Southeastern Colorado
Survey of Critical Biological Resources
2007

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May 2008

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EXECUTIVE SUMMARY

The biological diversity of the shortgrass prairies and juniper rimmed canyons of Southeast Colorado represent a vast and largely intact ecosystem that is not fully understood or documented. While the ranchers that make up the majority of landowners in the area understand much about the character and capabilities of the area, they too are limited in their knowledge of specifics regarding the full range of biological diversity on their lands. Their desire to better understand the natural heritage maintained on their lands, and in the region as a whole, served as the impetus for this study. It is with that objective in mind that the *Southeastern Colorado Survey of Critical Biological Resources 2007* was completed.

The Colorado Natural Heritage Program (CNHP) annually works to survey the critical biological resources of Colorado counties and other lands within the state, and this survey serves as a contribution to that effort. This *Southeastern Colorado Survey of Critical Biological Resources 2007* used the methods that are employed by Natural Heritage Programs and Conservation Data Centers worldwide. The intent of the project was to: 1) identify the location of high quality examples of plant and animal populations and plant communities on CNHP's list of rare and imperiled elements of biodiversity existing in the area; 2) to assess the conservation value of those Element Occurrences, and; 3) to systematically define and prioritize Potential Conservation Areas that may be used for effective conservation action.

Through a series of stakeholder meetings with private landowners, land managers, and other interested parties, we were able to establish a trust and a strong working relationship with a large number of landowners in the area. The meetings allowed us to meet landowners, discuss and receive permission for access to their lands, collect information from them on the biodiversity of their lands, and identify on maps high priority areas for survey. This and other existing data indicated a number of Target Inventory Areas that served to focus the field survey work completed over the summer of 2007.

Results of the survey confirm that there are many areas of high biological significance in Southeast Colorado. While the areas surveyed in summer 2007 represent only a portion of the area and not all the possible taxa, the work completed there yielded a large number of Element Occurrences (EOs). For example, a typical county level field survey will yield approximately 70 to 80 Element Occurrence Records (EORs) for plants, animals, and natural communities. Of those, about one third are typically new and two thirds are typically updates of existing EORs. In contrast, the Southeast Colorado Survey (this project) yielded 150 EORs, 131 of which were new and 19 were updates. The actual number of mapped locations, which represent the number of places we visited and documented a species or community observation, totaled 341, of which 236 were new.

Overall, the condition of the biological resources in the study area is excellent, and current management appears compatible with biological diversity in most places. This area harbors the largest intact working landscape remaining not only on Colorado's eastern plains, but also in the entire Central Shortgrass Prairie ecoregion. The Shortgrass Prairie Partnership (Neely et al.

2006) has identified this area as having high landscape integrity and very high conservation value – a testament to the quality of management by the landowners in this area.

Potential Conservation Areas (PCAs) were delineated for field surveyed areas found to contain significant elements. There are a total of 34 Potential Conservation Areas within or overlapping the Southeast Colorado project area. Of those 34 PCAs, 21 are either new or have been updated based on the 2007 field work and are highlighted in this report. Of the 21 highlighted here, 13 are new and were based entirely on the 2007 inventory work, while another 8 were preexisting and were updated with data from the 2007 work. While all 34 of the PCAs in the project area are listed in this report, only the 21 that are new or updated have been highlighted. Additional information is needed to evaluate and revise the other PCAs listed. Of the 21 PCAs highlighted in the report:

- Nine are of very high biodiversity significance (B2),
- Eight are of high biodiversity significance (B3),
- One is of moderate biodiversity significance (B4), and
- Three are of general biodiversity significance (B5).

These PCAs represent the best examples of targeted species and plant communities and their ecological processes observed on the private and public lands visited. *The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of all activity.* All of the PCAs presented in this report represent unique opportunities for Southeast Colorado and its Stakeholders to conserve significant components of the natural heritage of Southeast Colorado, and each is worthy of conservation attention.

As the Shortgrass Prairie Partnership (Neely et al. 2006) has identified, this area harbors the largest intact working landscape remaining not only on Colorado's eastern plains, but also in the entire Central Shortgrass Prairie ecoregion. This is attested to by the excellent condition of the biological resources in the study area, indicating that current management is compatible with biological diversity in most places.

