Significant Natural Heritage Resources of the Caribou Ranch Open Space and their Conservation

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EXECUTIVE SUMMARY

In 1998, the Colorado Natural Heritage Program (CNHP) was contracted by Boulder County Parks and Open Space (BCPOS) to conduct a biological inventory of significant or rare plants, animals and plant communities at the Caribou Ranch near Nederland, Colorado. The goal of this project was to accumulate and examine existing biological data, incorporate appropriate field surveys and identify significant natural heritage resources (species and plant communities of conservation interest) occurring on the Caribou Ranch. The information was prioritized according to conditions of the populations and species' level of imperilment. We were also asked to make recommendations on actions that will protect these resources.

During the combined inventory efforts of 1998 and 1996, we identified three species and one plant community of conservation concern at Caribou Ranch. One of these was of global significance, an A-strain (genetically pure) population of the greenback cutthroat trout (*Oncorhynchus clarki stomias*). This fish is a globally rare subspecies that represents one of three native subspecies of trout in the state. Additionally, the ranch harbors two species of statewide significance: the wood lily (*Lilium philadelphicum*), and Townsend's big-eared bat (*Plecotus townsendi*). Furthermore, we identified a fair occurrence of a globally rare plant community, a montane willow carr (*Salix geyeriana-Salix monticola/Calamagrostis canadensis*) along Delonde Creek.

Based on the combination of information collected in this study and previously existing information, one potential conservation site has been identified for BCPOS. This site is considered significant because of its inclusion of a genetically pure strain of greenback cutthroat trout. The Colorado Natural Heritage Program site has designated this site the Como Creek Site, which not only encompasses a portion of the Caribou Ranch, but also incorporates private and US Forest Service lands as well.

INTRODUCTION

Purpose

In 1998, The Colorado Natural Heritage Program (CNHP) was contracted by Boulder County Parks and Open Space (BCPOS) to assess the biodiversity values of the Caribou Ranch Open Space near Nederland, Colorado. The goal of the project was to accumulate new biological data and examine existing data from the area, incorporate appropriate portions into the CNHP's Biological Conservation Database (BCD), and with appropriate field verification, identify significant natural heritage resources. Natural heritage resources are defined as rare, threatened, endangered, or sensitive species and significant natural communities that are monitored by CNHP. In short, we were to identify those sites supporting unique or exemplary natural communities, rare plants and rare animals, and other significant natural features. It is within the purpose of this effort to identify the conservation sites that will protect these most sensitive elements of natural diversity. Additionally, we were to develop a map of the major plant communities and areas with concentrations of non-native plant species.

Overview of the Study Area

The Colorado Front Range and its eastern foothills are well known for their biological diversity (Opler 1994, Whitney 1983, Armstrong 1972). The convergence of the Rocky Mountains' interface with the Great Plains provides an unusual variety of environmental conditions, supporting moist and arid zones, mountain and plain habitats, forest and grassland communities. This provides for a heterogeneous group of organisms representing the biogeographic elements of northern arctic and boreal biomes, Rocky Mountains, southwestern deserts, and grasslands of the Great Plains.

The Caribou Ranch Open Space is located 3.2 km (2 miles) north of Nederland and approximately 20 km (12.5 miles) west of Boulder. Colorado Highway 72 runs near the ranch to the east and the Indian Peaks and Arapaho Moraine occur to the west. The site consists of Precambrian granitic rocks; glacial drift material of the Pinedale and Bull Lake Glaciations (Tweto 1979). It is theorized that approximately 2,000 years ago a breach of a cirque lake on Caribou Creek resulted in the alluvial fan where the Caribou Ranch Open Space is located (Mike Figgs *pers. comm*.). Caribou Ranch Open Space is located between the towns of Ward and Nederland, and is located at the north end of the Colorado Mineral Belt, which contains most of the mines within Colorado (Chronic 1980). The Bluebird Mine, located on the Caribou Ranch Open Space, was an active silver and tungsten mine at the turn of the century. There are also several abandoned mill sites (e.g., Batesville) located on the ranch. An abandoned railroad grade from the 1900s is located along the west edge of the ranch.

There are several first-order streams on Caribou Ranch Open Space: Delonde Creek, Caribou Creek, and Como Creek. North Boulder Creek originates upstream of the ranch at Silver Lake and bisects the ranch. The City of Boulder aqueduct runs below ground parallel to North Boulder Creek into Lakewood Reservoir, which is located downstream along Highway 72. Riparian communities occur along upper Delonde and North Boulder creeks. These include stands dominated by quaking aspen (*Populus*

tremuloides), Engelmann spruce (*Picea engelmannii*), sub-alpine fir (*Abies lasiocarpa*), or Douglas fir (*Pseudotsuga menziesii*). Among the stands of trees are various shrub species including Rocky Mountain willow *(Salix monticola*), Geyer's willow *(S. geyeriana*), plane-leaf willow *(S. planifolia),* Drummond's willow *(S. drummondiana),* Bebb's willow (*Salix bebbiana),* as well as abundant thin-leaf alder (*Alnus incana*). The herbaceous undergrowth is mostly dominated by several introduced European hay grasses e.g., timothy (*Phleum pratense*)*,* redtop (*Agrostis stolonifera*)*,* and orchard grass (*Dactylis glomerata*). There are several beaver ponds and associated wetlands located along Delonde Creek and at its confluence with North Boulder Creek. These are dominated by many of the previously listed willow species with native grasses and sedges in the understory. Additionally, a number of wetland areas exist on the ranch, which were mined in the 1930s for peatmoss. Hay and pasture meadows, dominated by non-native plant species, are located on the floodplain and low benches near the main ranch house and along Delonde and Little Como Creeks.

Emergent plants within the wetlands consist of beaked sedge (*Carex utriculata*), aquatic sedge (*C. aquatilis*), and Canada reedgrass (*Calamagrostis canadensis*). There are several riverine wetlands located next to the creeks and associated with the beaver ponds. There appears to be high level of groundwater discharge, creating several wetlands along the porous soils of the alluvial fan adjacent to Delonde and Caribou Creeks.

Many water diversions exist in the area including pipelines and reservoirs. Other anthropogenic disturbances include: highways, roads, trails, housing, mine tailings, and powerlines. The general area receives heavy recreational use in the forms of hiking, cycling, off-road vehicle use, horseback riding, cross-country skiing, hunting, and fishing. There is also limited snowmobile use and dispersed camping along the creek.

MAJOR THREATS AND STRESSES TO THE BIODIVERSITY OF THE COLORADO FRONT RANGE

1. Alteration of natural ecological processes. Since colonial times, human settlement has drastically impacted large landscape features, including grasslands and forests along the Colorado Front Range. In general, most of the ecosystems along the Front Range of Colorado have evolved with natural disturbances such as grazing and/or fire. Alteration of these natural disturbances can alter ecological functions such as plant succession and nutrient and energy cycles that in turn impact other balances in the ecosystem.

2. Alteration of natural fire regimes in natural habitats allows certain species to invade sites where they otherwise would not occur and allows fire fuels to build up to catastrophic levels. Suppression of fires due to settlement and residential development has altered vegetation structure, plant community composition and has resulted in increased fire fuel loads. Fires that are more severe than they were historically could result (Hobbs 1987), especially in areas invaded by cheatgrass (*Bromus tectorum*) and smooth brome (*Bromopsis inermis*).

Fire return intervals in the southern Rocky Mountains range from estimates of 200-400 years for subalpine *Pinus contorta* (lodgepole pine) and *Picea engelmannii-Abies lasiocarpa* (Engelmann spruce-subalpine fir) forests to 50-150 years for lower elevation *Pinus contorta* forests (references summarized by Peet 1988). Insect outbreaks due to increased tree density have also had dramatic effects on Rocky Mountain forests as have human impacts. Increases in fire frequency during the late 1800s, fire suppression after settlement, logging, road building, mining, and introduction of non-native species have altered the structure, composition, and distribution of many of the plant communities. While large stands are common, very few are thought to represent the pre-settlement condition of the forests. Site specific management can restore natural conditions to some extent but because of the large scale of many ecological processes in montane forests, natural systems would have to be managed in the context of multiple ownerships.

3. Alteration of grazing patterns along the Colorado Front Range allows for modifications in plant community composition, often negatively affecting native species populations. The elimination of many native herbivores and replacement with domestic livestock has altered this natural process. While management with domestic livestock often mimics the grazing of native herbivores, certain differences do affect the plant communities (Lauenroth and Milchunas 1991). Certain grazing practices, such as continuous grazing for the entire growing season, can alter the composition of plant communities over time by reducing the abundance of native species and allowing less desirable, non-native species or native increasers to increase in abundance.

4. Habitat loss, creation of edge habitats, and fragmentation can be detrimental to many species of concern known from the Colorado Front Range. In Colorado, housing and urban development, mining, water development, industry, agricultural conversion, and recreation continue to negatively impact natural plant

communities and their faunal components. Loss of habitat occurs either through destructive removal of habitat or through the creation of "edge" habitats or zones.

Perhaps one of the least easily understood concepts is that of "edge" habitats. “Edge” habitats are zones of sharply contrasting habitats or landscapes (Schwarz *et al*. 1993). Natural examples of these zones may be a grassland and a riparian area, or a grassland and a forest edge. Edges are often created by naturally occurring processes such as floods or fires and will recover naturally over time. Edges can also be anthropologically created, for example: a grassland and an agricultural field or a grassland and a road. Edges are often dominated by plant species adapted to disturbance and have become, as a result, more common and widespread. These areas often attract high numbers of generalist animal species that are widespread and able to utilize disturbance tolerant plant species (Rathcke and Jules 1993).

These last examples of edge habitat have increasingly become the focus of habitat conservation. As our landscape is increasingly fragmented by large-scale, rapid anthropogenic conversion, these edges become increasingly abundant in the remaining open space areas. As a result, many generalist species of plants and animals become increasingly common in these areas, and compete, either directly or indirectly, for food sources with the specialist species (Rathcke and Jules 1993). The specialists, meanwhile, have become increasingly less common as the overall structure of their habitat landscape is dramatically altered, and interspecies competition has increased. Furthermore, the overall reduction of large landscapes jeopardizes the existence of the specialists further. Specialists that occur in small, patchy populations are more likely to be excluded from small fragments or to be affected by local disturbance events that could cause the extinction of the entire population. Specialists that exploit sparse and/or scattered plant species could be threatened by fragmentation (Rathcke and Jules 1993). Should a large-scale disaster such as fire, flood, or disease occur, populations normally recolonizing after landscape recovery may actually be extirpated if they exist in an isolated fragment. They cannot travel the distance to recolonize similar habitat (Moffat and McPhillips 1993).

