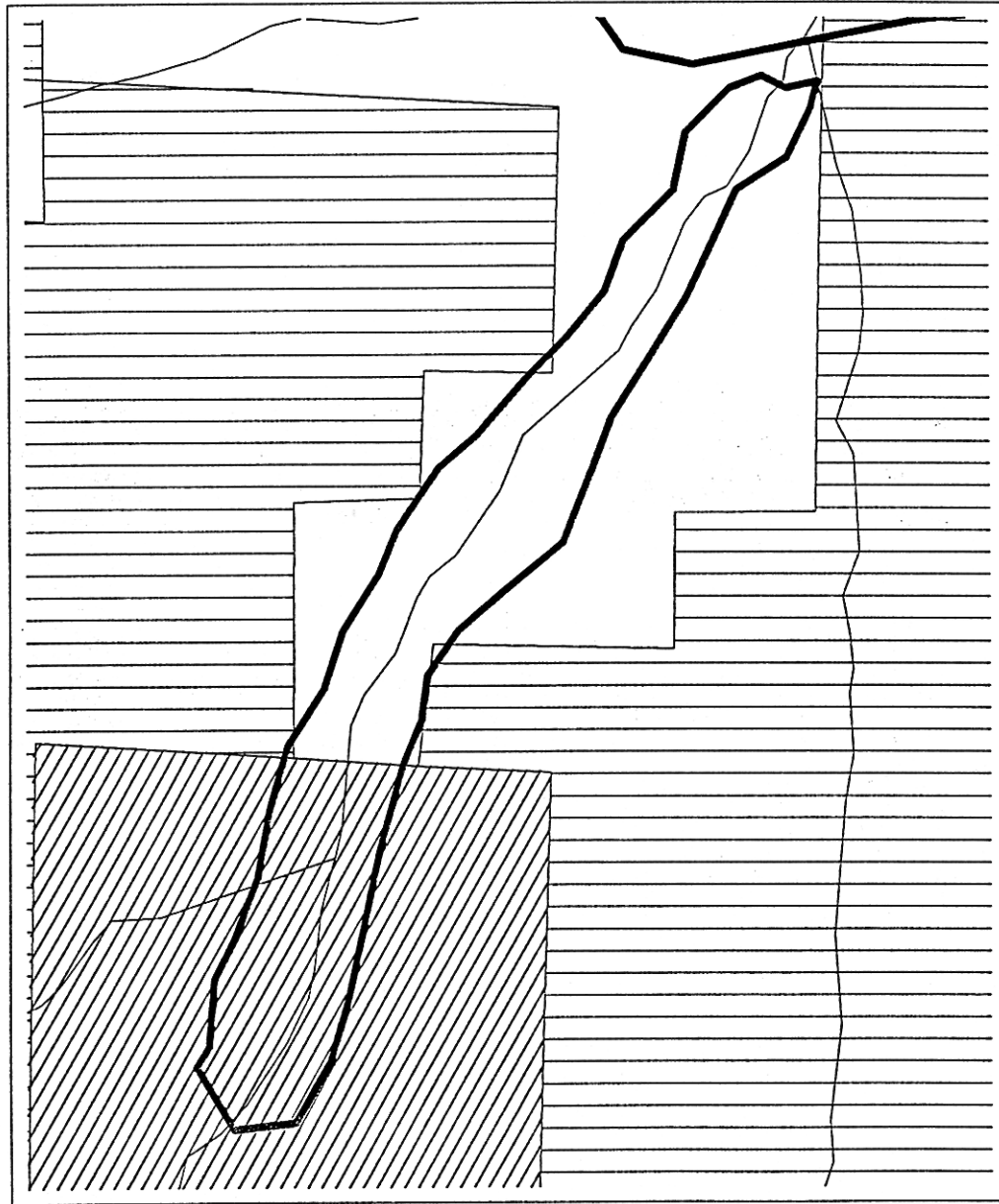


Jacks Creek Cemetery

(ownership status)



Closed Basin



2 0 2 4 Miles

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

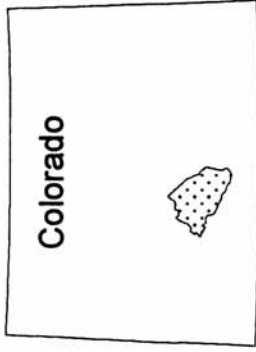
- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
- Roads
 - ▤ Streams
- Suggested conservation sites
- Land ownership
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private



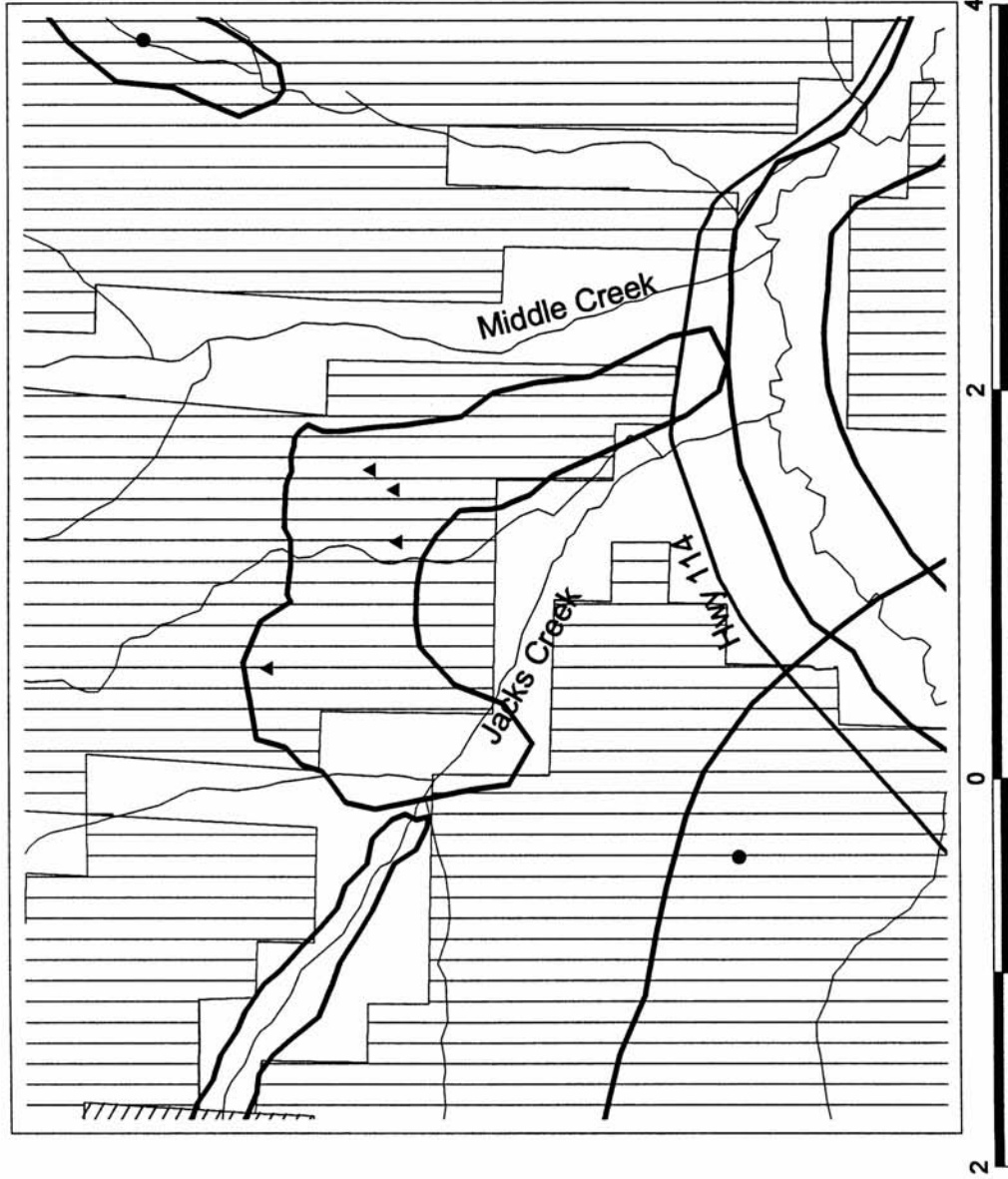


Jacks Creek

(ownership status)



Closed Basin



Public land element occurrences

- vertebrate
- ★ invertebrate
- ▲ plant
- community
- Closed basin
- ▭ Roads
- ▭ Streams

Suggested conservation sites

- ▭ Land ownership
- ▨ USFS
- ▨ BLM
- ▨ NPS
- ▨ CDOW
- ▨ State
- ▨ Private



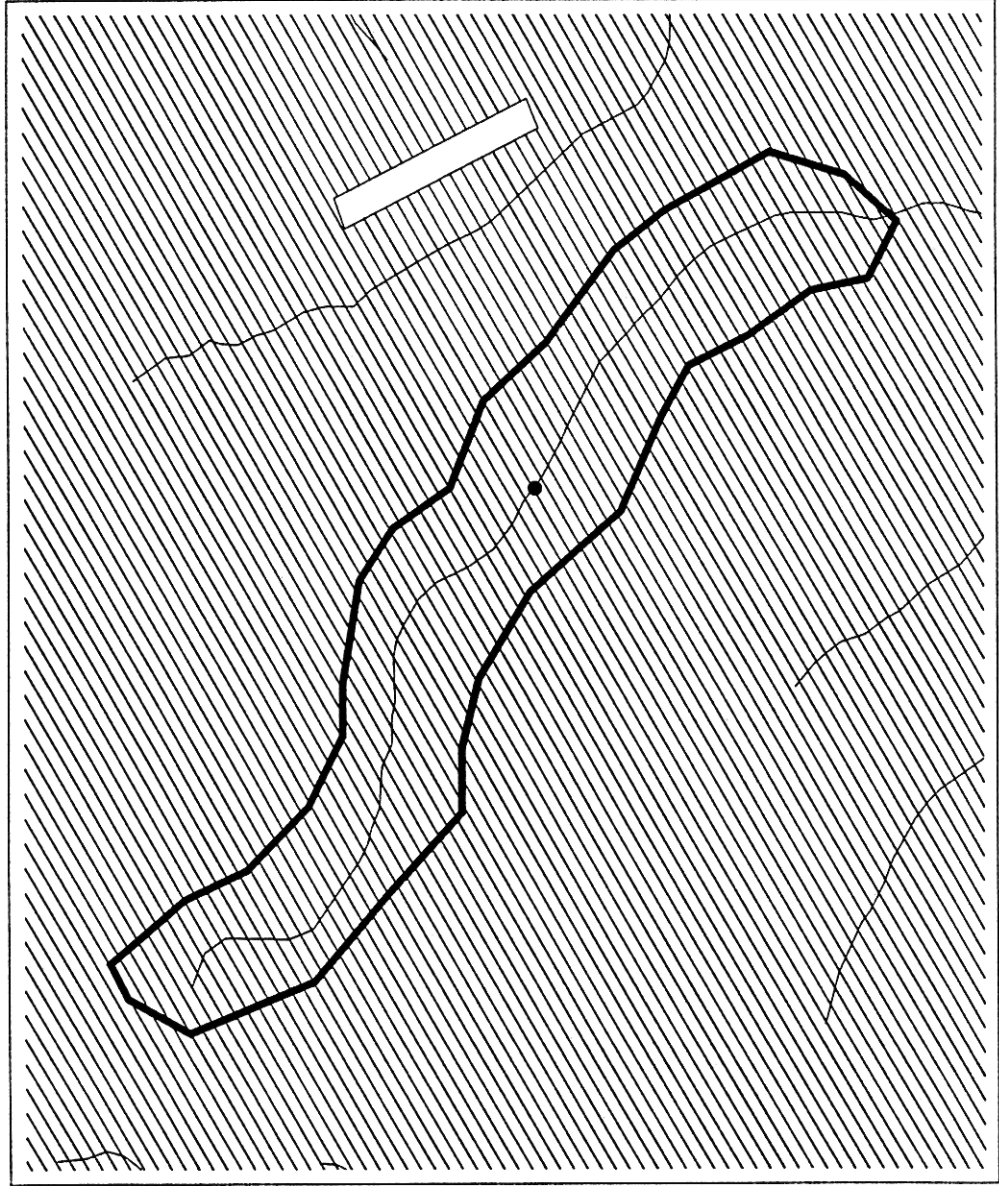
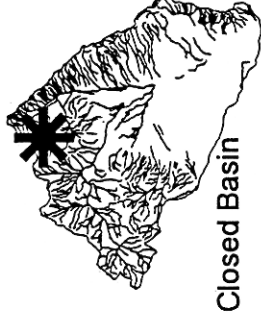
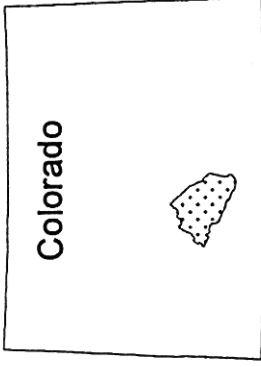
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Kelley Creek

(ownership status)



4 Miles

2

0

2



Public land element occurrences

- vertebrate
- ★ invertebrate
- ▲ plant
- community

□ Closed basin

▬ Roads

▬ Streams

Suggested conservation sites

□ Land ownership

▨ USFS

▨ BLM

▨ NPS

▨ CDOW

▨ State

▨ Private

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.