The canyon communities are unique in the CSP ecoregion, and are in excellent condition compared to similar canyon systems elsewhere in Colorado. They are generally intact in terms of condition and function, based on the presence of indicators such as the plains leopard frog. Though many of the canyon communities are in excellent condition, there are some areas where altering the management approach could alleviate adverse impacts from current or past land use. Some streams have bullfrogs that compete with, and predate on, native amphibians. Many of the canyons get very little, if any, grazing during growing season, and only light grazing in the winter. Some of the smaller side-tributaries do not get grazed at all due to the difficulty of access for cattle. Side canyons that are not grazed are in very pristine condition. In general, side slopes in the canyons are in excellent condition, due largely to the fact cattle tend to stay in the bottoms of the canyons, and tend to not go upslope.

In areas where the predominant land use is cattle grazing, juniper zones are often intensely managed to increase forage production. Within the study area, chaining, bulldozing, herbicides, and burning have been used to reduce juniper density and improve conditions for cattle. The soil disturbance that results from chaining allows for proliferation of weeds such as cheatgrass, whose seeds germinate earlier and have a competitive advantage over native species. Even so, much of the remaining juniper woodland and savanna systems appear to be in good condition in most areas. In places where control of junipers is unavoidable or desirable (e.g., where junipers are encroaching into adjacent grasslands), controlled burns that mimic the natural fire regime are preferable to use of herbicides or the more destructive methods of chaining or bulldozing.

The condition and species composition of grasslands and shrublands is highly variable across the study site. Differences are likely due to variations in soils and grazing management. Areas that have previously been tilled are still showing altered species composition. Many of these areas have significantly reduced cover of blue grama. The grassland and shrubland communities in the study area support many conservation targets, including a suite of declining prairie birds, swift fox, spadefoot toads that inhabit small pools and basins, massasauga rattlesnake, and Texas horned lizard. Though shortgrass prairie is the dominant grassland system, the landscape also supports exemplary patches of midgrass prairie species such as New Mexico feathergrass (*Hesperostipa neomexicana*). One of the factors that makes this area so phenomenal, and so unique in Colorado, is the fact that the landscape still supports a mosaic of ecological systems, with large, very high quality patches of rare communities such as the New Mexico feathergrass occurring where conditions are suitable.

There are many ways to think about conservation of biological diversity. Conservation strategies can include legal land protection (e.g., easements, long-term leases, fee simple acquisition, purchase of specific land use rights) and compatible land management, as well as public education and research. Any or all of these strategies may be employed to protect habitat and to alleviate threats, and may be focused on conserving specific local populations or on making large-scale, strategic contributions to species recovery overall. A comprehensive approach to biodiversity conservation would employ all of these approaches.

The first step in facilitating conservation of biological resources is to identify the significant elements of biodiversity and their locations within the study area. This report provides the information necessary for this first step. The next step is to use this information to conserve these elements and the areas that support them. The PCA descriptions within this report provide protection and management suggestions for most areas identified during the inventory. In addition, some general recommendations for conservation of biological diversity in Southeast Colorado are given here. The strategies suggested in the document are offered as a suite of potential conservation actions that could be implemented by single landowners, or by groups of landowners working in coordination, as the needs and desires of each landowner allow.

It is our hope and intention that the data contained in this report will be valuable to ensuring the lasting conservation of the species and natural communities that comprise the rich biological diversity of this important area.

ACKNOWLEDGEMENTS

The Colorado Natural Heritage Program would like to acknowledge and sincerely thank the following individuals and organizations for their assistance in completing this project.

This project would not have been so successful without the help of many dedicated individuals. Thanks to Chris West and Carolyn Aspelin of Colorado Cattleman's Agricultural Land Trust for sponsoring the project and bringing together the community of private landowners from the project area. Steve and Joy Wooten of Beaty Canyon Ranch were wonderful partners to work with and without whose help we would not have been as successful as we were. They provided countless hours of assistance with organizing stakeholder meetings, arranging landowner contacts, and sharing firsthand knowledge of the land and its biodiversity. Special thanks are due to Jerry Wenger and Corwin Brown for there assistance with work on the JE Canyon Ranch and to all the ranch families that provided accommodations and other material support to the effort, including Beaty Canyon Ranch, Edgar Ranch, JE Canyon Ranch, Last Chance Ranch, Rancho Largo, R.C. Patterson Ranch, and River Canyon Ranch. Additional thanks go to all of the landowners of Southeastern Colorado who participated in the survey, allowed us access to their land, and assisted us in making the most efficient use of our time while there.