5. Construction of trails and roads negatively impact native plants, animals and plant communities. Increased recreation in open space areas has created a demand for trails and trail management. It is generally believed that pedestrian and bike trails do not substantially fragment the natural landscapes. However, any disturbance to a natural landscape can create fragmentation and edges. Trails, to the native components of a system, may be viewed as breaks or barriers in otherwise natural habitat. Such breaks may impede or eliminate movement by animals. For example, rodents may avoid trail openings because of exposure to predation (Harker *et al*. 1993). Habitat specialists are very exacting in environmental requirements and are obligated to conditions of habitat continuity. They often cannot survive for extended periods of time in small patches and fragments, and cannot exist, as plants occasionally do, in dormant states during intervals of habitat unsuitability (Oates 1995). Trails are also ideal places for early successional species to grow because disturbance is continuous and regular. With the arrival of early successional vegetation there are edges, and consequently, a preponderance of generalist species. It is known that with every edge habitat created, a larger proportion of interior or undisturbed habitat is lost (Schwarz *et al*. 1993). If the impact of additional both formal

and social trails is considered, the habitat and landscape is increasingly fragmented, resulting in creation of additional edge habitat, and increased displacement of natural habitat (Harker *et al*. 1993).

Trails and roads also provide ideal corridors for the spread of non-native and invasive plants. Many of these species are tolerant of or rely on continuous disturbance from use and maintenance of the trails to become established. Belcher and Wilson (1989) observed that most leafy spurge infestations were associated with areas that had been disturbed by human activities such as vehicle tracks, road construction, and fire guards. Even in areas that seem relatively free of non-native species, seeds of non-native species often occur in the seed bank and remain viable for many years. With trail construction and use, the soil is disturbed, increasing the opportunity for aggressive non-native species to spread *via* trail corridors. Trail related erosion also increases the availability of habitat for non-native vegetation. When eroded trails become too difficult for use, construction of additional trails or going off trail creates additional negative impacts on the natural landscape.

6. Invasion of non-native species can result in the widespread replacement of native species, often greatly altering ecosystem functions, and is one of the most significant threats to the natural resources along the Colorado Front Range. European-American settlement of the area introduced numerous alien plant species. Some species were intentionally introduced as hay or pasture grasses (such as smooth brome), while others were accidentally introduced as contaminants in hay or grain crops or as garden escapees. Regardless of the source, the introduction of non-native species has significantly impacted natural communities. Numerous studies have shown that areas invaded by non-native species have reduced populations of both native plant and animal species (Bedunah 1992, Bock and Bock 1988). For example, cool season smooth brome and cheatgrass compete with later emerging native species for water and negatively affect the water status and productivity of the native species (Melgoza *et al*. 1990). Other ecological functions may also be altered.

RECOMMENDATIONS

The following recommendations are based on the needs of the elements identified at the Como Creek Potential Conservation Site and for the Caribou Ranch Open Space in general.

1. Develop and implement management plans for protecting the conservation site and other locations of natural heritage elements profiled in this report. Restore natural disturbance regimes to the extent possible. While it is probably not possible to completely return to pre-settlement conditions, more closely mimicking these conditions should be a positive step in protection of sensitive species, restoration of the natural communities, and in preservation of natural biodiversity

Avoid impacts to the Bluebird Mine to protect the roosting site of the big-eared bat. Prohibit plant collecting to avoid impacts to the wood lily population.

2. Incorporate the information included in this report to review proposed activities in or near conservation sites so that these activities do not adversely affect the natural heritage elements found within. The natural heritage elements presented in this report represent species of global and statewide significance. Management and development activities, either in or near the site, may affect the elements present. Should a proposed activity potentially impact the site, review of the plans by BCPOS scientists is recommended. If necessary, planning personnel should contact persons, organizations or agencies with expertise in order to obtain detailed comments and feedback.

3. Encourage cooperation among landowners, government agencies, and conservation organizations to protect natural diversity. Combine efforts with interested allies including the US Forest Service and private landowners to design and effect a practical strategic plan aimed for the long-term survival of these significant species and their habitats.

4. Encourage well-planned and proper management of natural heritage resources existing within BCPOS parks, and recognize that identification of conservation sites and open space designation does not necessarily confer complete protection of the plants, animals and plant communities. Developing a conservation plan is just one of many steps necessary to preserve natural heritage resources. Some of the most serious threats, however, are understood within an ecosystem context. For example, residential encroachment, recreational development, fire suppression, noxious weed invasion, and altered hydrology are anthropogenic influences that are detrimental to habitat integrity and long term survival of natural heritage elements. Consideration of all ecosystem influences is meaningful when considering management plans for a site. In this context, building partnerships with other agencies and entities is essential in development of plans for long-term protection of a site. Developing partnerships that encourage research and development of techniques to maintain or restore sites for preservation of rare natural heritage elements would be beneficial. There are many agencies and organizations available for consultation in the development of conservation

plans, including the Colorado Natural Heritage Program, the Colorado Natural Areas Program, The Nature Conservancy, Colorado Division of Wildlife, various academic entities, and open space agencies in neighboring counties.

5. Develop a strategy for improving the quality of the riparian and aquatic systems along Como Creek. Water quality, quantity, and timing of flows are jeopardized by hydrologic modifications. Restore or improve hydrologic regimes on Como Creek where possible. Stocking of non-native sport fishes (e.g., brook, brown, and rainbow trout) should cease and removal of these species may be necessary to reduce the unnatural selection pressures or effected genetic impurities on the native trout known to inhabit the creek. This may require cooperation with the Forest Service, the Colorado Division of Wildlife, and private landowners. Restoration of the wet meadows and riparian areas with native plant species would be beneficial for general biodiversity protection in the area.

6. Natural heritage resource inventories should be continued when and where necessary, including inventory for species that cannot be adequately surveyed in one field season. Further inventories, research, and monitoring are necessary to acquire a more thorough comprehension of significant species, their habits and habitats. Continue to monitor, document, and verify both known and predicted localities for targeted species. Despite the best efforts during the field season, it is very likely that some elements cannot be detected and are not identified in this report.

7. Increase public awareness of the benefits of protecting significant natural areas. Increase public awareness that sensitive natural resources exist in parts of the Open Space and certain open space activities may be detrimental to these resources.

8. Prohibit the introduction of non-native species known to negatively and profoundly affect natural areas. Strategies to decrease exotic floral invasion and possibly increase the quality of native flora communities in the area should be developed. Exotic plant invasion compromises quality habitat for native flora and also for dependent invertebrate fauna. Public agencies and private landowners should be strongly encouraged to remove these species from their properties. Property owners immediately adjacent to open space areas should be encouraged to consider xeriscaping with locally native flora to minimize the further spread of noxious weeds and exotics into natural areas. If restoration of an area becomes necessary, CNHP recommends the use of locally grown native flora for revegetation efforts.

BACKGROUND

Colorado's Natural Heritage Program

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

CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in Colorado for 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 natural communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system, the Biological Conservation Data System (BCD). 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 plots the data on 1:24,000 scale USGS maps and enters it into the BCD. The BCD can be accessed by many categories, 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.

The CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System developed by The Nature Conservancy. The CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources, 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 Heritage Programs throughout 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 allows us to evaluate the significance of each to the conservation of Colorado's, and indeed a global natural biological diversity. By using species rarity ranks and occurrence quality ratings, priorities can be established for the protection of the most sensitive or imperiled sites. An updated locational database and priority-setting system such as CNHP provides is an effective, proactive land-planning tool.

The Natural Heritage Network and Biodiversity

Colorado is well known for its rich diversity of geography, wildlife, plants, and natural 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 this 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 specialist species are more likely to become extinct than common and generalist species, 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. By ranking the relative rarity or imperilment of a species, the quality of its populations, and the importance of associated conservation sites, the methodology can facilitate prioritizing conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community began to realize that plant communities are as equally important as individual entities, this methodology has also been applied to ranking and preserving significant natural plant communities. By protecting and managing aggregate units, associated species that we do not track can be included and protected.

Natural Heritage Programs throughout North, Central, and South America utilize the Natural Heritage Methodology, which form 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 Central and South 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 and 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 viruses, bacteria, and protists, through multicellular kingdoms of fungi, plants and animals. At finer levels of organization, biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within single populations. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of

species and natural communities, and all are important for the well being of humans. It stands to reason that natural diversity should be of concern to everyone.

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 of a species 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 natural communities or ecosystems within that area. These communities may be diagnostic or even endemic to an area. It is within these ecosystems that all life dwells.
4. **Landscape Diversity**. The type, condition, pattern, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape may also 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 lost of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The conservation of natural 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.

The Natural Heritage Ranking System

Information is gathered by CNHP on Colorado's plants, animals, and natural communities. Each of these species and natural 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, e.g., 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. Other important factors are: size of the geographic range, number of individuals, trends in both population and distribution, identifiable threats, and number of already protected occurrences.

Element rarity ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's level of 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. CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to imperiled (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. Watchlisted species are noted in the lists by an asterisk (*) next to the species name. A complete description of each of the Natural Heritage ranks is provided below.

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 1. Definition of Colorado Natural Heritage Program Rarity Ranks.

Global rarity ranks are based on the range-wide status of a species. State rarity 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 (five 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 (six 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 taxa 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.

Note: Where two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the element falls between the two numbers.

Protection Urgency Ranks

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

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

A protection action involves increasing the current level of legal protection accorded one or more tracts at a potential conservation area. It may also include activities such as educational or public relation 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, e.g., any action requiring stewardship intervention. Threats that may require a protection action are as follows:

1. Anthropogenic forces that threaten the existence of one or more element occurrences at a site; e.g., development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence and timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
2. The inability to undertake a management action in the absence of a protection action; e.g., obtaining a management agreement;
3. In extraordinary circumstances a prospective change in ownership 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 must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). 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 five years to prevent the loss of element occurrences.
M3 New management action will be needed within five 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.

Element Occurrence Ranks

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

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

2. **Condition** – an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include reproduction and health, development/maturity for communities, ecological processes, species composition and structure, and abiotic physical or chemical factors.