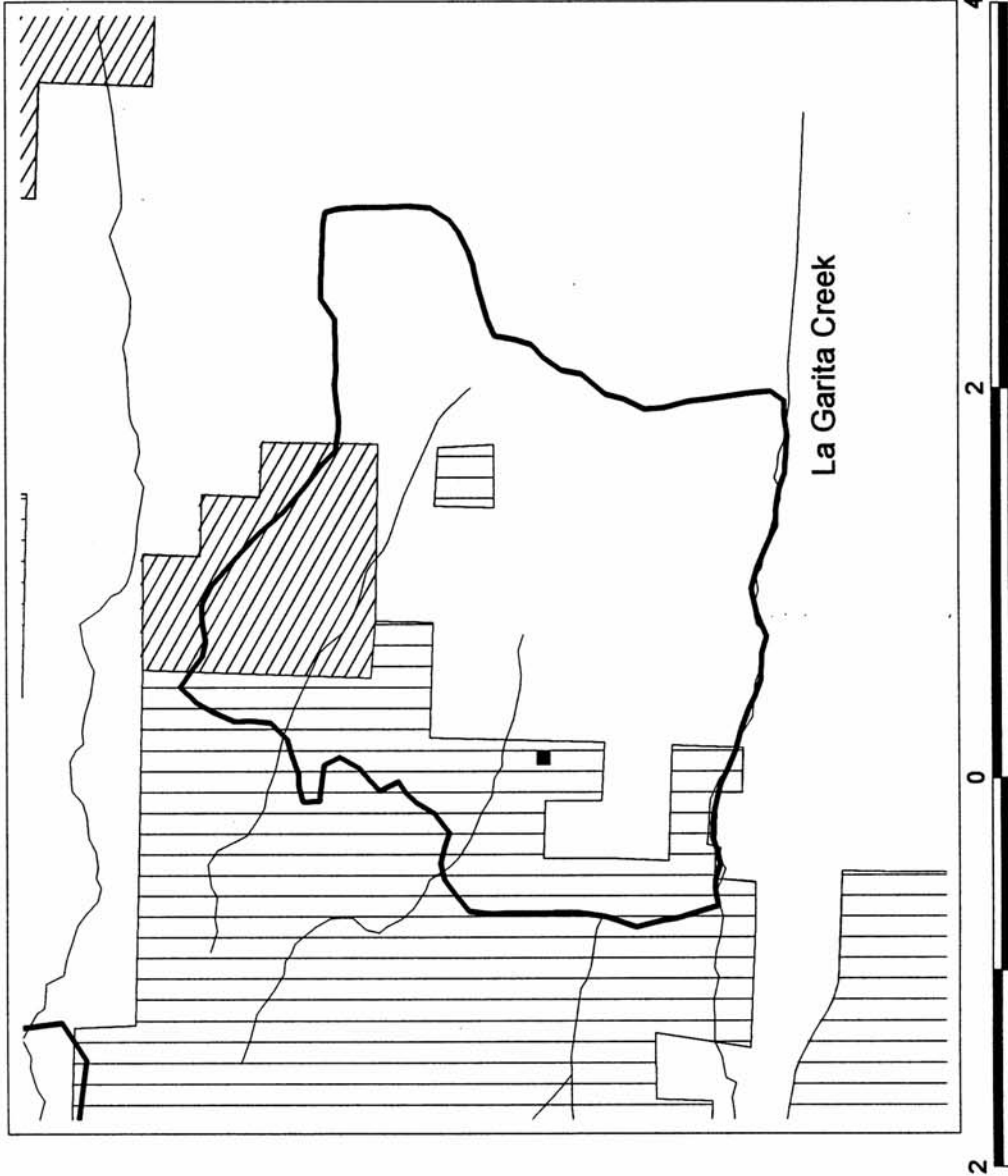
La Garita

(ownership status)



Closed Basin

- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Saguache county
 - ▭ Closed basin
 - ▭ Roads
 - ▭ Streams
 - ▭ Suggested conservation sites
 - Land ownership
 - ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private



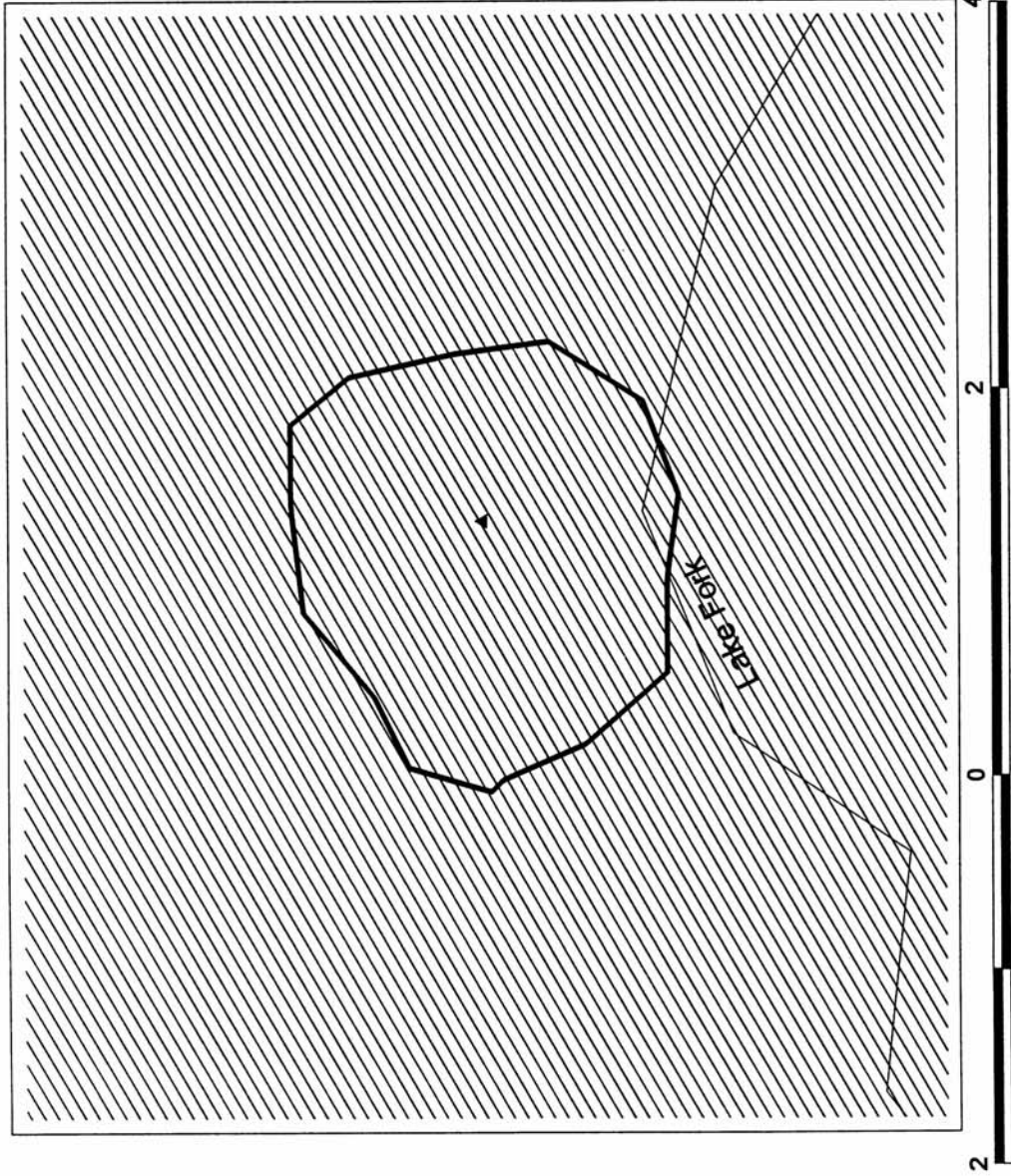
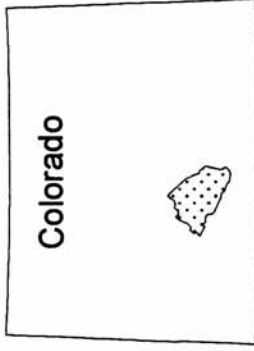
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



Lake Fork of North Creststone Creek

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin**
- ▭ Roads
 - ▭ Streams
- Suggested conservation sites**
- Land ownership**
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private



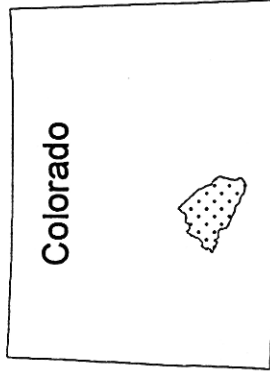
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

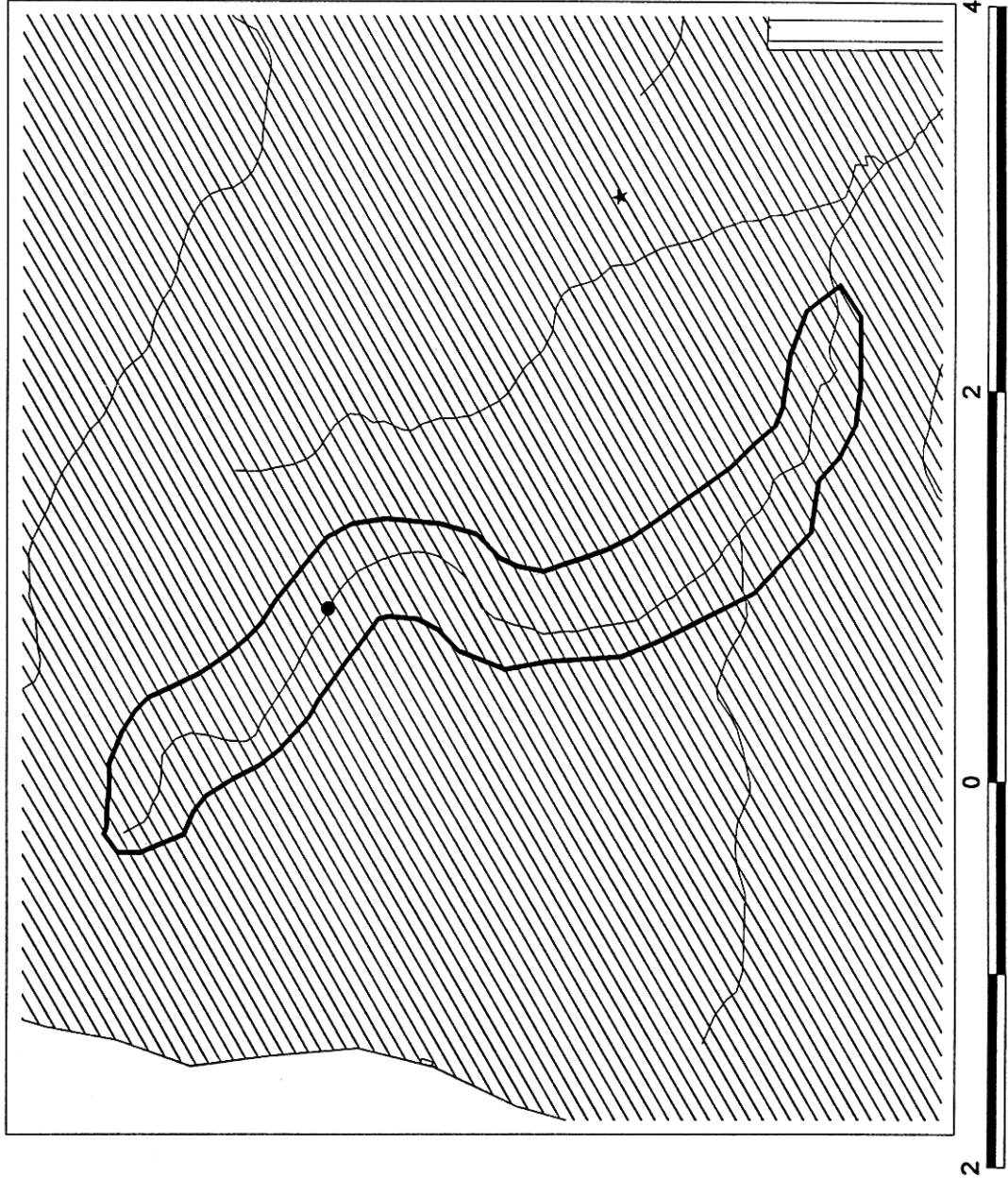


Luders Creek

(ownership status)