Great thanks go to The Colorado Natural Heritage Program staff and work-studies that assisted with this project including Kelsey Forrest, Joanna Griego, Aaron Kilgore, Doug Clark, Adam Anderson, Renée Rondeau, Jodie Bell, Jill Handwerk, Jeremy Seimers, Rob Schorr Fagan Johnson, Melissa Landon, Pam Smith, Elin Franzen, and Mary Olivas. Thanks are also due to Dina Clark, of the Denver Botanical Gardens, whose donation of time and exceptional botanical and historical expertise legitimized and brightened the botanical field survey work.

We are pleased to sincerely thank the people of the State of Colorado and the Board of the Great Outdoors Colorado Trust Fund for funding this project through a generous planning grant. Additional sincere thanks are due to the Colorado Division of Wildlife for the Colorado Wildlife Conservation Strategy grant they provided and to The Nature Conservancy for the financial and biological support they provided.

Colorado Cattlemen's Agricultural Land Trust

Great Outdoors Colorado

Colorado Division of Wildlife

The Nature Conservancy
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INTRODUCTION

The shortgrass prairie and juniper rimmed canyons of Southeast Colorado represent a vast and largely intact ecosystem. While the suite of plants, animals, and natural plant communities that exist there are known generally, specifics about their numbers and the full diversity of species present there is not fully known. The ranchers that make up the majority of landowners in the area understand much about the character and capabilities of the area, but they too are limited in their knowledge of specifics regarding the biological diversity of their lands and the region as a whole. Their desire to better understand the natural heritage maintained on their lands, and in the region as a whole, served as the impetus for this study. It is with that objective in mind that the *Southeastern Colorado Survey of Critical Biological Resources 2007* was completed.

The Colorado Natural Heritage Program (CNHP) annually works to survey the critical biological resources of Colorado counties, and this survey serves as a contribution to that effort. To date, similar inventories have been conducted on a county-wide basis in all or parts of 33 Colorado counties. In early 2007, The Colorado Cattleman's Agricultural Land Trust (CCALT) contracted with Colorado State University (CSU) and CNHP to conduct a biological survey of private ranch lands in southeastern Colorado. This survey differs from the typical county based survey only in that the county limits are not the project area boundary, but rather the project area boundary was defined by a pending proposal to expand the existing Pinyon Canyon Maneuver Site. Similar to our county based surveys, we hope that identification of sites containing natural heritage resources will allow land managers and land owners proactively to avoid conflicts between current land use objectives and the conservation of natural heritage resources for future generations.

This *Southeastern Colorado Survey of Critical Biological Resources 2007* used the methods that are employed by Natural Heritage Programs and Conservation Data Centers worldwide. The primary focus was to identify locations of the plant and animal populations and plant communities on CNHP's list of rare and imperiled elements of biodiversity, to assess their conservation value, and to systematically prioritize these for conservation action.

The locations of biologically significant areas were identified by:

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

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

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

CNHP uses the Heritage Ranking Methodology to prioritize conservation actions by identifying those areas that have the greatest chance of conservation success for the most imperiled elements. The sites are prioritized according to their **biodiversity significance rank**, or “B-rank,” which ranges from B1 (outstanding significance) to B5 (general or statewide significance). These ranks are based on the conservation ranks (imperilment or rarity) for each element and the element occurrence ranks (viability rank) for that particular location. Therefore, the highest quality occurrences (those with the greatest likelihood of long-term survival) of the most imperiled elements are the highest priority (receive the highest B-rank). See the section on Natural Heritage Ranking System for more details. The B2-B3 sites are the highest priorities for conservation actions (due to limited resources, the B2-B3 PCAs are highlighted in the report). Based on current knowledge, the sites in this report represent areas CNHP recommends for protection in order to preserve the natural heritage of Southeast Colorado. In addition to presenting prioritized PCAs, this report also includes a section with summaries of selected plants and animals that are known to be found within the PCAs.

THE NATURAL HERITAGE NETWORK RANKING SYSTEM

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

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

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

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

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

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

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

What is Biological Diversity?