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

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If there is insufficient information

available to rank an element occurrence, an EO-Rank is not assigned. Possible EO-Ranks and their appropriate definitions are as follows:

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

Potential Conservation Sites

To successfully protect populations or occurrences, it is necessary to delineate potential conservation sites. These potential conservation sites focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation sites may include a single occurrence of a rare element or a suite of rare elements 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 or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is a hypothesis 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 potential conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Potential Conservation Site Boundaries

Once the presence of rare or imperiled species or significant natural communities has been confirmed, the first step towards its protection is the delineation of a potential conservation site planning boundary. In general, the potential conservation site planning boundary is an estimate of the landscape that supports the rare elements as well as the ecological processes that allow them to persist. In developing such boundaries, CNHP staff considers 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 protect the site against future changes in the use of surrounding lands;
- exclusion or control of invasive exotic species;
- land necessary for management or monitoring activities.

As the label "potential conservation site 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. All land within the potential conservation site planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

Off-Site Considerations

It is often the case that all relevant ecological processes cannot be contained within a site of reasonable size. 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 what is thought to be the most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve broad county-wide or regional 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 the CNHP uses these element and element occurrence ranks is to assess the overall biodiversity significance of a site, including one or many element occurrences. 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 Local Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Legal Designations

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

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plant 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 only those species that would have been included in the former Category 1 as candidates for listing. 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 2. Federal and State Agency Special Designations.

1. *U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996*):
   - **LE** Endangered; taxa formally listed as endangered.
   - **E(S/A)** Endangered due to similarity of appearance with listed species.
   - **LT** Threatened; taxa formally listed as threatened.
   - **PE/PT** Proposed E or T; taxa formally proposed for listing as endangered or threatened.
   - **C** Candidate: taxa 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 that could easily become endangered or extinct in a state, as designated by a State Director
4. *State Status (Colorado Division of Wildlife):*
   - **E** Endangered
   - **T** Threatened
   - **SC** Special Concern

METHODS

The study followed a general method that the Colorado Natural Heritage Program has successfully employed in rare or imperiled species inventories.

Existing information collection. Information was accumulated prior to the fieldwork from a variety of sources, including both published and unpublished information. This included the gathering of maps, reviewing the BCD and manual Natural Heritage data, and consulting with experts including local naturalists and knowledgeable BCPOS staff members.

Identify potentially occurring species. Using known county records previously input into the BCD, a list of rare or imperiled plant, plant community, and animal species known to occur in Boulder County was compiled. Based on elevation range and professional judgement the list was limited to those believed to most likely occur on the Caribou Ranch Open Space (Table 3). The inclusion of historical records provided information for elements that potentially could be relocated as well.

Table 3. Rare or Imperiled Plant, Plant Community and Animal Species Potentially Occurring on Caribou Ranch Open Space.

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sensitive
Plants						
Botrychium lineare (historical record)	A moonwort	G1	S1	(C2)		FS
Botrychium pallidum	Pale moonwort	G2	S2			
Aletes humilis	Larimer aletes	G2G3	S2S3			FS
Carex oreocharis	A sedge	G3	S1			
Botrychium hesperium (historical record)	Western moonwort	G3	S2			
Carex sychnocephala	Many headed sedge	G4	S1			
Botychrium minganense	Mingan moonwort	G4	S1			
Listera convallarioides (historical record)	Broad-leaved twayblade	G4	S2			
Pyrola picta	Pictureleaf wintergreen	G4G5	S2			
Potentilla effusa var. *rupincola*	Rocky Mountain cinquefoil	G5?T2	S2			FS
Carex diandra	Lesser panicled sedge	G5	S1			
Lilium philadelphicum	Wood lily	G5	S3			
Juncus vaseyi	Vasey bulrush	G5	S3			
Botrychium lanceolaturm var. lanceolatum	Lance leaved moonwort	G5T4	S2			
Lycopodium annotinum var. pungens	Stiff clubmoss	G5TU	SU			
Invertebrates						
Promenetus exacuous	Sharp sprite	G?	S2			
Acroloxus coloradensis	Rocky Mountain capshell	G?	S2		SC	FS

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	Federal Sensitive
Promenetus umbilicatellus	Umbilicate sprite	G?	S3			
Erebia theano	Theano alpine	G4	S3			
Paratrytone snowi	Snow's skipper	G4	S3			
Pyrgus ruralis	Two-banded skipper	G4	S3			
Cicindela nebraskana	Nebraska tiger beetle	G4Q	S1?			
Cordulia shurtleffi	American emerald	G5	S1?			
Lycaena edita	Edith's copper	G5	S1?			
Aeshna eremita	Lake darner	G5	S1?			
Somatochlora hudsonica	Hudsonian emerald	G5	S2S3			
Oeneis jutta reducta	Rocky Mountain arctic jutta	G5TU	S1			
Herpetiles						
Bufo boreas	Boreal toad	G5T2Q	S1	C	E	FS
Mammals						
Plecotus townsendii pallescens	Townsend's big eared bat	G4T4	S3	(C2)		

Select and prioritize Targeted Inventory Areas. Targeted Inventory Areas (TIAs) were selected by identifying suitable habitats for the targeted species (Table 4). The survey areas were prioritized by the time of year the species is most easily recognized, degree of rarity or imperilment, and by habitat condition. Use of aerial photographs and vegetation maps proved particularly useful. See Figure 1 for TIA locations within Caribou Ranch Open Space.

Because each major habitat was to be field surveyed for a vegetation mapping effort on the property, individual areas were not identified as "Targeted Inventory Areas" for plant communities. See Figure 3 in the appendix for the route surveyed for the vegetation-mapping component of this project.

Birds were not targeted in this survey, due to an intensive bird survey projected for the Caribou Ranch Open Space at a future date.

Table 4. Targeted Inventory areas for Caribou Ranch Open Space and Related Targeted Species of Concern.

Targeted Inventory Area (TIA)	TIA #	Targeted Species
Caribou Kettle Ponds	CR1	*Promenetus exacuous, Promenetus umbilicatellus, Acroloxus coloradensis, Aeshna eremita, Cordulia shurtleffi*
Como Creek	CR2	*Lilium philadelphicum, Aletes humilis, Potentilla effusa, Cicindela nebraskana, Pyrgus ruralis, Paratrytone snowi, Lycaena editha, Erebia theano, Oeneis jutta reducta, Oncorhynchus clarki stomias*
North Boulder Creek	CR3	*Listera convallarioides, Pyrola picta*

Targeted Inventory Area (TIA)	TIA #	Targeted Species
North Boulder Creek Meadow	CR4	*Aletes humilis, Potentilla effusa,* var. *rupincola, Cicindela nebraskana, Oeneis jutta reducta*
Bluebird Mine Meadows	CR5	*Botrychium lineare, Botrychium pallidum, Botrychium hesperium, Botrychium minganense, Botrychium lanceolatum* var. *lanceolatum, Lilium philadelphicum, Aletes humilis, Potentilla effusa, Cicindela nebraskana, Oeneis jutta reducta, Plecotus townsendi*
Delonde Wetlands/Creek	CR6	*Juncus vaseyi, Carex cychnocephala, Carex diandra, Promenetus exacuous, Promenetus umbilicatellus, Acroloxus coloradensis, Aeshna eremita, Cordulia shurtleffi, Pyrgus ruralis, Paratrytone snowi, Lycaena editha, Erebia theano, Oeneis jutta reducta, Bufo boreas, Sorex nanus, Sorex hoyi*
Delonde Creek Uplands	CR7	*Aletes humilis, Potentilla effusa, Cicindela nebraskana, Lycaena editha, Oeneis jutta reducta*

Field Surveys. Field surveys took place during times concordant with the times of year the species were most easily recognized. Most surveys took place during June, July, August, and September. Trained personnel conducted the surveys, and collection was limited to voucher specimens of targeted species, and to those species difficult to distinguish in the field. The relative "quality" of each targeted species was estimated (= element occurrence rank), and a brief assessment of relevant ecological processes, threats, and management concerns was noted during the surveys.

Delineation of potential conservation sites. A **potential conservation site planning boundary** delineates the potential conservation sites. In developing these boundaries, a number of factors was considered including: habitat for rare species, protection of water quality, protection from potentially detrimental land uses, and maintenance of ecological processes necessary to perpetuate the viability of significant elements in the area.

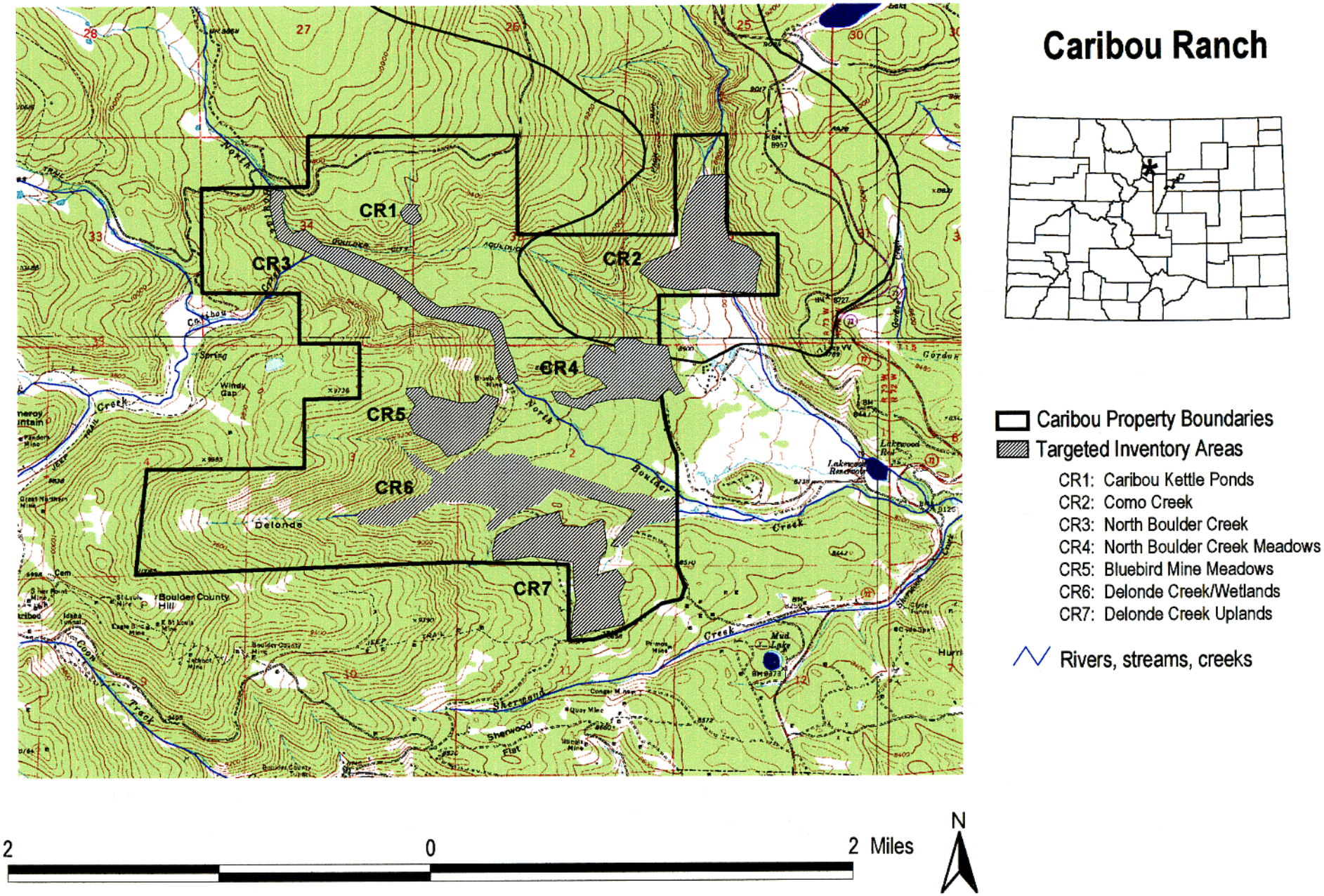


Figure 1. Caribou Ranch with Locations of Targeted Inventory Areas.