Closed Basin



Public land element occurrences

- vertebrate
- ★ invertebrate
- ▲ plant
- community

- Closed basin
- ▬ Roads
- ▬ Streams

Suggested conservation sites

- Land ownership
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

4 Miles

2

0

2

Miles

N

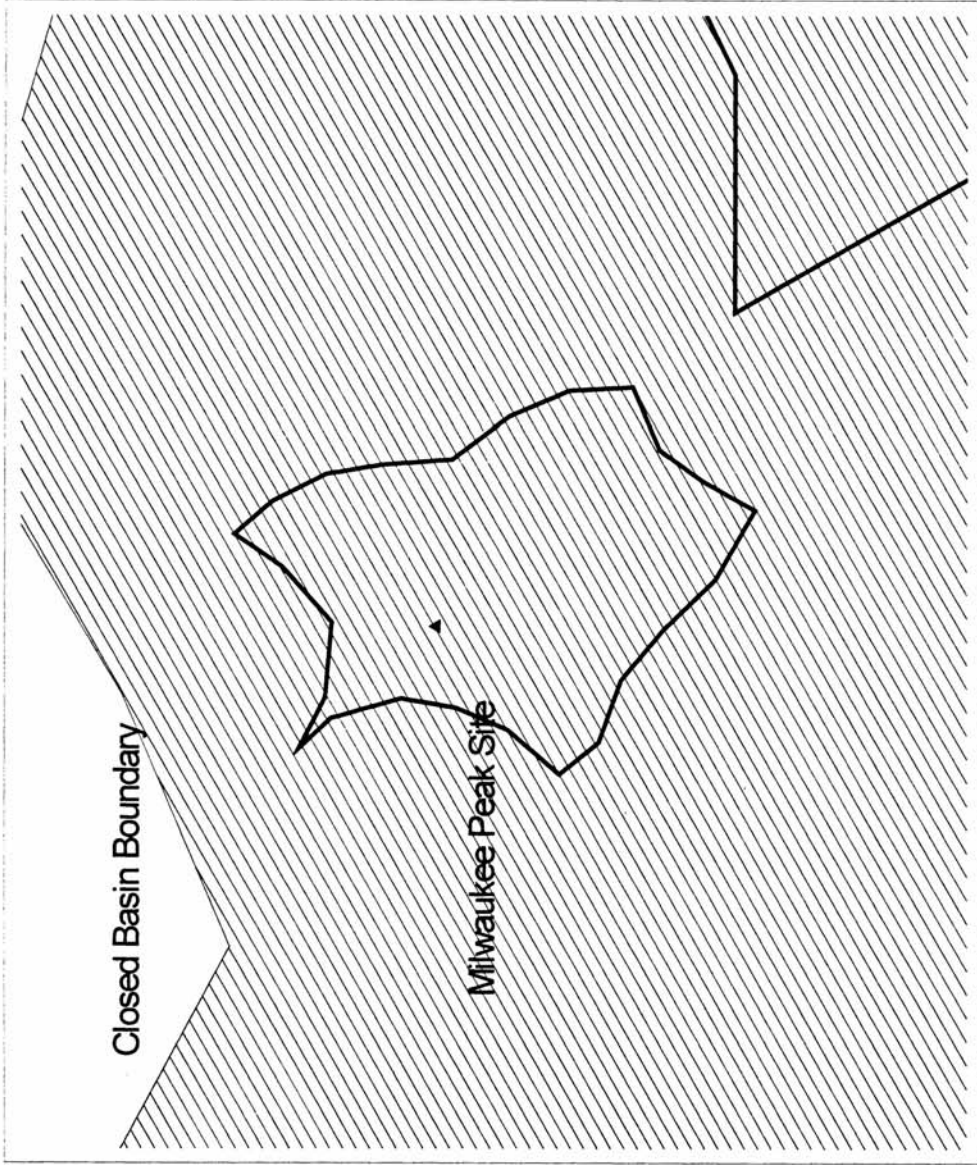
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Milwaukee Peak

(ownership status)



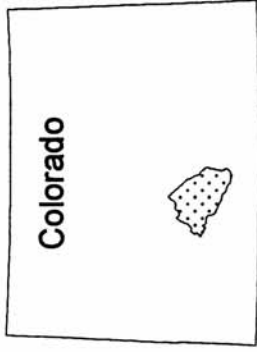
- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



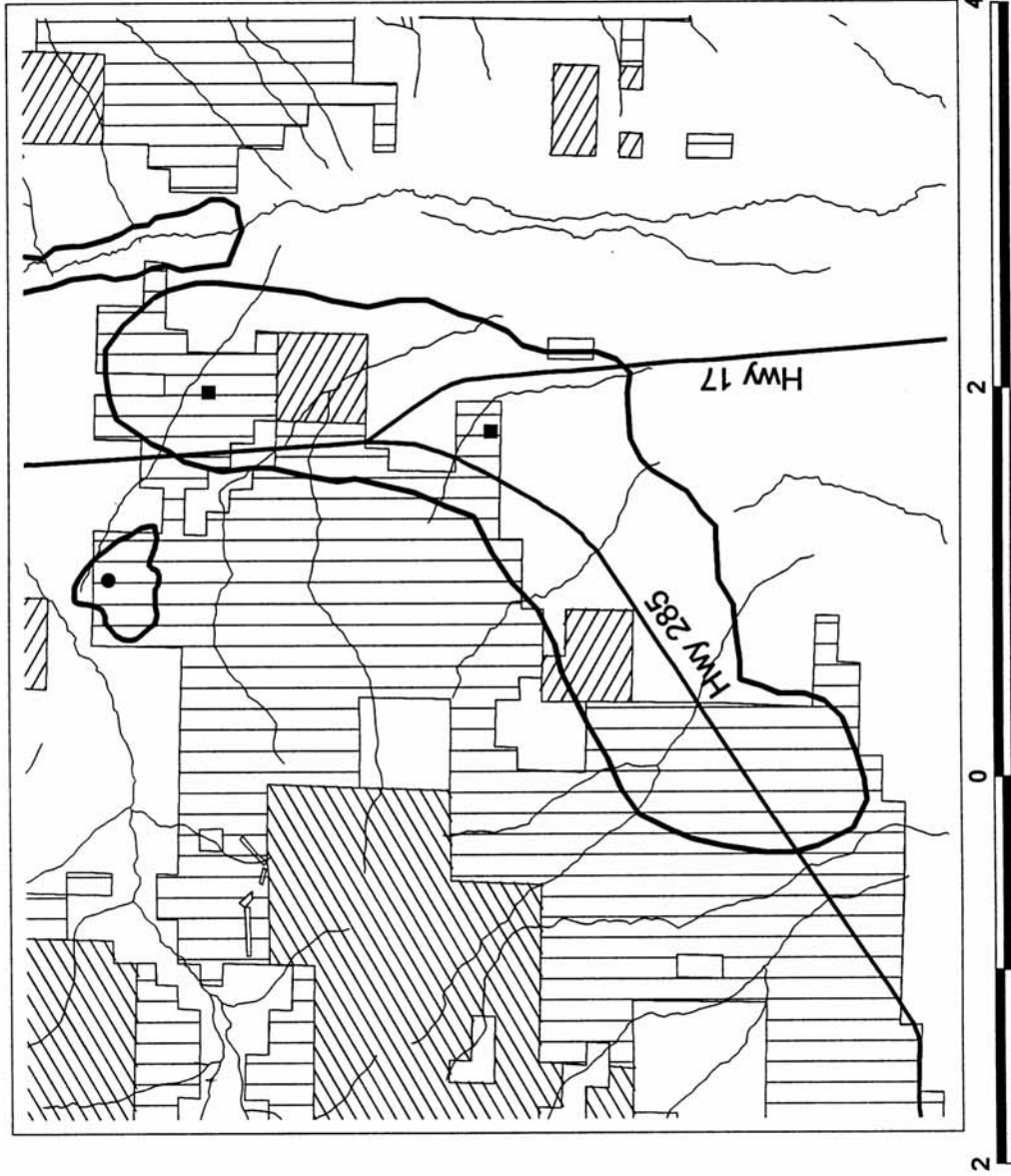
Occurrence data and site boundaries are current as of 9 January, 1998. Map created by Anne Ochs.



Mineral Hot Springs (ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Land ownership**
- Closed basin
 - ▬ Roads
 - ▬ Streams
 - ▭ Suggested conservation sites
 - ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private



Miles

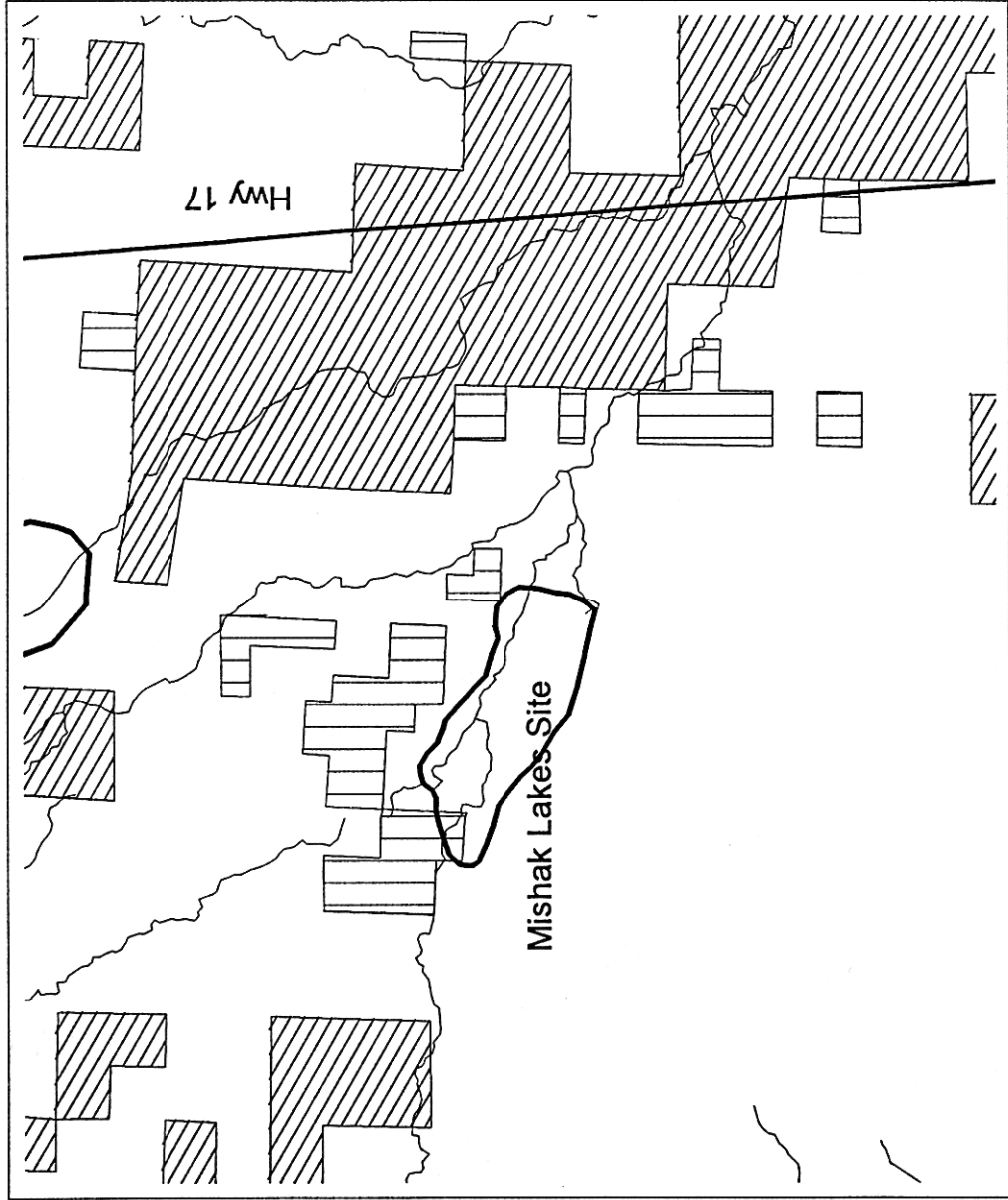
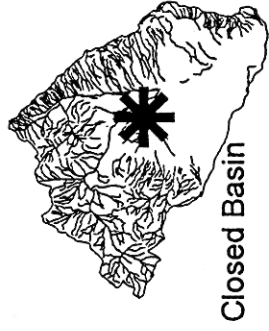
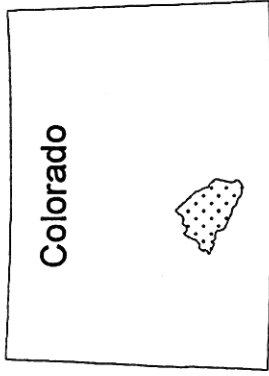
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Mishak Lakes