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

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

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

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

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

Landscape Diversity — the type, condition, pattern, and connectedness of natural communities. A landscape consisting of a mosaic of natural communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through short grass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region.

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

Colorado Natural Heritage Program

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

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

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

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

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

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

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

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

The Natural Heritage Ranking System

Key to the functioning of Natural Heritage Programs is the concept of setting priorities for gathering information and conducting inventories. The number of possible facts and observations that can be gathered about the natural world is essentially limitless. The financial and human resources available to gather such information are not. Because biological inventories tend to be under-funded, there is a premium on devising systems that are both effective in providing information that meets users' needs and efficient in gathering that information. The cornerstone of Natural Heritage inventories is the use of a ranking system to achieve these twin objectives of effectiveness and efficiency.

Ranking species and ecological communities according to their imperilment status provides guidance for where Natural Heritage Programs should focus their information-gathering activities. For species deemed secure, only general information needs to be maintained by Natural Heritage Programs. Fortunately, the more common and secure species constitute the majority of most groups of organisms. On the other hand, for those species that are by their

nature rare, more detailed information is needed. Because of these species' rarity, gathering comprehensive and detailed population data can be less daunting than gathering similarly comprehensive information on more abundant species.
To determine the status of species within Colorado, CNHP gathers information on plants, animals, and plant communities. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats, and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than five current locations in Colorado, is ranked G5 S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3 S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1 S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 1.

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

Table 1. Definition of Natural Heritage Imperilment Ranks.

G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
G/S4	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
G/SX	Presumed extinct globally, or extirpated within the state.
G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but usually not verified for an extended period of time.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not residents.
S#N	Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ	Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SA	Accidental in the state.
SR	Reported to occur in the state but unverified.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

Legal Designations for Rare Species

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

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

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

Element Occurrences and their Ranking

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

- **Size** – a measure of the area or abundance of the element's occurrence. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation, and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance). This factor for an occurrence is evaluated relative to other known, and/or presumed viable, examples.
- **Condition/Quality** – an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory, and ground cover in a forest community), and biotic interactions (such as levels of competition, predation, and disease).
- **Landscape Context** – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent rank and D representing a poor rank. These ranks for each factor are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table 3.

Table 3. Element Occurrence Ranks and their Definitions.

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

Potential Conservation Areas

In order to successfully protect populations or occurrences, it is helpful to delineate Potential Conservation Areas (PCAs). These PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. Potential Conservation Areas may include a single occurrence of a rare element, or a suite of rare element occurrences or significant features.

The PCA is designed to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features; vegetative cover; and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- Ecological processes necessary to maintain or improve existing conditions;
- Species movement and migration corridors;
- Maintenance of surface water quality within the PCA and the surrounding watershed;
- Maintenance of the hydrologic integrity of the groundwater;
- Land intended to buffer the PCA against future changes in the use of surrounding lands;
- Exclusion or control of invasive exotic species;
- Land necessary for management or monitoring activities.

The boundaries presented are meant to be used for conservation planning purposes and have no legal status. The proposed boundary does not automatically recommend exclusion of all activity. Rather, the boundaries designate ecologically significant areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA affect the natural heritage resources and sensitive species on which the PCA is based. Please note that these boundaries are based on our best estimate of the primary area supporting the long-term survival of targeted species and plant communities. A thorough analysis of the human context and potential stresses has not been conducted. However, CNHP's conservation planning staff is available to assist with these types of analyses where conservation priority and local interest warrant additional research.

Off-Site Considerations

Frequently, all necessary ecological processes cannot be contained within a PCA of reasonable size. For example, taken to the extreme, the threat of ozone depletion could expand every PCA to include the entire planet. The boundaries described in this report indicate the immediate, and therefore most important, area to be considered for protection. Continued landscape level conservation efforts that may extend far beyond PCA boundaries are necessary as well. This will involve regional efforts in addition to coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Potential Conservation Areas

CNHP uses element and element occurrence ranks to assess the overall biological diversity significance of a PCA, which may include one or many element occurrences. Based on these ranks, each PCA is assigned a biological diversity rank (or B-rank). See Table 4 for a summary of these B-ranks.