RESULTS

Seven Targeted Inventory Areas (TIAs) were outlined for this survey in 1998. During the 1998 field season, all TIAs were surveyed for targeted vertebrates and plants. All but the North Boulder Creek Meadow (CR4) were surveyed for invertebrates. Colorado Natural Heritage Program field scientists documented four targeted elements at Caribou Ranch Open Space through this inventory. Several plant community occurrences found on Caribou Ranch Open Space during the 1996 survey will no longer be tracked in CNHP databases. For further information, see the section below that addresses these communities under "Additional Element Occurrences within or near the Caribou Ranch Open Space."

This section includes:

- A profile of the Potential Conservation Site, including site description, location, table of known elements, and protection and management considerations;
- A map of the site with the boundaries delineated on 1:24,000 scale image;
- A table summarizing elements previously documented within the Como Creek Potential Conservation Site, but not on the Caribou Ranch Open Space Property;
- A table summarizing additional elements occurring within Caribou Ranch Open Space property boundaries, but not included in a Potential Conservation Site;

Potential Conservation Site

The Como Creek Site has been outlined based on results from 1998 and 1996 inventories. All occurrences documented from the property underwent Element Occurrence Rank reevaluations as a result of newly gathered information.

The delineation of a potential conservation planning boundary in this report does not confer any regulatory protection on recommended areas. These boundaries are intended to guide planning and decision-making for the conservation of these significant areas.

The site delineated in this report contains varying taxa that are of conservation concern. This adds levels of complexity to management plans, and these elements should be considered in the design of such management plans. It also indicates that the Caribou Ranch Open Space property is of meaningful conservation significance.

Potential Conservation Site Format

The potential conservation site is described in a standard site report reflecting data fields in CNHP's Biological and Conservation Data System (BCD). The sections of this report and the contents are outlined and explained below. For more detailed descriptions of each rank refer to the Natural Heritage Ranking System section beginning on page 15.

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.

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).

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).

Location: General location and specific road/trail directions.

Legal Description: USGS 7.5 minute quadrangle name and Township, Range, and Section(s).

General Description: A brief narrative of the topography, vegetation, and current use of the potential conservation site. Common names are used along with scientific names.

Biodiversity Rank Justification*:* A synopsis of the significant elements occurring in the site. Table 5 within the site profile lists the element occurrences found within the site (in order of Global Rank), their rarity ranks, 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.

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

Protection Rank Justification: A summary of major land ownership issues that may affect the site and the element(s) within the site.

Management Rank Justification: A summary of site management issues that may affect the long-term viability of the site.

Como Creek

Biodiversity Rank: B4 (*Moderate or regional significance*).
The Como Creek site contains a population of the globally rare subspecies greenback cutthroat trout with fair estimated viability. One state rare plant is also known from the site.

Protection Rank: P2 (*Threat expected within five years*).
The majority of this site is publicly owned and managed by the US Forest Service and Boulder County Parks and Open Space. A small portion of this site is privately owned, and the University of Colorado owns another small portion. Because much privately-owned land surrounds and to some extent isolates the site, any private ownership management plans and activities could impact the elements within the conservation site.

Management Rank: M3 (*New management action will be needed within five years to maintain current quality of element occurrences*).
Non-native brook trout are present in Como Creek and will prey on the native greenback cutthroat trout. Several anthropogenic disturbances exist within this site, e.g., highways, dirt roads, powerlines, aqueducts. Expansion and maintenance of these structures could potentially impact the elements within the site.

Location: The Como Creek Site is located in Boulder County, Colorado, northwest of the town of Nederland. Como Creek flows southeast out of the Indian Peaks to its junction with North Boulder Creek.

Legal Description: USGS 7.5 minute quadrangles: Ward, Gold Hill and Nederland; T1N, R72W, R73W.

General Description: The Como Creek Site is at an elevational range of 2550 to 3353 m (8360 to 11,000 ft). The upper part of the site (above the Caribou Ranch Open Space) is forest dominated by lodgepole pine (*Pinus contorta)*, sub-alpine fir (*Abies lasiocarpa),* and Engelmann spruce *(Picea engelmannii).* Ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*) occur less frequently. Areas in the lower part of the site (within the Caribou Ranch Open Space) have forest openings dominated by big sagebrush (*Artemisia tridentata)* and graminoids, most of which are non-native. Riparian communities occur along Como Creek. These communities include stands dominated by quaking aspen (*Populus tremuloides*), Engelmann spruce (*Picea engelmannii*), or sub-alpine fir (*Abies lasiocarpa*), with various shrub species including willows (*Salix* spp.) and thin-leaf alder (*Alnus incana*). The herbaceous

Como Creek

undergrowth is dominated by several European hay grasses e.g., timothy (*Phleum pratense*), redtop (*Agrostis stolonifera*), and orchard grass (*Dactylis glomerata*). Only a narrow band along the wettest parts of the riparian area is dominated by native species, mainly Canada reedgrass (*Calamagrostis canadensis)* and aquatic sedge (*Carex aquatilis*).

Many water diversions exist in the area, including pipelines and reservoirs. Other anthropogenic disturbances include: highways, roads, trails, housing, mine tailings, and powerlines. The general area receives heavy recreational use in the forms of hiking, cycling, horseback riding, cross-country skiing, hunting, and fishing. There is also limited snowmobile use and dispersed camping along the creek.

Biodiversity Rank Justification: The part of the Como Creek Site within the Caribou Ranch Open Space contains a population of the globally rare fish subspecies, the greenback cutthroat trout (*Oncorhynchus clarki stomias)*. While this population has only fair predicted viability, it is legally protected (by the U.S. Fish and Wildlife Service) and represents one of three native subspecies of trout in the state. The Colorado Division of Wildlife refers to this particular population of greenback cutthroat trout as an A-strain (genetically pure) population. Additionally, the site includes an occurrence of a state rare plant, the wood lily (*Lilium philadelphicum*). This striking and brightly colored lily is found in riparian areas, wet meadows, and moist forests in Colorado. Because it is appealing to collectors, and the quality of its associated riparian habitats continues to be threatened, it remains a plant species of special concern.

Table 5. Elements of Concern at the Como Creek Site.

Element	Common Name	Global Rank	State Rank	EO* Rank
Oncorhynchus clarki stomias†	Greenback cutthroat trout	G4T2T3	S2S3	C
Lilium philadelphicum	Wood lily	G5	S3	C

**EO = Element Occurrence
† = Basis for Biodiversity Rank

Boundary Justification: The water quality and flow of Como Creek is important to the survival of the elements found here, particularly the greenback cutthroat trout. This site encompasses the headwaters and the uplands directly adjacent to the creek to reduce negative impacts to the creek from higher points in the watershed.

Extensive off-site activities within the watershed such as clear-cutting or severe fires could impact the hydrology of the stream. Stocking of non-native trout downstream and upstream would impact the native trout if barriers to movement of fish do not exist on the stream.

Protection Rank Justification: Land protection appears complete for the majority of the site under public ownership and management by the US Forest Service and BCPOS. However, certain environmental regimes, such as fire and hydrology, are

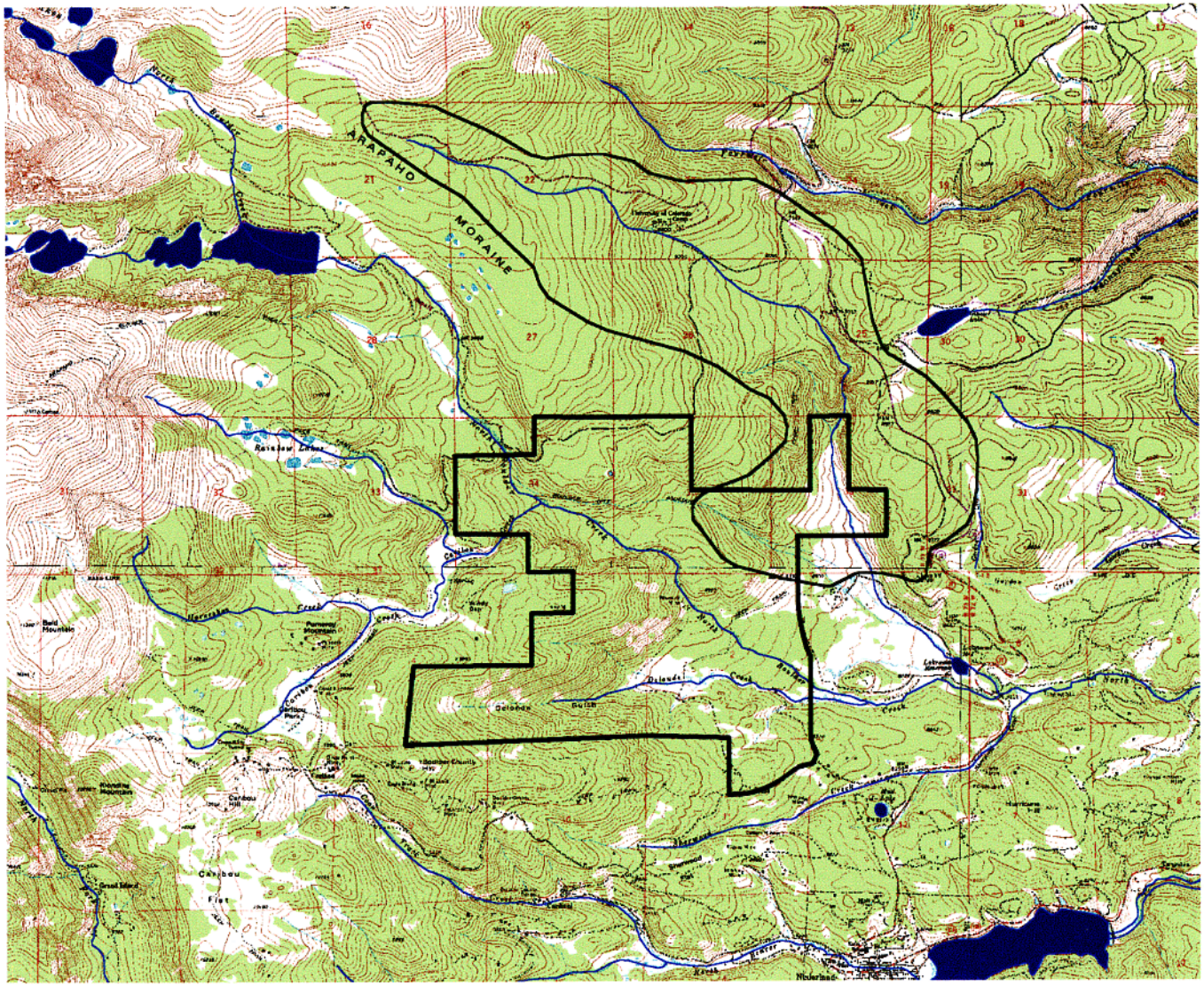
not consistently protected by land acquisition and may be impacted both by on-site management and off-site activities. Certain activities on private lands in the area could also degrade the site. Residential development, recreational development, road and highway expansion, aqueduct placement, water diversions, increased fire suppression, invasion of non-native plants, and exotic faunal introductions and stocking all potentially have negative impacts on the natural integrity of this site. Review of these proposed activities by BCPOS biologists is recommended.