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Other symbols:**
- Closed basin
 - ▬ Roads
 - ▬ Streams
 - ▭ Suggested conservation sites
- Land ownership:**
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private

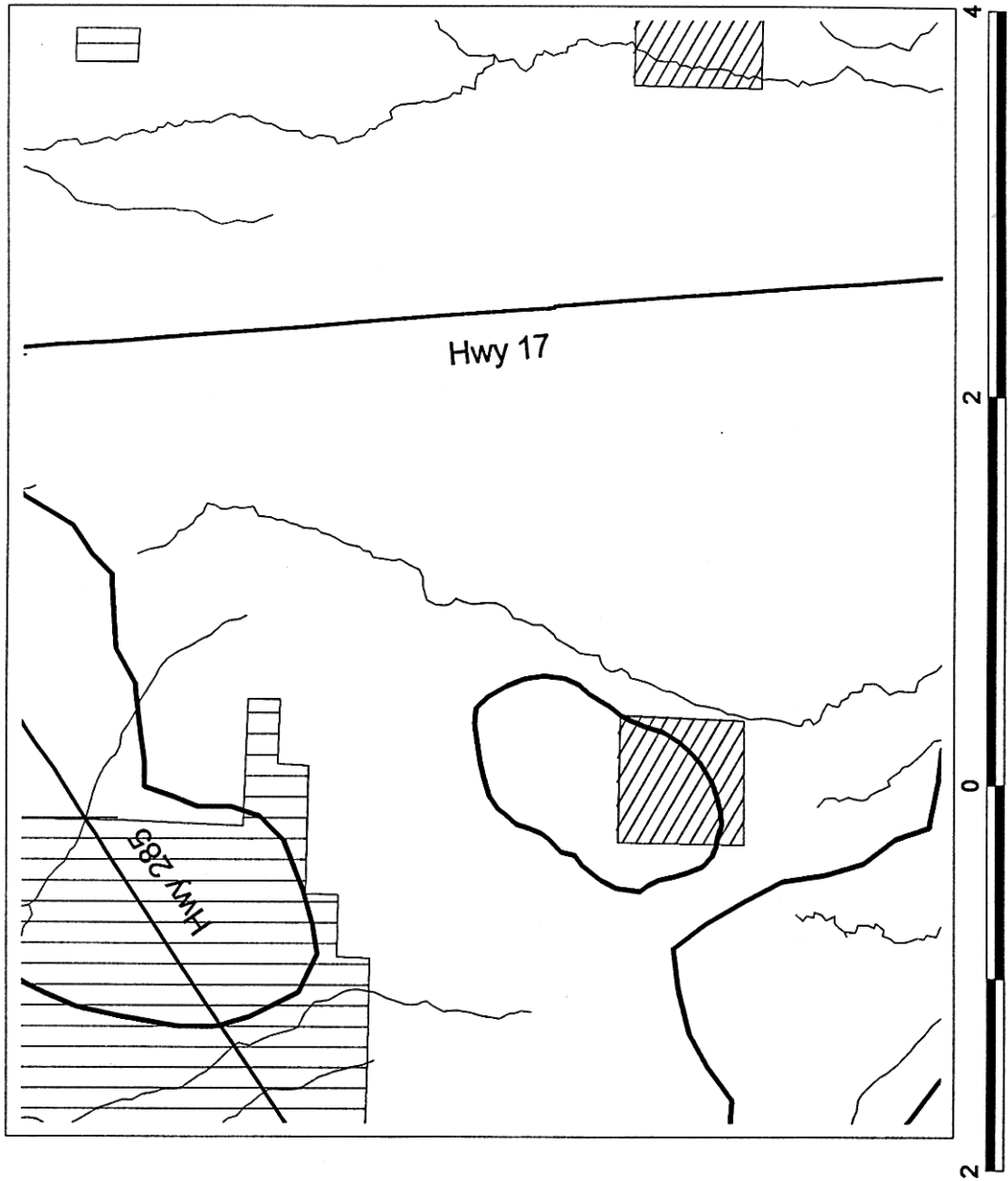
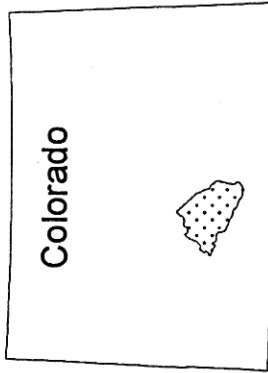
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.



Moffat Playas

(ownership status)



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

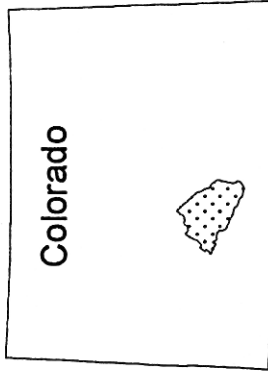
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

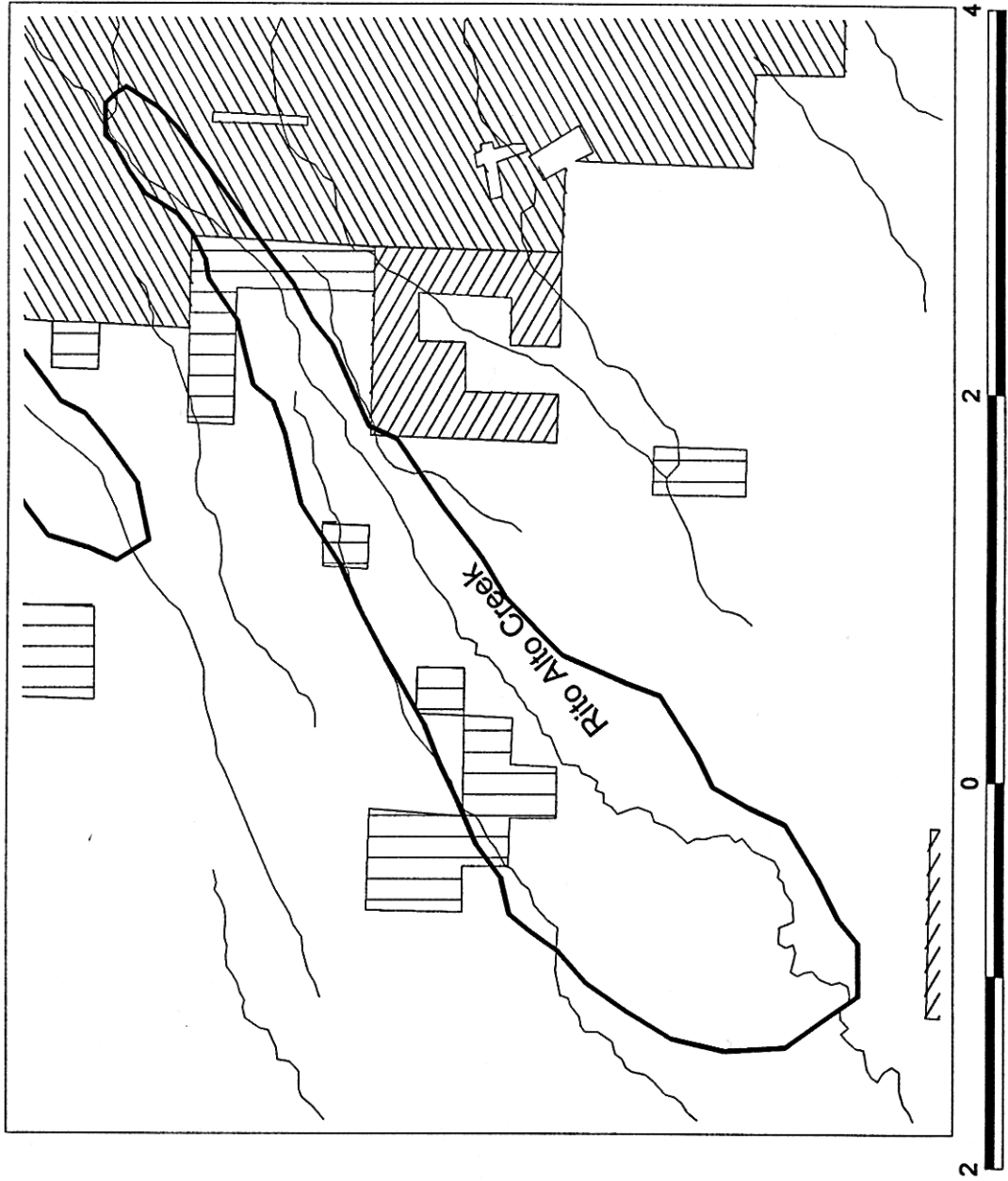


Rito Alto Bosque

(ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▤ Roads
 - ▥ Streams
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - NPS
 - CDOW
 - ▬ State
 - ▮ Private

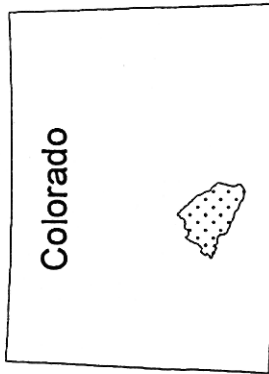
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

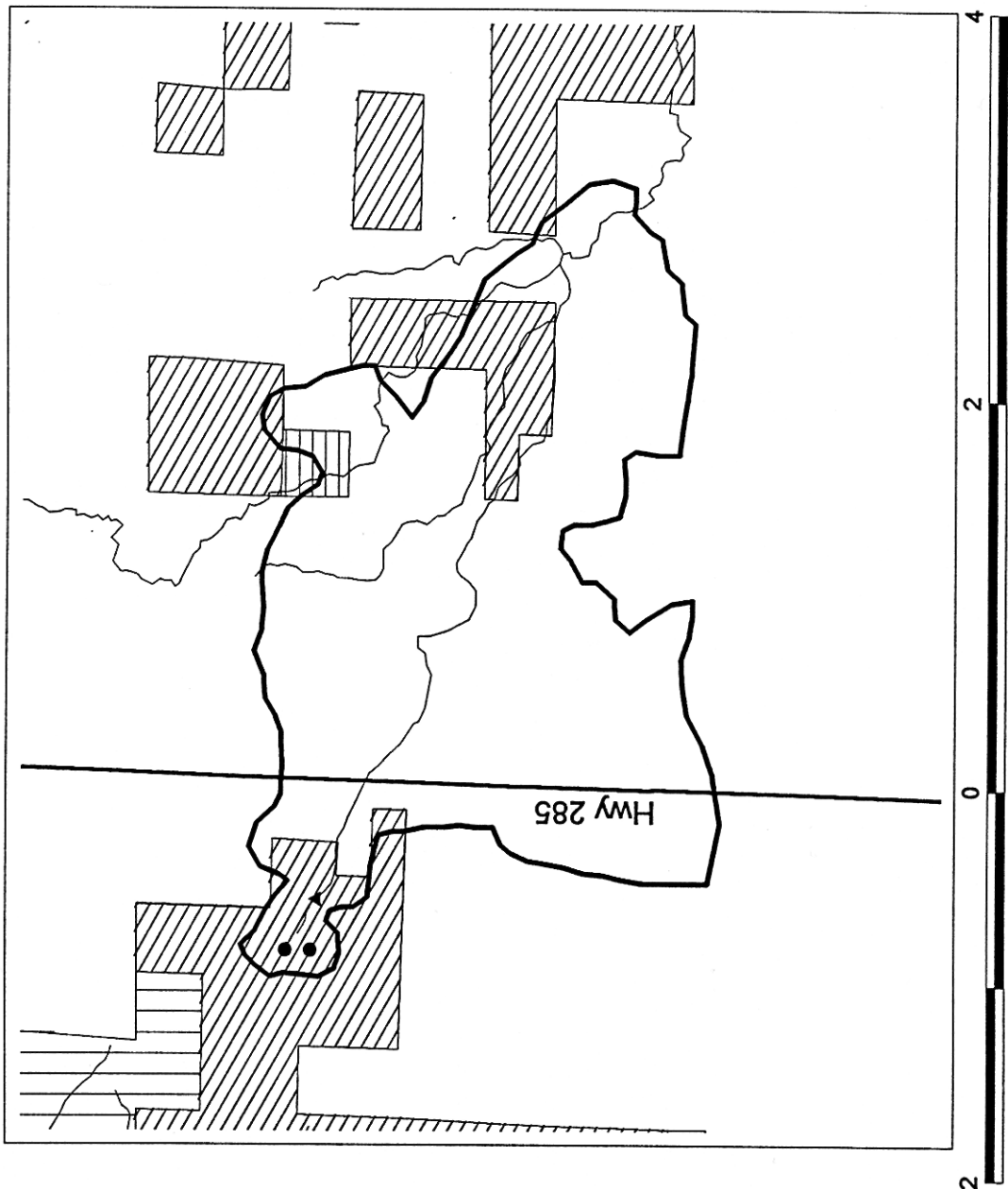


Russell Lakes

(ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
- Roads**
- Streams**
- Suggested conservation sites**
- Land ownership**
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