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

B1	Outstanding Significance (indispensable): -Only known occurrence of an element -A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence) -Concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)
B2	Very High Significance: -B- or C-ranked occurrence of a G1 element -A- or B-ranked occurrence of a G2 element -One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element. -Concentration of A- or B-ranked G3 elements (four or more) -Concentration of C-ranked G2 elements (four or more)
B3	High Significance: -C-ranked occurrence of a G2 element -A- or B-ranked occurrence of a G3 element -D-ranked occurrence of a G1 element (if best available occurrence) -Up to five of the best occurrences of a G4 or G5 community (at least A- or B-ranked) in an ecoregion (requires consultation with other experts)
B4	Moderate Significance: -Other A- or B-ranked occurrences of a G4 or G5 community -C-ranked occurrence of a G3 element -A- or B-ranked occurrence of a G4 or G5 S1 species (or at least C-ranked if it is the only state, provincial, national, or ecoregional occurrence) -Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more) -D-ranked occurrence of a G2 element -At least C-ranked occurrence of a disjunct G4 or G5 element -Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more)
B5	General or State-wide Biological Diversity Significance: -good or marginal occurrence of common community types and globally secure S1 or S2 species.

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occur. In most cases, this rank refers to the need for a major change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table 5 summarizes the P-ranks and their definitions.

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

P1	Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.
P2	Protection actions may be needed within 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA within this approximate timeframe.
P3	Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA if protection action is not taken.
P4	No protection actions are needed in the foreseeable future.
P5	Land protection is complete and no protection actions are needed.

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

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;
- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

Management Urgency Ranks

Management urgency ranks (M-ranks) indicate the timeframe in which it is recommended that a change occur in management of the PCA. This rank refers to the need for management in contrast to protection (for example, increased fire frequency, decreased grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, re-routing trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. Table 6 summarizes M-ranks and their definitions.

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

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

PROJECT BACKGROUND

Location of the Study Area

The study area is a 2,052,474 acre tract of land surrounding the Pinyon Canyon Maneuver Site in southeastern Colorado (Figure 1). Located primarily in Las Animas and Otero Counties, and including small portions of Pueblo and Bent Counties, the area extends some 60 miles north from the Colorado-New Mexico border and about 65 miles east from the Las Animas/Huerfano county boundary. The most striking landforms of the area are the highlands of Raton Mesa and Mesa de Maya, and the canyons of the principal rivers. The drainage of the Purgatoire River and its associated tributaries bisects the area from southwest to northeast, as it descends from its headwaters above Trinidad towards its eventual junction with the Arkansas River. The Apishapa River crosses the northwest corner of the study area in a course roughly parallel to the Purgatoire some 20-30 miles to the northwest. Between these two rivers, Timpas Creek also drains to the Arkansas. Chacuaco Creek and Smith Canyon Creek run north from the Mesa de Maya to the Purgatoire through well developed canyons.

Elevations in the area generally decrease from southwest to northeast, as the terrain descends from the heights of Raton Mesa and Mesa de Maya on the southern edge and the foothills of the Sangre de Cristos and Spanish Peaks to the west. Elevations range from a high of 8,770 ft (2,673 m) on Raton Mesa at the southwest corner to a low of 4,087 ft. (1,246 m) in the canyon of the Purgatoire at the northeast boundary.

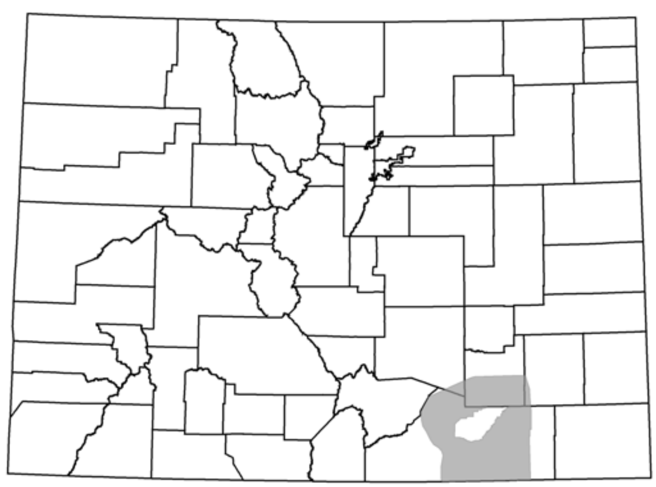


Figure 1. Location of Southeast Colorado Project Area.