Management Rank Justification: The Peak to Peak highway, several dirt roads, powerlines, pipelines, reservoirs, and houses exist within or are very near to this site. Expansion, maintenance, and future developments remain a significant threat to this site's elements. Impacts that would alter the natural hydrologic regime or potentially introduce non-native species (both plants and animals) into the watershed need to be minimized.

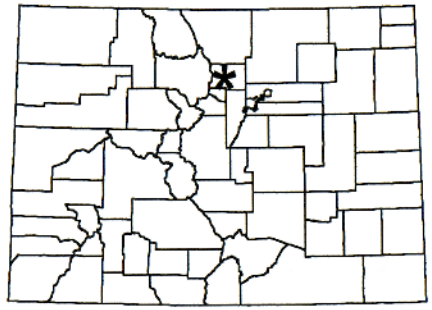
Dams, dykes, diversions, ditches, and pipelines compromise water quality, quantity, and natural flow. This degree of water quality degradation further diminishes the quality of the fish occurrence within the site. This quality, quantity and timing must be maintained to protect the fish. Exotic fishes (e.g., brook, brown, and rainbow trout) introduce unnatural selection pressures or effect genetic impurities on the native trout known to inhabit the creek. Stocking of non-native sport fish should be avoided and removal of these species may be necessary to perpetuate long-term viability and genetic purity of the native greenback cutthroat trout. This may require cooperation from the U.S. Forest Service, Colorado Division of Wildlife, and private landowners in the watershed above the Caribou Ranch Open Space.

Numerous studies have shown that areas invaded by non-native species have reduced populations of native plant and animal species (Bedunah 1992, Bock and Bock 1988). Non-native plant species are common in all but the wettest areas along the creek, chiefly a result of introduced hay meadow grasses: timothy grass (*Phleum pratense*) smooth brome (*Bromus inermis*) and bentweed grass (*Agrostis stolonifera*) and from seed dispersion along roads and other disturbance corridors. Studies have determined that cheatgrass (*Bromus tectorum*) competes with warm season native species for water and negatively affects the water status and productivity of the native species (Melgoza *et al*. 1990). While cheatgrass is uncommon near the creek, the abundance of other non-native hay grasses may have similar negative impacts on native species. It is unknown if the abundance of non-native species affects the hydrology of the stream and, consequently, the native trout. Efforts to decrease the abundance of non-native species, and possibly increase the quality of native plant communities in the area would improve the habitat for many native plant and animal species.

Figure 2. Como Creek Site



Caribou Ranch



Como Creek Site

Caribou Ranch Property Boundary

Rivers, streams, creeks

2 0 2 Miles

N

Additional Element Occurrences within or near the Caribou Ranch Open Space Property

In addition to the elements occurring within the proposed boundaries of the Como Creek Site, there are several additional elements known from within or very near to the defined property boundaries of Caribou Ranch Open Space and the Como Creek Site. These include historical occurrences of elements, observations of elements from the 1996 survey, and observations made by other agencies. Because these elements are previously known from the area, it remains highly likely that additional surveys could detect these elements at Caribou Ranch Open Space.

Table 6 below summarizes the additional occurrences known from within the Como Creek Site but not on the Caribou Ranch Open Space.

Table 6. Additional Elements known from the Como Creek Site.

Element	Common Name	Global Rank	State Rank	*EO Rank
Plants				
Botrychium echo	Reflected moonwort	G2	S2	None assigned
Botrychium lineare	A moonwort	G1	S1	H
Botrychium hesperium	Western moonwort	G3	S2	None assigned
Invertebrates				
Promenetus exacuous	Sharp sprite	G?	S2	H
Promenetus umbilicatellus	Umbilicate sprite	G?	S3	H
Somatochlora hudsonica	Hudsonian emerald	G5	S2S3	H
Vertebrates				
Bufo boreas pop 1	Boreal toad (southern rocky mountain population)	G4T1Q	S1	H
Accipiter cooperii	Cooper's hawk	G4	S3S4B,S4N	C
Aquila chrysaetos	Golden eagle	G5	S3S4B,S4N	C

*EO = Element Occurrence

Table 7. Additional Elements known from the Caribou Ranch Open Space.

Element	Common Name	Global Rank	State Rank	*EO Rank
Vertebrates				
Plecotus townsendi	Townsend's big-eared bat	G4T4	S3	C
Plant Communities				
Salix geyeriana-Salix monticola/Calamagrostis canadensis	Montane willow carr	G3	S3	C

*EO = Element Occurrence

Two occurrences were documented within the Caribou Ranch Open Space property but were not included in the Potential Conservation Site (see Table 7). A Townsend's big-eared bat (*Plecotus townsendi*) occurrence was documented at the Bluebird Mine. The actual roost site should be protected in its present condition. Contact the Bats In Mines project (Kirk Navo 719-587-6934) for information on grating the mine entrance to protect from disturbance. Although forage and water sources may exist in close proximity to the bat roost, bats often range long distances to utilize other resources. Because of this foraging behavior, a potential conservation site was not delineated for this species. Visitation to the buildings adjacent to the mine should have little impact to other bat species, provided the visitation in not destructive or intrusive. Invasive non-native species and hydrologic alterations on Delonde Creek (water diversion to the adjacent meadow) degrade the occurrence of the montane willow carr community (*Salix geyeriana-Salix monticola/Calamagrostis canadensis*). Avoiding impacts to the physical area occupied by the willow carr would allow some protection of biodiversity values but restoration of the natural hydrologic regime, and of the adjacent hay meadows would help increase the biodiversity value of the willow carr.

The Caribou Ranch Open Space contains a wide variety of vegetation types known to occur throughout the Rocky Mountains, many of which are globally common (G4 or G5). For globally common plant communities, only the largest and best condition examples are tracked by CNHP due to their higher conservation significance. Several of the plant communities documented during the initial visit to the site by CNHP (November 1996) were reevaluated during the 1998 field season and consequently were found to be of lower quality than originally estimated. Quality ranks for many of these occurrences were lowered because of the abundance of numerous non-native species. Natural Heritage Programs have also recently begun to regard landscape context as a more fundamental component in assessing the long-term viability of plant communities and the associated fauna. Because much of the surrounding area on and near the Caribou Ranch Open Space has been altered by human activities, the natural condition of the landscape is considered to range in quality from fair to poor. Thus, several of the plant communities found on the Caribou Ranch Open Space during the 1996 survey will no longer be tracked in the CNHP databases. See Table 8 for the plant communities identified at the Caribou Ranch and the appendix for descriptions and locations of plant communities identified during the mapping part of the project.

Table 8. Plant Communities of Caribou Ranch Open Space.

Plant Community	Common Name	Global Rank	State Rank
Abies lasiocarpa/*Carex geyeri*	Subalpine fir/elk sedge montane forest	G5	S2S3
Abies lasiocarpa/*Vaccinium myrtillus*	Subalpine fir/blueberry montane forest	G5	S5
Abies lasiocarpa-Picea engelmannii/*Salix drummondiana*	Subalpine fir-Engelmann spruce/Drummond's willow montane forest	G5	S4
Artemisia tridentata alliance	Big sagebrush	--	--

Plant Community	Common Name	Global Rank	State Rank
Carex utriculata	Montane wet meadow	G5	S4
Pinus contorta/*Carex geyeri*	Lodgepole pine/elk sedge persistent pine forest	G5	S4
Pinus contorta/*Juniperus communis*	Lodgepole pine/common juniper montane forest	G5	S3
Pinus contorta/*Vaccinium myrtillus*	Lodgepole pine/blueberry montane forest	?	?
Pinus flexilis/*Juniperus communis*	Limber pine/common juniper montane forest	G5	S3
Pinus ponderosa/*Arctostaphylos uva-ursi*	Ponderosa pine/bear berry montane forest	G5	S3
Pinus ponderosa/Carex geyeri	Ponderosa pine/elk sedge montane forest	G4	S2S3
Pinus ponderosa/*Muhlenbergia montana*	Ponderosa pine/mountain muhly montane forest	G5	S2S3
Populus tremuloides/*Carex geyeri*	Aspen/elk sedge montane forest	G4	S4
Populus tremuloides/*Festuca thurberi*	Aspen/Thurber fescue montane forest	G4	S4
Populus tremuloides/*Juniperus communis*	Aspen/common juniper montane forest	G4	S4
Salix geyeriana-Salix monticola/*Calamagrostis canadensis*	Geyer's willow-Drummond's willow/ bluejoint reedgrass montane willow carr	G3	S3

CONCLUSIONS

The anticipated importance that Boulder County Parks and Open Space lends to conservation is further supported by these findings. This property supports or potentially supports habitat for several species of conservation concern, including rare and imperiled species of both global and statewide concern.