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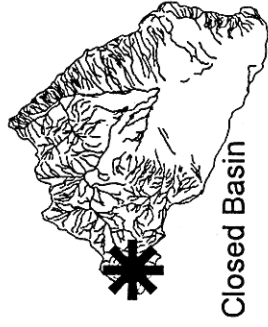
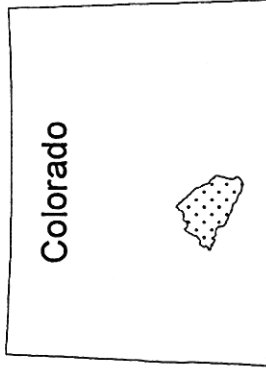
Miles

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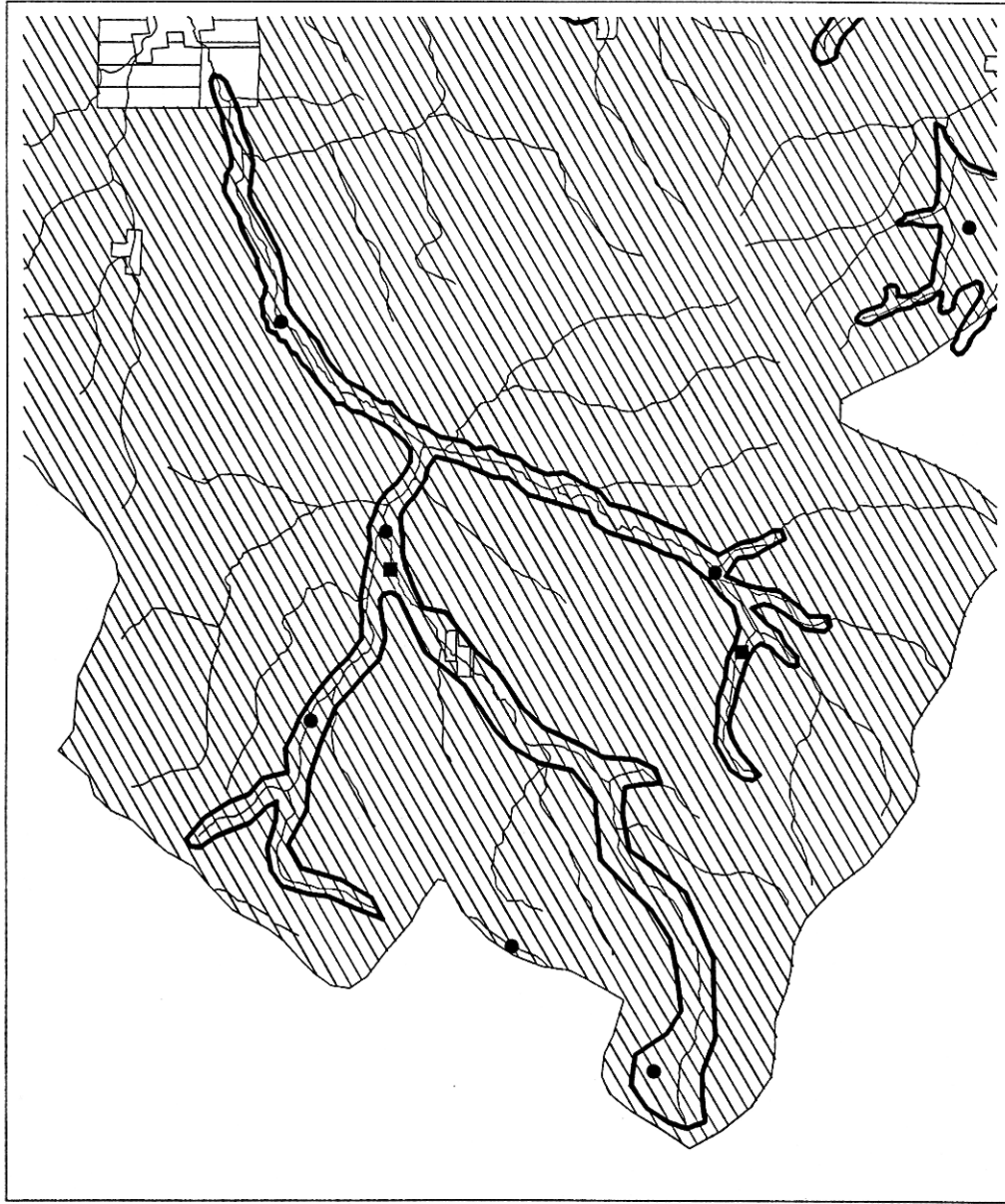


Saguache Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
 Land ownership
 USFS
 BLM
 NPS
 CDOW
 State
 Private

4 Miles

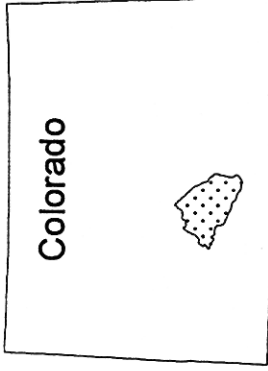


Element occurrences on private lands not shown.

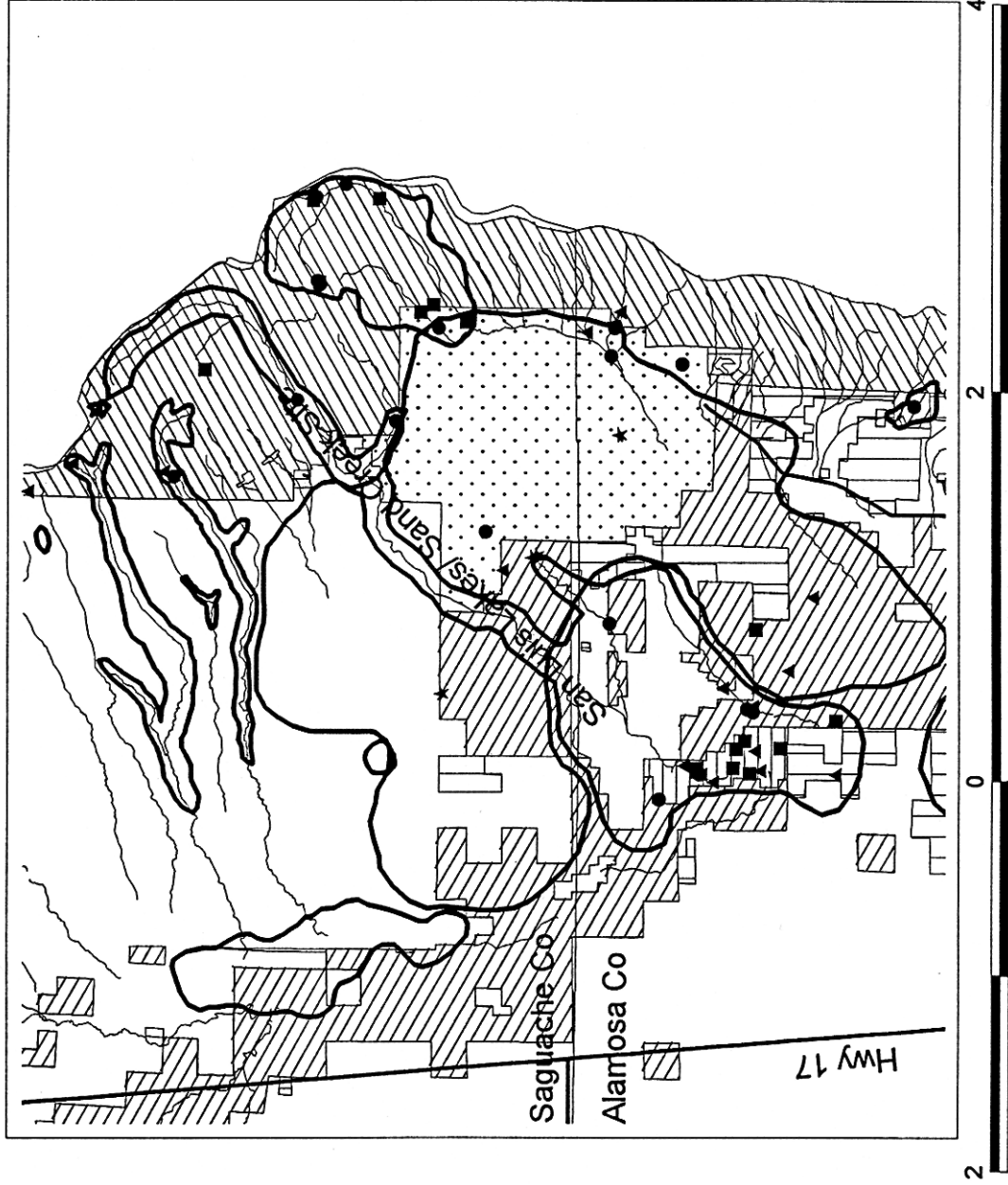
Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



San Luis Lakes/ Sand Creek (ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Saguache county
 Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private

Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

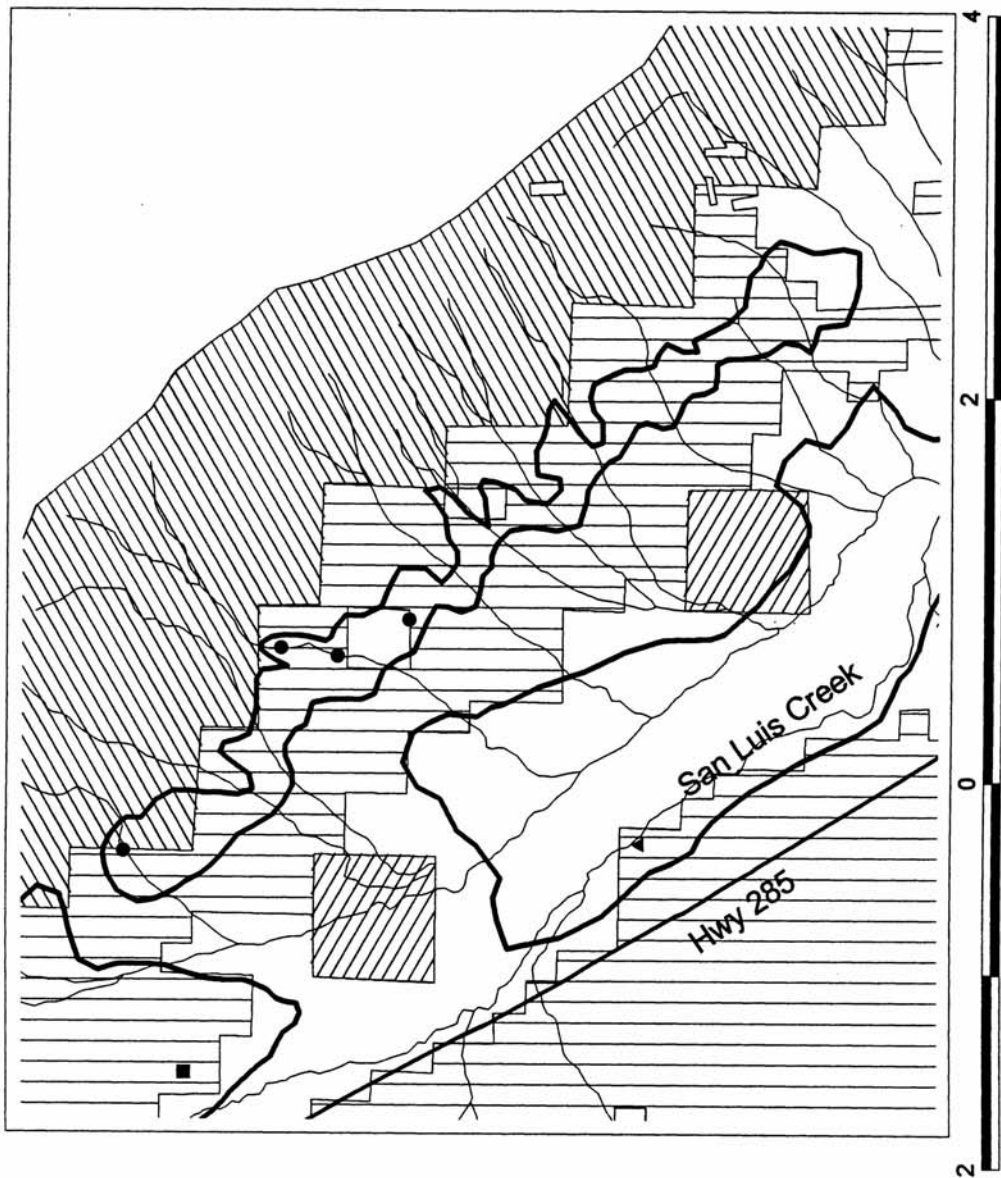


Sangre's Alluvial Fan

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▬ Streams
 - ▭ Suggested conservation sites
- Land ownership
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private



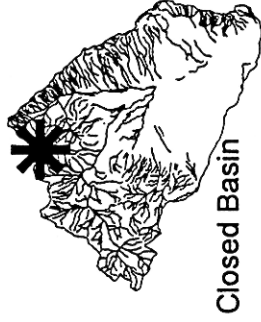
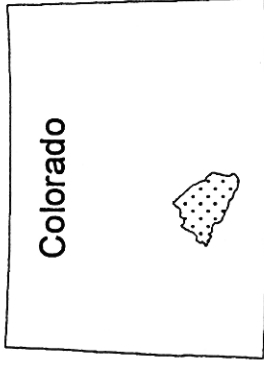
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

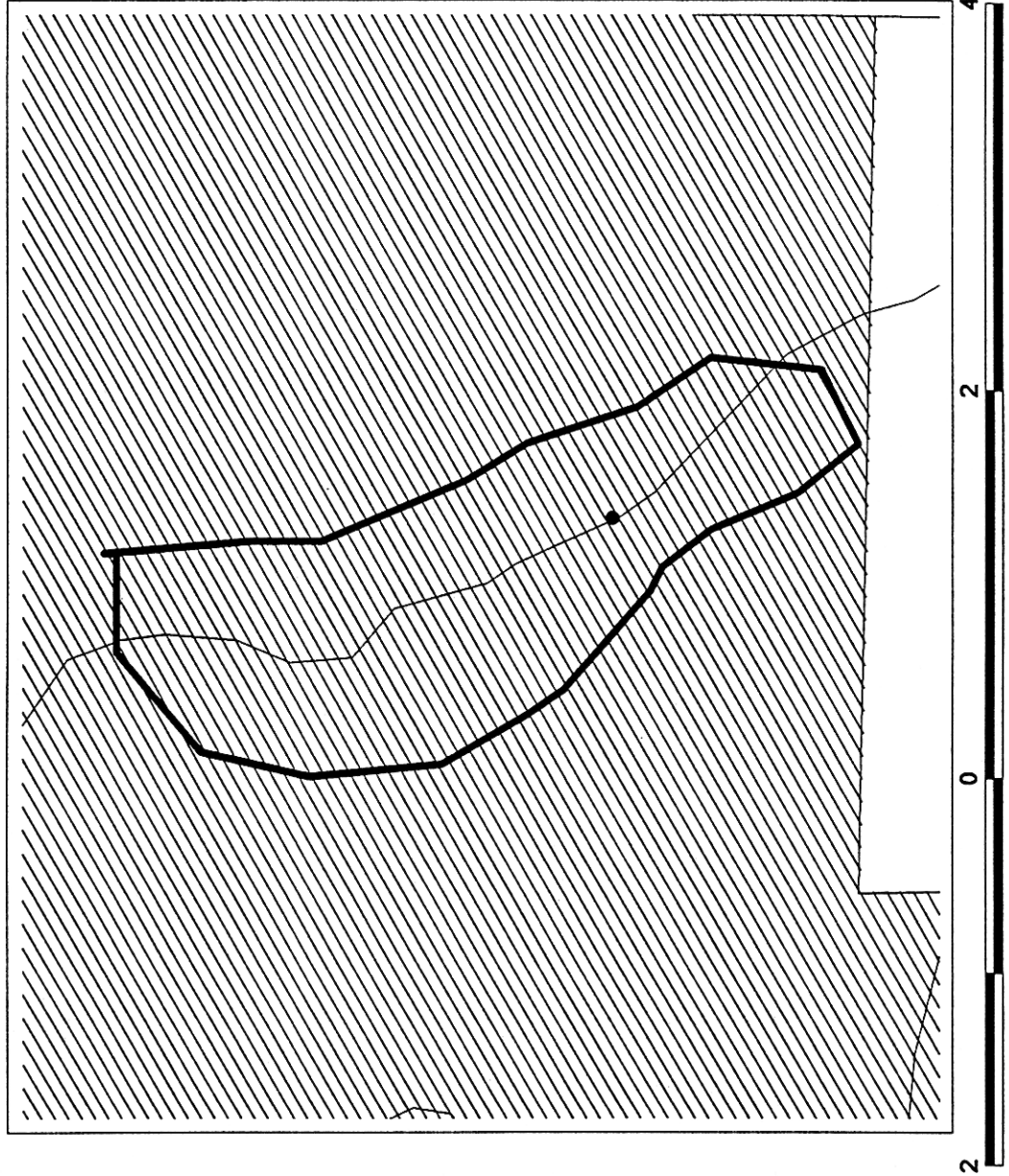


Slaughterhouse Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



Miles

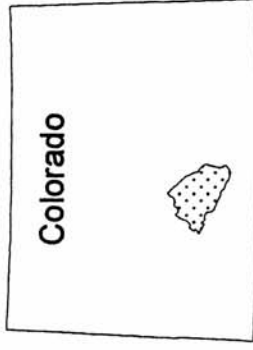
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

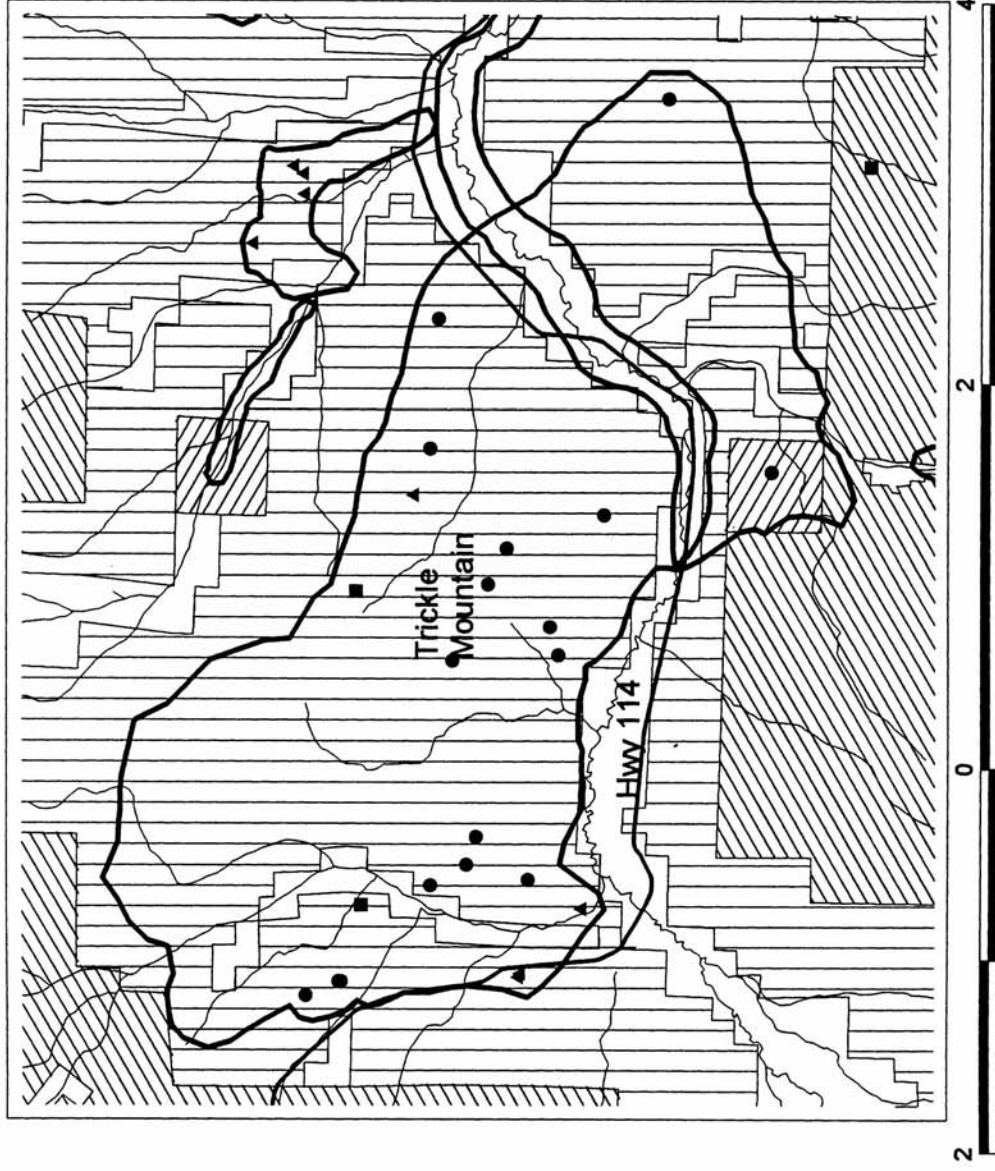


Trickle Mountain

(ownership status)



Closed Basin



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▬ Roads
 - ▬ Streams
- Land ownership**
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

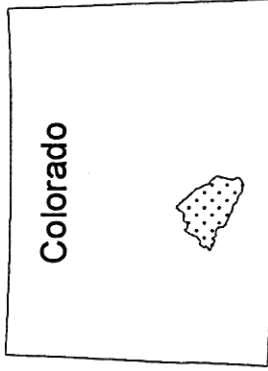
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.