These findings further address the need to implement comprehensive and cooperative management plans to secure the population viability of rare species here, especially that of the greenback cutthroat trout. Should proper management and conservation plans be developed and practiced, those species encountered in this survey have potential for long-term viability. Management considerations should be given to all elements (flora and fauna) occurring or potentially occurring on the ranch or within the Como Creek Site.

Examples of threats to continued survival of these species include continued or increased residential development throughout the area, road and trail construction, continued water diversion, exotic floral invasion, exotic fish introductions, and increased tree density in a formerly more open habitat. A contiguous landscape with minimal habitat fragmentation and natural ecological functions will help insure the survival of these elements. Management actions will have to consider the impacts that urban development, past management, and management on adjacent lands has on the site and to the species contained within.

The conservation site presented here can be used as a baseline for designing and implementing management plans to secure viable populations of the targeted species.

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APPENDICES

These appendices will provide some brief background information regarding species of concern that were identified by the Colorado Natural Heritage Program on the Caribou Ranch Open Space. It may be useful to incorporate some of this information as a management tool for any plans or actions taken by open space personnel.

In Appendix A, the characterization abstracts for each species documented by the CNHP are given. Each abstract gives information with respect to taxonomy, global and state distribution, habitat phenologies and management issues. These are intended to be a guide for basic information regarding these species.

Appendix B is in reference to the vegetation map that was completed for Caribou Ranch and presented with this report.

Appendix A
Characterization Abstracts

Plant Characterization Abstract

Lilium philadelphicum
Wood lily

Lilium philadelphicum

Taxonomy:
Class: Monocotyledoneae
Order: Liliales
Family: Liliaceae
Genus: *Lilium*

Taxonomic Comments: No subspecies or variants are listed for this species.

CNHP Ranking: G5S3

Distribution: Global range: Alberta to Ontario and Maine, south to Arkansas, North Carolina, West Virginia, New Mexico and Colorado. State range: Known from an elevational range of 2072 to 2987 m (6,800 to 9800 ft) in the northern, central and southern Rocky Mountains of Colorado and from the San Juan Mountains of southern Colorado. Reported from 18 Colorado counties: Archuleta, Boulder, Clear Creek, Custer, Douglas, El Paso, Gilpin, Gunnison, Hinsdale, Huerfano, Jefferson, La Plata, Larimer, Las Animas, Mineral, Park, Rio Grande, and Teller.

Habitat Comments: Occurs in moist woods and thickets along riparian areas. Viable in areas of open canopy which allow sufficient amounts of sunlight into the understory.

Phenology: A perennial plant with flowers most evident during June, July and August. Peak blooming period is during mid-July (Kettler *et al*. 1993). Large red-orange to brick-red lily flowers are unmistakable in identification.

Known Threats and Management Issues: Because this species is large and attractive, it may be vulnerable to over-collection, particularly in areas of high visibility, e.g., roadsides and trails (Weber 1976). Quality of riparian areas continues to be threatened by invasive exotic flora, and by increased canopy density.

Vertebrate Characterization Abstract

Oncorhynchus clarki stomias
Greenback cutthroat trout

Oncorhynchus clarki stomias

Taxonomy:
Class: Osteichthyes
Order: Salmoniformes
Family: Salmonidae
Genus: *Oncorhynchus*

Taxonomic Comments: The classification of *Oncorhynchus clarki* as a polytypic species and the declination of genetically pure populations due to extensive hybridization with introduced trout species has made it troublesome to unravel its taxonomic status (USFWS 1993).

CNHP Ranking: G4T2T3S2S3

Distribution: Although once abundant, the greenback cutthroat trout was extirpated from most of its natural range by the early 1900s. This subspecies is restricted to the South Platte and Arkansas drainages of Colorado. Reported from Boulder, Clear Creek, Costilla, Custer, Gilpin, Grand, Huerfano, Jackson, Larimer, Park, and Teller Counties.

Habitat Comments: Inhabits clear, swift-flowing, well-oxygenated mountain streams with cover such as overhanging banks and vegetation; juveniles tend to shelter in shallow backwaters. Also found in lakes (Matthews and Moseley 1990).

Phenology: Spawns in riffles in the springtime or early summer, depending on elevation. Spawns in water temperatures of 5-8°C (41-46°F), but this is variable depending on elevation and the age of the fish.

Food: Consumes invertebrates as the major part of its diet. Terrestrial invertebrates make up a large portion of their consumption during the warmer months through September, but this source decreases rapidly in October as temperatures decline. It is known to be an opportunistic feeder on a wide variety of organisms (USFWS 1993).

Known Threats and Management Issues: The decline in greenback cutthroat trout populations is largely due to land and water exploitation, mining, logging, and unregulated fishing. The principal factor of decline is the introduction of non-native salmonid species (USFWS 1993). The non-native trout negatively affect populations of the greenback through hybridization, resulting in populations with genetic impurities, or

by competition from brook and brown trout. Barriers to keep non-native game fish from invading greenback habitat are not considered a viable management option (Kehmeier, VanBuren and Bestgen *pers. comm*.). Barriers often fail and the cost of maintenance can be great. CDOW is studying the natural movements of stream fish populations, which barriers would inhibit (Kehmeier, VanBuren and Bestgen *pers. comm*.). Whirling disease in Colorado is widespread, however, not enough is known to formulate a workable management plan; CDOW only acknowledges preventing further spread of the disease at all costs (Kehmeier, VanBuren and Bestgen *pers. comm*.).

There is a proposed delisting of the greenback by the year 2000 should there be twenty stable populations occupying at least fifty hectares each. Efforts to increase the number of greenback populations throughout their range are underway to support delisting in the near future (Ryke *et al*. 1994). Optimum management should be at the watershed level, especially for the greenback, because it is influenced most by problems within the watershed. However, activities by local landowners can affect local and downstream habitat. Grazing is a controversial issue with recommendations ranging from complete exclosure in riparian areas to allowing grazing in riparian areas at certain times (Kehmeier, VanBuren and Bestgen *pers. comm*.). Buffer zones of 50 feet may be adequate for small plains streams; however buffer zone sizes would have to vary depending on landscape or management activities. Furthermore, buffers of 1000 feet may not be sufficient for high elevation, high gradient systems (Kehmeier, VanBuren and Bestgen *pers. comm*.). Smaller microhabitats within a reach can be source areas for recolonization of the entire reach. Absolute numbers are not the target goal and protecting breeding habitat should take precedence (Kehmeier, VanBuren and Bestgen *pers. comm*.).

Vertebrate Characterization Abstract

Plecotus townsendi
Townsend's big-eared bat

Plecotus townsendi
Photo by Jeremy Siemers

Taxonomy:
Class: Mammalia
Order: Chiroptera
Family: Vespertilionidae
Genus: *Corynorhinus*

Taxomonic Comments: Formerly known as *Corynorhinus rafinesquii*. Placed in the genus *Plecotus* by Handley (1959). Frost and Timm (1992) evaluated morphological and karyological characters from a phylogenetic perspective; they re-elevated the subgenus *Corynorhinus* to full genus status. The North American species *Plecotus mexicanus, P. rafinesquii,* and *P. townsendii* were moved from the genus *Plecotus* and again placed in the genus *Corynorhinus*. A morphological placement and phylogenetic analysis by Tumlison and Douglas (1992) also concluded that *mexicanus, rafinesquii,* and *townsendii* should be placed in the genus *Corynorhinus*.

CNHP Ranking: G4S2

Range: Most of range is in western North America, but there are small subspecies populations known from Kentucky, West Virginia and Virginia. This bat is not known from the North American Great Plains. In Colorado, it ranges mostly in the western two-thirds of the state, but does not occur in the eastern plains (Fitzgerald *et al*. 1994).

Habitat Comments: Townsend's big-eared bats are cave dwelling bats and have been found in a wide variety of habitats, from arid juniper-pine forests to high elevation, mixed-coniferous forests. In winter, large aggregations of bats roost communally in caves or abandoned mine tunnels. They have been known to use abandoned buildings. Occasionally individuals will roost in tree cavities (Ryke *et al*. 1994)

Phenology: These bats breed in late fall and winter while occupying their hibernacula. Females will store the sperm until spring (Fitzgerald *et al*. 1994). Gestation is from 50 to 60 days, with the birth of a single young occurring in May or June. Females will assemble nursery colonies with a few to several hundred individuals. The young develop rapidly, and are able to fly at about three to four weeks of age. Adult males are segregated from the females during this time, and will either inhabit the same cave or roost in separate sites. Males are usually solitary or may form small groups. During the

summer, individuals may hang exposed from the roof or walls of the chamber, and will take flight if they are disturbed.

Food: Caddisflies (Trichoptera) appear to make up the majority of the Townsend's big eared bat's diet (Fitzgerald *et al*. 1994). Their diet also includes flies, moths, and other insects. They forage mostly after dark, gleaning insects from leaves of plants occurring along watercourses and in sagebrush habitats.

Known Threats and Management Issues: These bats are very sensitive to disturbance. Human disturbance, even unintentional, will force bats to leave caves or mines where such disturbance occurs. Access should be restricted into caves and mines where they roost. The Bats In Mines project (Kirk Navo 719-587-6934) should be contacted for information and guidelines on grating mine entrances to protect from disturbance.

Community Characterization Abstract

Salix geyeriana-Salix monticola*/*Calamagrostis canadensis
Geyer willow-mountain willow/bluejoint reedgrass Deciduous Alluvial Shrubland

Alliance: *Salix geyeriana-Salix monticola*

Related Types/Synonyms: The *Salix monticola/Calamagrostis canadensis* (mountain willow/bluejoint reedgrass) plant association (Cooper and Cottrell 1990) contains several stands co-dominated by *Salix geyeriana* (Geyer willow) that can be considered synonymous with the Colorado *Salix geyeriana-Salix monticola/Calamagrostis canadensis* plant association.

Classification Problems: Without catkins (the flowering stalk), *Salix drummondiana* (Drummond willow) can be difficult to distinguish from the similar looking *Salix geyeriana* (Geyer willow). Both species are tall, greater than five feet (two meters), montane willows with strongly pruinose (a waxy covering that rubs off, similar to the coating on a plum) current-year twigs. The two species can be readily distinguished using only vegetative characters. *Salix geyeriana* (Geyer willow) leaves are never more than 0.5 inches (13 mm) wide and *Salix drummondiana* (Drummond willow) leaves are, on average, over 0.5 inches (13 mm) wide (on non-sucker shoots) (Welsh *et al*. 1987).

CNHP Ranking : G3S3

Rank Reasons: This association has been documented in only two locations, but is expected to occur in at least thirty to forty stands. It is highly threatened by improper livestock grazing, inappropriate stream flow alterations, and heavy recreational use.