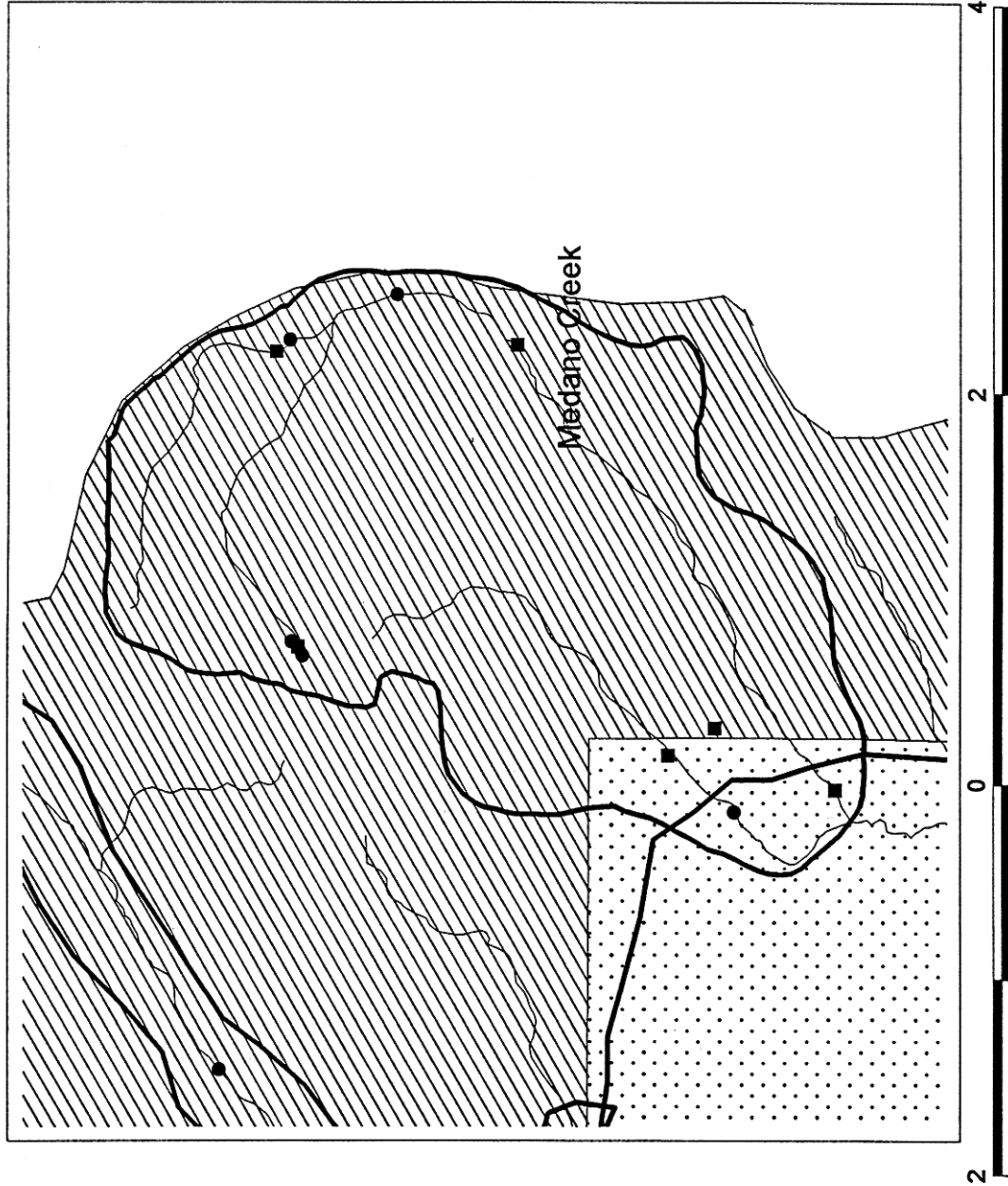


Upper Medano Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
- Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



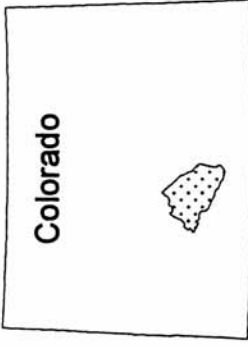
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.

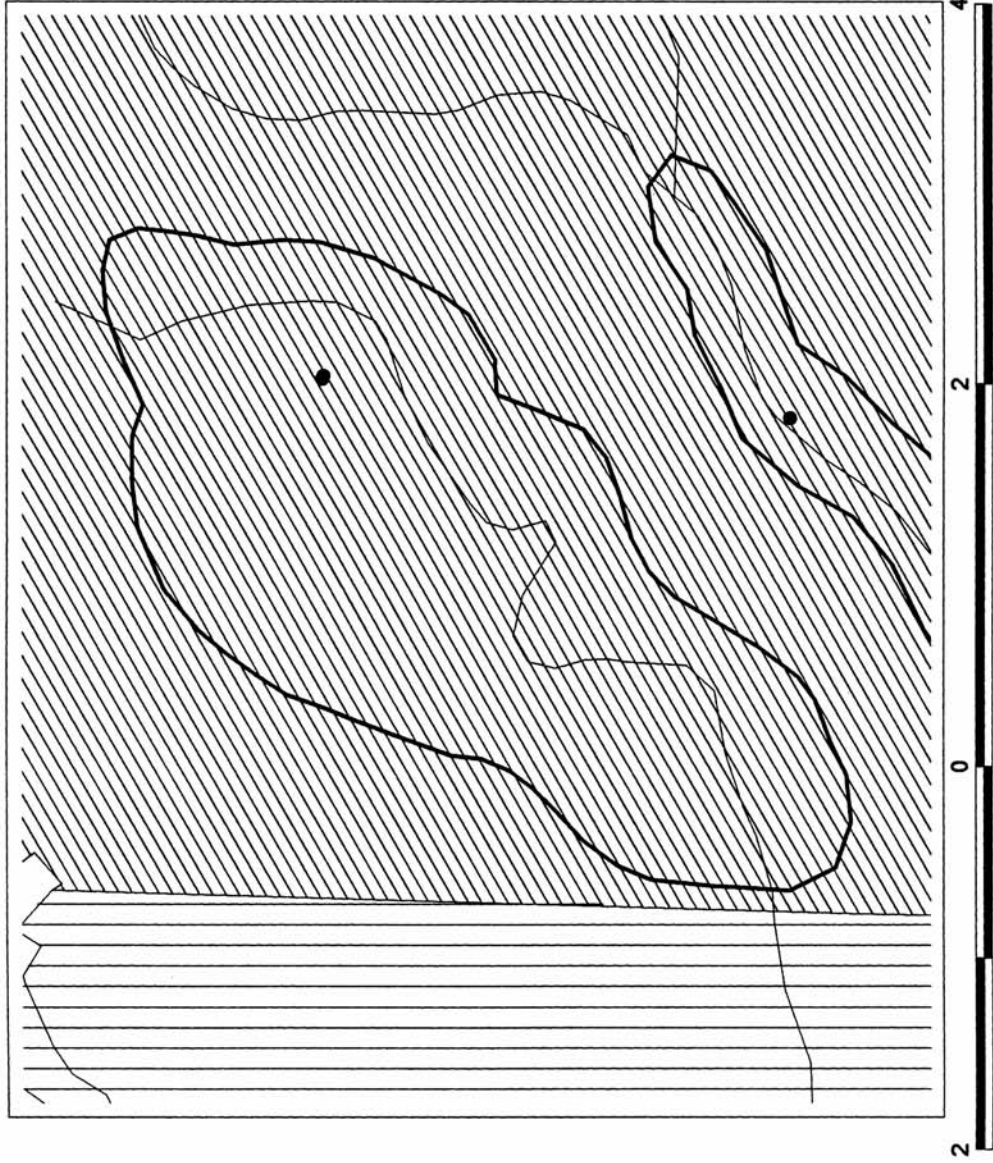


Valley View

(ownership status)



Closed Basin



All element occurrences

- vertebrate
- ★ invertebrate
- ▲ plant
- community

- Closed basin
- ▬ Roads
- ▬ Streams

Suggested conservation sites

- Land ownership
- ▨ USFS
- ▨ BLM
- ▨ NPS
- ▨ CDOW
- ▨ State
- ▨ Private



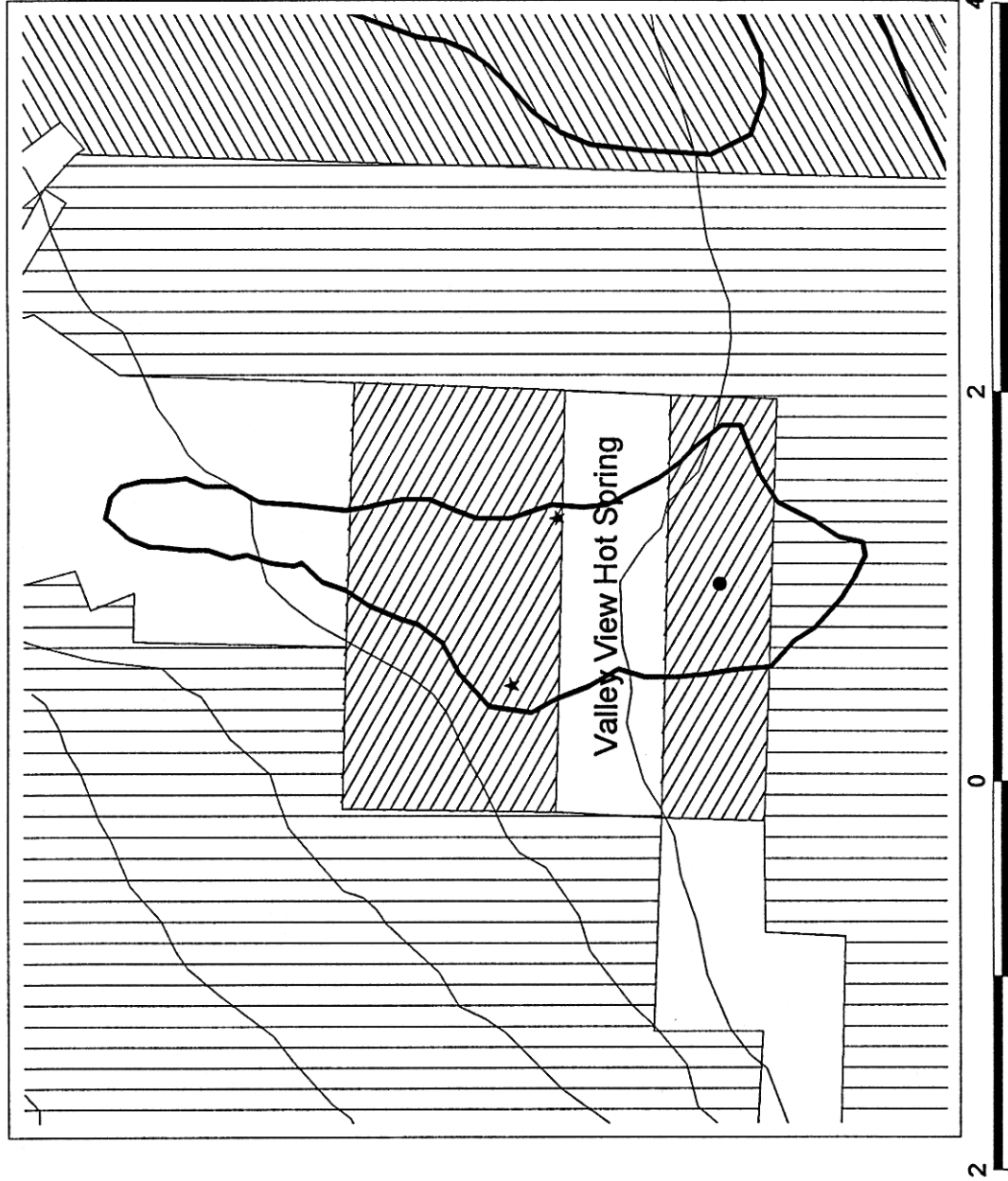
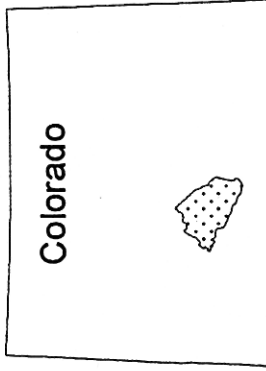
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 29 December, 1997. Map created by Anne Ochs.



Valley View Hot Spring

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▬ Streams
- Suggested conservation sites**
- Land ownership**
- ▨ USFS
 - ▨ BLM
 - ▨ NPS
 - ▨ CDOW
 - ▨ State
 - ▨ Private

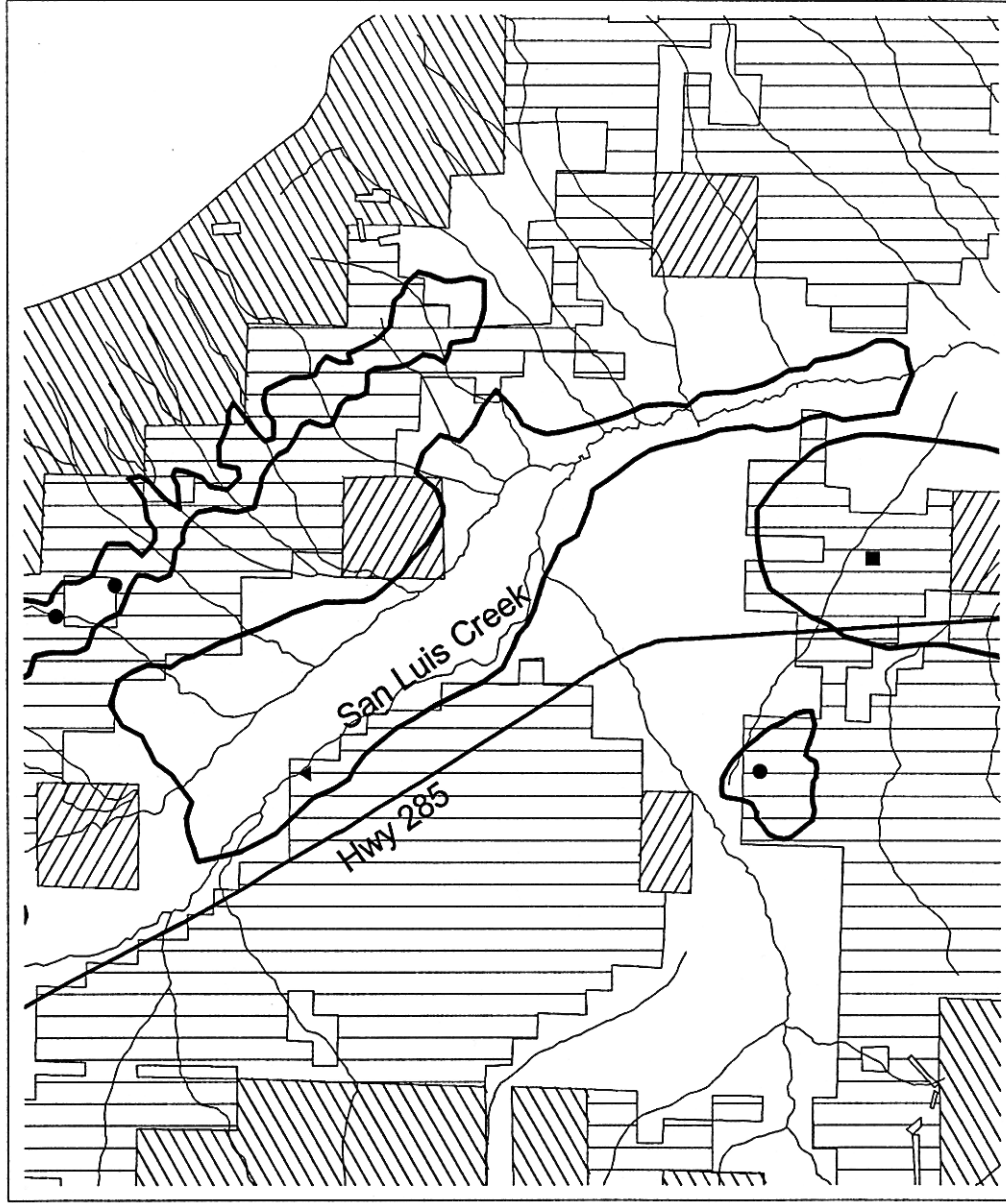
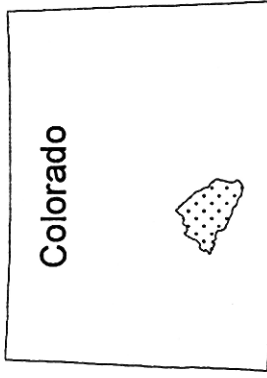
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Villa Grove

(ownership status)



- Public land element occurrences**
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Suggested conservation sites**
- Closed basin
 - ▤ Roads
 - ▥ Streams
- Land ownership**
- ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private



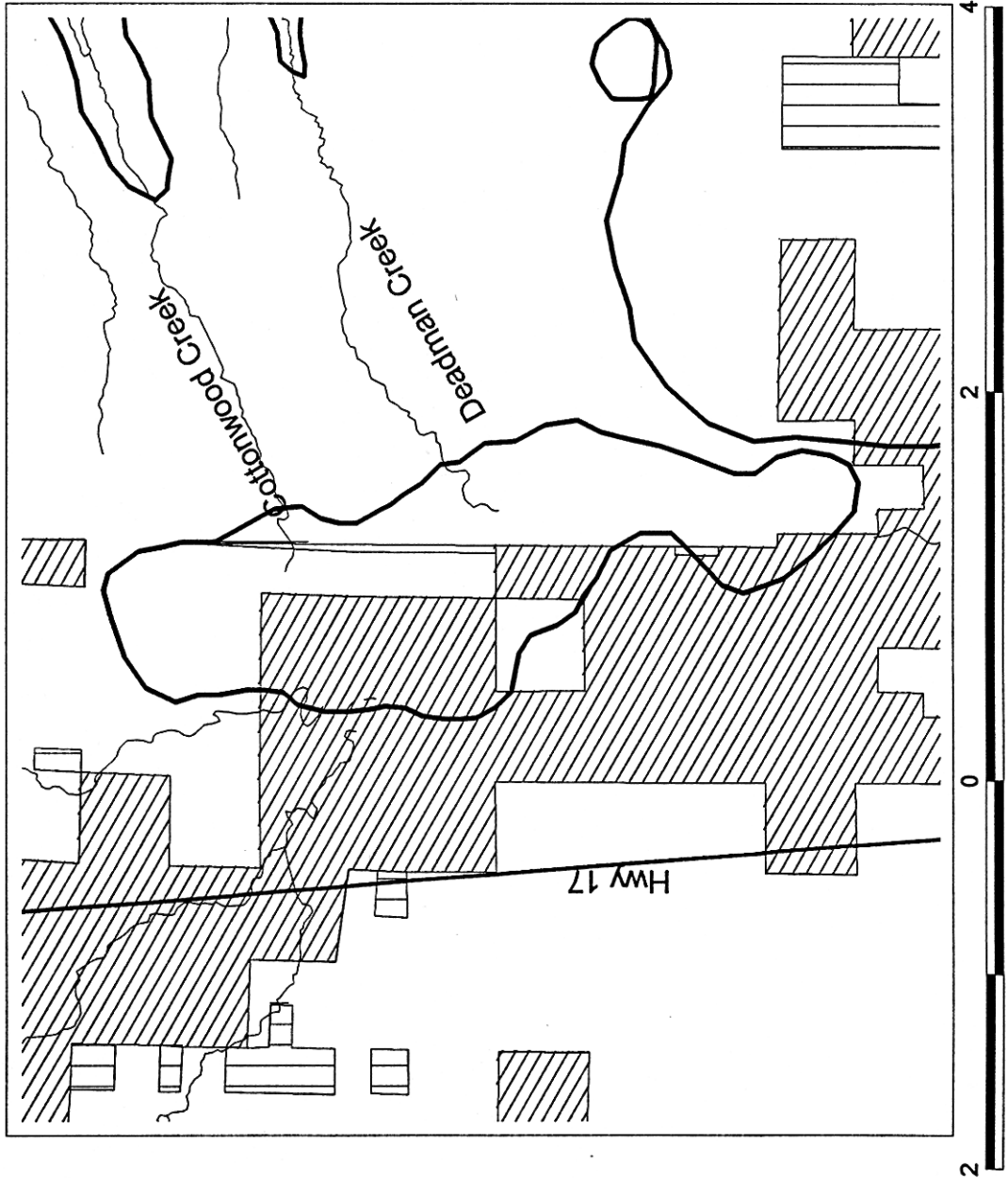
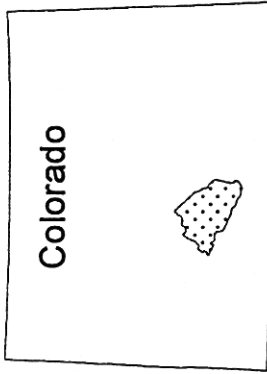
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.



Weisman Lakes

(ownership status)



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
- Closed basin
 Roads
 Streams
 Suggested conservation sites
- Land ownership
- USFS
 - BLM
 - NPS
 - CDOW
 - State
 - Private



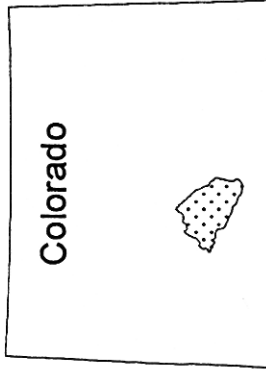
Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 12 January, 1998. Map created by Anne Ochs.

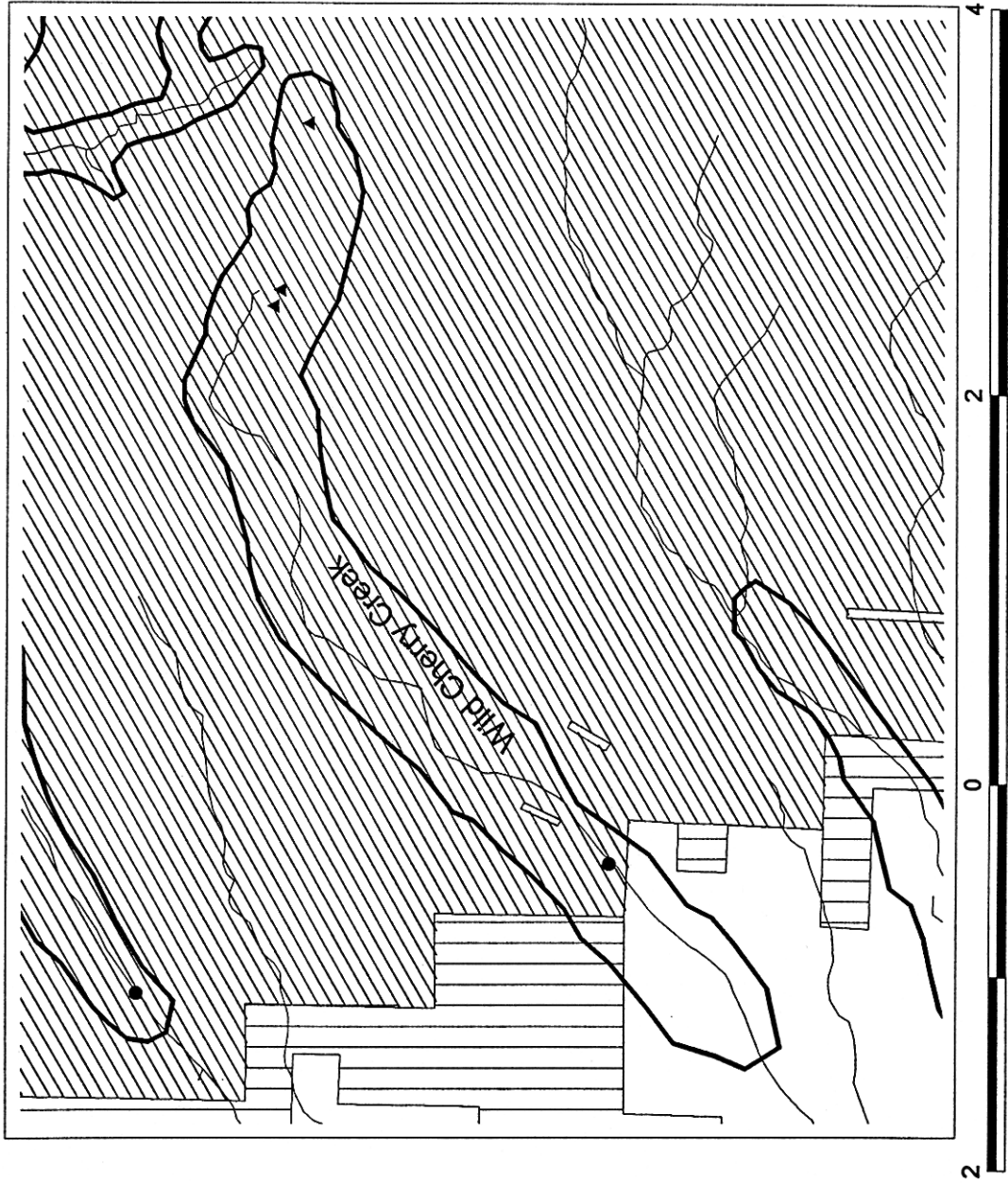


Wild Cherry Creek

(ownership status)



Closed Basin



- Public land element occurrences
- vertebrate
 - ★ invertebrate
 - ▲ plant
 - community
 - Closed basin
 - ▬ Roads
 - ▬ Streams
- Suggested conservation sites
- Land ownership
 - ▨ USFS
 - ▩ BLM
 - ▧ NPS
 - ▦ CDOW
 - ▥ State
 - ▤ Private

4 Miles

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0

2

4 Miles



Element occurrences on private lands not shown.

Occurrence data and site boundaries are current as of 14 January, 1998. Map created by Anne Ochs.