Regional Distribution: This plant association occurs in Colorado (Osborn *et al.* 1998).

Distribution in Colorado: This association occurs on the western slope and on the Colorado Front Range (Cooper and Cottrel 1990, Osborn *et al.* 1998).

Habitat Comments: *Elevation Range*: 8200-9200 ft (2500-2800 m). *Site Geomorphology*: This plant association occurs on wide floodplains that are flat or hummocky and occurs within 2 feet (0.5 m) of the channel high water mark. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are narrow and highly sinuous (Rosgen's Channel Type: E4) or braided by beaver activity (Rosgen's Channel Type: D4). *Soils***:** Soils textures range from sandy loam to silty clay, with up to 50% organic matter in the upper layers. Water table depths range from 8-25 inches (20-60 cm).

General Description and Comments: The *Salix geyeriana-Salix monticola/Calamagrostis canadensis* (Geyer willow-mountain willow/bluejoint reedgrass) plant association is a tall (4-8 feet, 1.5-2.5 m), deciduous shrubland that occurs in small and large stands interspersed with wet meadows, open stream channels, and

beaver ponds. The willow canopy is nearly a homogeneous mix of the two willow species.

Closely related communities include: the *Salix geyeriana/Calamagrostis canadensis* community type (Hansen *et al.* 1995, Cooper and Cottrell 1990, Padgett *et al.* 1989, Youngblood *et al.* 1985). This community type does not have any *Salix monticola*, the *Salix geyeriana-Salix monticola/*mesic graminoid (Geyer willow-mountain willow/mesic graminoid) and the *Salix geyeriana-Salix monticola/Carex aquatilis* (Geyer willow-mountain willow/aquatic sedge) which may be similar, but detailed stand data is not available (Osborn *et al.* 1998).

Vegetation: The following information is based on a total of two quantitative plots from the South Platte River Basin (96LS02, 96GK12) (Osborn *et al.* 1998):

The shrub canopy is dominated by 20-25% cover of *Salix geyeriana* (Geyer willow) and 15-30% cover of *Salix monticola* (mountain willow). Other shrubs present include 5-15% cover of *Salix planifolia* (planeleaf willow), 0-10% cover each of *Salix drummondiana* (Drummond willow) and *Lonicera involucrata* (bush honeysuckle), and <1% cover of *Ribes inerme* (gooseberry). The undergrowth is patchy, but dominated by 30-50% cover of *Calamagrostis canadensis* (bluejoint reedgrass), and 0-15% cover each of *Carex aquatilis* (aquatic sedge) and *Geum macrophyllum* (largeleaf avens).

Successional and Ecological Processes: Stands dominated by *Salix geyeriana* (Geyer willow) appear to be stable, long-lived communities. *Salix geyeriana* is most stable where the water table does not drop below 3 feet (1 m) of the surface. It appears to be limited to cold, wet environments of broad valley bottoms at high elevations. Due to the colder environments, organic matter builds up in the soils and succession to other associations is likely to be slow (Padgett *et al.* 1989). Beaver activity is also important in maintaining this association since it may be the last successional community to establish on naturally silted-in beaver ponds (Cooper and Cottrel 1990).

Stands of *Carex utriculata* (beaked sedge)*, Carex aquatilis* (aquatic sedge)*,* and *Calamagrostis canadensis* (bluejoint reedgrass) are common undergrowth of several Salix plant associations. These three graminoids indicate different micro-environments, generally separating out along a moisture gradient related to the depth of the water table, and can represent different stages of succession of the floodplain (Cooper 1986).

Carex utriculata (beaked sedge) occurs on the wettest sites, such as shallow pond margins, low-lying swales, and overflow channel with the shallowest water tables. *Carex aquatilis* (aquatic sedge) occurs on intermediate sites that have saturated but not inundated soils. *Calamagrostis canadensis* (bluejoint reedgrass) dominates the drier sites with lower water tables. As wetter sites become drier, it can colonize stands of *Carex utriculata* (beaked sedge) and *Carex aquatilis* (aquatic sedge) (Cooper 1986).

Changes in the physical environment, brought on by flooding or other disturbance, can initiate successional shifts in species composition. Sediment deposition on the floodplain

raises the surface higher above the water table (Cooper 1986). As aggradation, or build up, of the floodplain proceeds, the site becomes drier and the dominant graminoid understory changes. Thus *Carex aquatilis* (aquatic sedge) dominated stands (regardless of any overstory canopy) may shift toward *Calamagrostis canadensis* (bluejoint reedgrass) dominated stands.

Adjacent Riparian Vegetation: This association can occupy an entire stream reach, but meadows of *Carex aquatilis* (aquatic sedge) or *Poa pratensis* (Kentucky bluegrass) may also occur nearby.

Adjacent Upland Vegetation: *Populus tremuloides* (quaking aspen), *Pinus contorta* (lodgepole pine), and *Pinus ponderosa* (ponderosa pine) forests occur on surrounding hillslopes.

Management: The management responses of this plant association are likely to be similar to other tall-willow shrublands dominated by *Salix geyeriana* (Geyer willow) or *Salix monticola* (mountain willow). The wet and often saturated soils of this plant association are vulnerable to compaction by livestock and heavy equipment. Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of willow root structure. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen *et al*. 1995).

Deferred and rest rotation grazing systems are recommended for maintaining the vigor and productivity of this plant association. Rest periods are recommended in order to provide time for plant establishment. Late summer and fall grazing is not recommended because willow species are vulnerable to pruning damage due to limited regeneration at the end of the growing season (Hansen *et al*. 1995).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Beaver dams abate channel downcutting, bank erosion, and downstream movement of sediment. Beaver dams raise the water across the floodplain and provide year-round saturated soils. Plant establishment and sediment build-up behind beaver dams raise the channel bed and create a wetland environment. Land managers should consider maintaining beaver activity rather than removing them (Hansen *et al*. 1995).

Prescribed burning is an effective method of rejuvenating decadent stands of willows. The willow species in this plant association vigorously sprout following quick, hot fires. Slow burning fires can actually damage the plants. *Calamagrostis canadensis* is an aggressive invader of moist, burned sites due to its propagation from seeds and rhizomes. Burning also temporarily increases the productivity of *Carex aquatilis* (aquatic sedge) and *Carex utriculata* (beaked sedge). Grazing should be eliminated from burned sites for 2-3 years following a fire in order to prevent livestock from browsing the young, palatable regrowth (Hansen *et al*. 1995).

Both *Salix geyeriana* (Geyer willow) and *Calamagrostis canadensis* (bluejoint reedgrass) are valuable for revegetating and stabilizing stream banks. *Calamagrostis canadensis* is valuable due to its propagation from rhizomes. *Salix geyeriana* can be grown from nursery cuttings and then transplanted. Cuttings should be taken in the spring from dormant, 2-4 year-old wood. Cuttings should be 12-20 inches (30-50 cm) long and at least 0.5 inches (1 cm) in diameter. Roots and shoots should appear 10-15 days after planting if conditions are optimal (Hansen *et al*. 1995).

Appendix B
Vegetation Mapping

Caribou Ranch

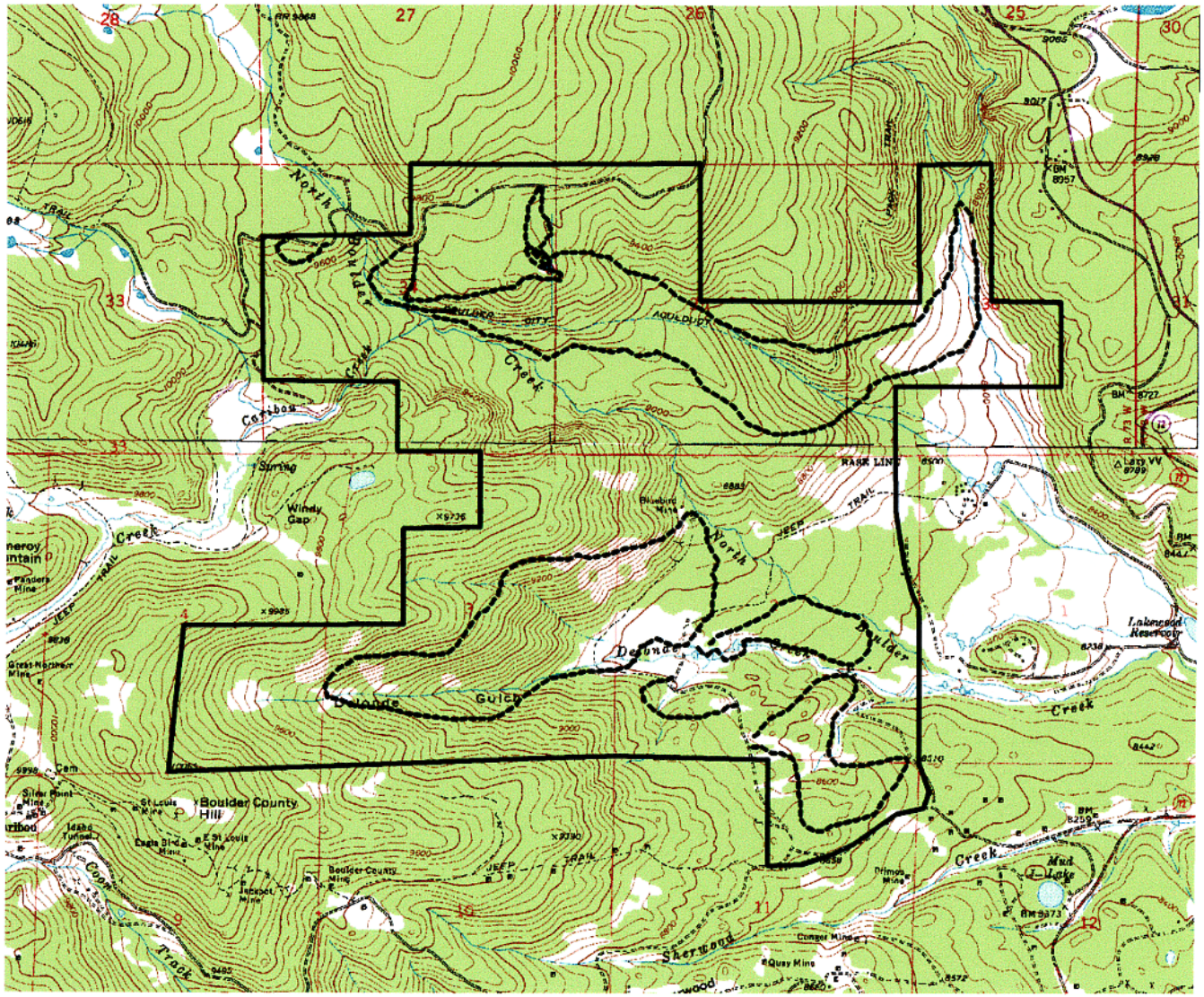

Figure 3. Survey Route for Vegetation Mapping

Vegetation and Non-Native Species Mapping

It should be noted that not all polygons were field verified. Boundaries for each polygon are approximate and are only drawn to the property boundary. Where possible, polygons are delineated around similar vegetation types, such as *Pinus ponderosa* or *Pinus contorta* alliances (alliances are similar to the series level of Forest Service classifications). Frequently different vegetation types occurred in a complex mosaic, such as *Pinus contorta* forests with small patches of *Populus tremuloides*. In those cases, the main vegetation types within the polygon are listed in the description but no effort was made to distinguish the different types on the aerial photograph. CNHP tracks many of the plant communities identified on the property but occurrences were considered either too small or too degraded to include in the CNHP databases. However, it is important to note that some of these occurrences, such as small old-growth patches, riparian areas, and wetlands (polygons 7, 8, 20, 26), may be of interest at a local scale.

Non-native species that are abundant or especially problematic are noted in the vegetation descriptions for the polygons delineated on the aerial photograph. Non-native hay grasses are the most abundant weeds on the property. *Bromus inermis*, *Bromus tectorum*, *Dactylis glomerata, Phleum pratense*, and *Poa pratensis* are common in many of the meadows on the properties. These species have also spread into shrublands and forests in certain places, but to a lesser extent than in the meadows. *Cirsium arvense* is common along Delonde Creek and in the *Pinus ponderosa* woodlands delineated as polygon 25, and is scattered in lesser abundance in other mesic places on the property. *Carduus nutans* is present over much of the property but rarely abundant. Ox-eye daisy (*Leucanthemum vulgare*) is very common along roads and trails, and in mesic meadows at lower elevations on the property. This species has some historical significance at the sight but if allowed to expand unchecked it may significantly impact native plant and animal species. It is doubtful that control efforts would ever completely remove the species from the site, which would leave some historical reference, but would also allow our native species to prosper.

Polygons Delineated on the Aerial Photograph (scale 1inch:350feet)

1 - *Pinus flexilis* occurs on steep, rocky areas on south facing slopes above the creek. Some small, openings contain *Festuca thurberi* grasslands.

2 - Large *Pinus contorta* trees occur in the bottom near the riparian area but *Abies lasiocarpa* and *Picea engelmannii* are beginning to dominate. Areas with beaver ponds support small wetland plant communities.

3 – This polygon was only observed from the south-facing slope above North Boulder Creek but appears to be mostly dominated by *Abies lasiocarpa* and *Picea engelmannii* mixed with *Populus tremuloides* stands.

4 - Upper North Boulder Creek supports a narrow band of *Abies lasiocarpa-Picea engelmannii*/*Salix drummondii* (G5/S4).

5 – This south-facing slope supports scattered, open *Pinus flexilis*/*Juniperus communis* (G5/S3) stands. Small stands of *Populus tremuloides* also occur.

6 – This polygon is mainly dominated by very dense *Pinus contorta* with a fairly sparse understory. *Carex geyeri* and *Vaccinium myrtillus* occur in the understory in some places. Small patches of *Populus tremuloides* are scattered throughout the polygon. There are some small patches of *Artemisia tridentata* in openings on steep slopes.

7 – Two small ponds are found in this polygon. These are probably kettle ponds formed by glacial activity. The ponds support typical montane wetland and mesic species such as *Carex utriculata*, *Carex aquatilis*, *Calamagrostis canadensis*, and *Deschampsia cespitosa*. There is little evidence of impact from livestock grazing around these ponds but there is evidence of logging in the adjacent forests. The hydrology seems to be intact. Because these occurrences are small and fairly common, they are not included in CNHP databases. These may be of local interest as kettle ponds are not common on the Colorado Front Range.

8 – This narrow drainage supports numerous small wetland and riparian plant communities. Common species include *Carex utriculata*, *Carex aquatilis*, *Calamagrostis canadensis*, and *Alnus incana*. These wetland and riparian communities are generally considered common in the Rocky Mountains. Some small areas have floating mats of wetland vegetation. Dense patches of *Phleum pratense* exist on drier areas in this drainage. As the stream gradient decreases, *Abies lasiocarpa* and *Picea engelmannii* occur along the stream with abundant mesic forbs.

9 – This slope has small patches of a *Pinus ponderosa*/*Muhlenbergia montana* (G5/S2S3) plant community. There is also some *Artemisia tridentata* on steep east facing slopes but *Phleum pratense* has invaded the stand.

10 – Dense stands of *Pinus contorta* and open stands of *Pinus ponderosa* occur within this area.

11 – This polygon includes an open meadow that has been invaded by numerous non-native species. *Phleum pratense*, *Dactylis glomerata*, *Bromus inermis*, and *Poa pratensis* are very common. The native species *Danthonia parryi* still occurs in the meadow in small patches. This meadow may once have been dominated by a *Danthonia parryi* (G2?/S2?) or *Muhlenbergia montana-Danthonia parryi* (G3G4/S2?) plant community. Restoration of this meadow may be difficult given the abundance of non-native species.

The narrow riparian area along the stream corridor is a mix of *Populus tremuloides, Alnus incana,* and *Salix drummondii*, with *Calamagrostis canadensis* and mesic forbs. Non-native species, common in the adjacent meadow have

invaded all but the wettest places. *Agrostis stolonifera* and *Cirsium arvense* also occur along an irrigation diversion from the stream.

12 – This open meadow was not field surveyed but would be expected to be similar to the meadow to the north that is invaded by numerous non-native species (polygon 11).

13 – This area is dominated by dense stands of *Pinus contorta*. *Carex geyeri*, *Vaccinium myrtillus*, and *Juniperus communis* occur in the sparse understory.

14 – This area is dominated by *Pinus contorta*, with *Abies lasiocarpa*, and *Picea engelmannii* beginning to dominate.

15 – The most common alliances or plant associations represented in this polygon are *Pinus ponderosa/Carex geyeri* (G4/S2S3), *Pinus contorta/Carex geyeri* (G5/S4), and the *Artemisia tridentata*, *Populus tremuloides*, and *Pinus flexilis* alliances. This south slope above Delonde Creek is a complex mixture of numerous plant communities and small patches of different species. Open, stunted *Populus tremuloides* and patches of nearly closed or closed *Pinus contorta* and *Pinus ponderosa* forests occur with *Carex geyeri* in the understory. Open rocky areas are often dominated by *Prunus virginiana.* Patches of *Pinus flexilis* and *Artemisia tridentata* also occur but are fairly small.

16 – *Artemisia tridentata* occurs in open areas on southeast facing slopes with *Prunus virginiana*, and *Rubus idaeus*. *Bromus tectorum* and *Verbascum thapsus* are common in this area. The distribution of *Artemisia tridentata* is partially dependent on winter moisture. This may be why the species is not common on the northern Colorado Front Range except at higher elevations where snowpack is higher.

17 - The dominant plant associations or alliances represented in this polygon are *Pinus contorta*/*Carex geyeri (*G5/S4), *Abies lasiocarpa*/*Carex geyeri (*G5/S2S3*)*, *Abies lasiocarpa*/*Vaccinium myrtillus* (G5/S5) and the *Populus tremuloides* alliance.

The area is mostly dominated by plant communities in the *Pinus contorta* alliance and spruce-fir (*Picea engelmannii-Abies lasiocarpa)* alliance. *Abies lasiocarpa* and *Picea engelmannii* are reproducing. The forest is very dense in most places with a sparse understory. Small patches of aspen (*Populus tremuloides)* occur within the coniferous forest. Ponderosa pine (*Pinus ponderosa)* and Douglas-fir (*Pseudotsuga menziesii)* occur as scattered individuals or in small patches. The narrow riparian area supports an *Abies lasiocarpa-Picea engelmannii*/*Salix drummondii* (G5/S4) plant community.

An old road occurs along Delonde Creek with some evidence of logging. The non-native species *Trifolium repens*, *Phleum pratense, Bromus inermis,* and *Bromus tectorum* occur in openings along the upper part of the drainage.

18 – Most of the meadow is dominated by non-native grass species. Common species include *Phleum pratense*, *Dactylis glomerata*, *Elytrigia intermedia*, *Poa pratensis*, *Bromus tectorum*, and *Bromus inermis*. *Cirsium arvense* is somewhat common near the riparian area as is *Leucanthemum vulgare* and *Trifolium pratense*. An irrigation ditch runs along the upper end (north side) of the meadow. Patches of *Populus tremuloides* and *Populus balsamifera* occur near the stream.

19 – This polygon is dominated by a mixture of *Pinus ponderosa*, *Pinus flexilis, Pinus contorta,* and *Populus tremuloides.*

20 – This riparian/wetland complex is formed where there are numerous beaver dams on the creek. A *Salix geyeriana*-*Salix monticola*/*Calamagrostis canadensis* (G3/S3) plant community dominates the wetland. A few other willows occur (*Salix bebbiana* and *Salix boothii),* and some areas have abundant *Carex utriculata*. Hay grasses from the adjacent meadow, and *Leucanthemum vulgare* have invaded all but the wettest parts of the willow carr. *Cirsium arvense* is also common in this area.

21 – This polygon along North Boulder Creek includes a narrow riparian area dominated by *Populus tremuloides*, *Alnus incana*, *Salix monticola,* and *Salix drummondii*.

22 – This relatively flat area is mostly dominated by dense stands of *Pinus contorta* with some scattered *Pinus ponderosa*. *Phleum pratense* and *Poa pratensis* are common.

23 – This area is mostly dominated by *Pinus contorta*, although it includes stands dominated by *Populus tremuloides* and *Pinus ponderosa*. *Pinus flexilis* also occurs in small patches.

24 – *Populus tremuloides* occurs along the small stream with *Bromus inermis* in the adjacent meadow.

25 – This area is dominated by *Pinus ponderosa* stands, some of which have been thinned recently. *Cirsium arvense* is common in this area.

26 - A small drainage north of Delonde Creek supports some small patches of old *Pinus ponderosa* trees in the upper reaches. Cut stumps are common, and scattered or patchy *Populus tremuloides* and *Acer glabrum* occur in the area. There are some young *Pinus ponderosa* and *Pseudotsuga menziesii* and few dead and down trees, indicating that this stand probably does not meet Forest Service old-growth definitions. None-the-less, the area may be of local interest.