Ecoregions

With the exception of a small area in the extreme southwest corner, the study area is entirely contained within the Central Shortgrass Prairie ecoregion as defined by The Nature Conservancy (TNC 2000, modified from Bailey 1998). The Raton Mesa area belongs to the Southern Rocky

Mountain ecoregion (Figure 2). The Central Shortgrass Prairie encompasses approximately 55.7 million acres in the western Great Plains, and includes eastern Colorado, portions of southeastern Wyoming, western Kansas and Nebraska, the panhandles of Oklahoma and Texas, and northeastern New Mexico. The ecoregion is characterized by rolling plains and tablelands, dissected by streams, canyons, badlands, and buttes. Depending on the physiography, these are dominated by shortgrass prairie, mixed grass prairie, riparian woodlands and shrublands, and juniper woodlands (Neely et al. 2006). The Southern Rocky Mountain ecoregion includes the north-south trending mountain ranges with their intervening valleys and parks from southern Wyoming to northern New Mexico, and, in Colorado, more westerly mountain ranges and high plateaus. The major ecological zones are alpine, subalpine, upper montane, lower montane and foothill (Neely et al. 2001).

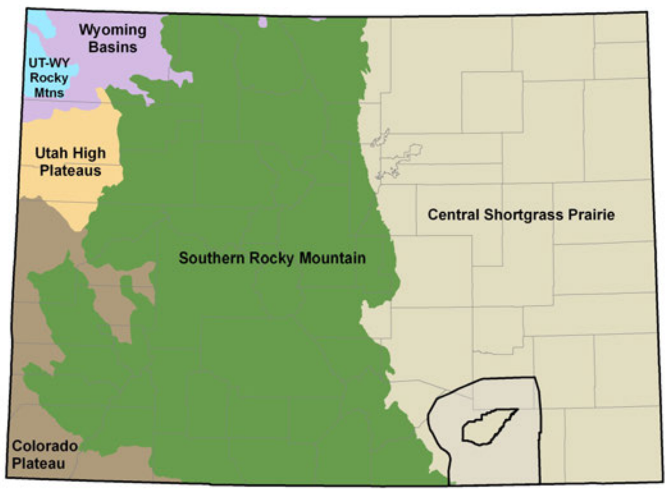


Figure 2. Colorado Ecoregions.

Hydrology

The study area is located in the Arkansas River Basin, and is drained by the Apishapa River, the Purgatoire River, the Timpas Creek, and the Cimarron River Headwaters watersheds (Figure 3). With the exception of the Cimarron River Headwaters, these tributaries join the Arkansas River in Colorado. The Purgatoire and Apishapa Rivers are the principal perennial streams of the area; other streams with perennial flow in some stretches in the study area include Timpas, San Isidro, Trinchera, Chacuaco, Smith Canyon, and West Carrizo Creeks.

The earliest water rights appropriations in the area date from the 1860's and 1870's (CDWR 2008). Hydrological modification of the Purgatoire and Apishapa Rivers is largely confined to areas upstream of the study area; there are no dams on the main stem of either river within the study area. Flows in the Purgatoire River are regulated in part by the operation of Trinidad Reservoir, constructed in 1977 as an irrigation and flood control project, and located west of the study area. Ditching and several small reservoirs on the western edge of the study area (Model, Seven Lakes, Gyuman) provide irrigation storage for nearby agriculture, which is the largest consumer of water in the study area. Smaller water developments, especially on 1st order streams throughout the area, provide water for livestock.

Flows on the Purgatoire River near the center of the study area are highest from April to August, and average about 105 cfs during that period. During the remainder of the year, flows average about 34 cfs. Peak flow was estimated at over 100,000 cfs on the Purgatoire near Highway 109 during the flood of June 14-20, 1965. A low of 0 cfs was recorded during the severe drought year in August of 2002 (USGS National Water Information System 2008).

Alluvial aquifers in the study area are largely absent, occurring to the north of the area where they are associated with the Arkansas River and the lowest reaches of its major tributaries. The study area is underlain by the Dakota-Cheyenne aquifer, formed in the sedimentary rocks of the Dakota Sandstone/Dakota Group and the underlying Cheyenne Sandstone Member of the Purgatoire Formation (Topper et al. 2003). This aquifer provides water for livestock and domestic use throughout the area, where surface water is scarce (Topper et al. 2003).

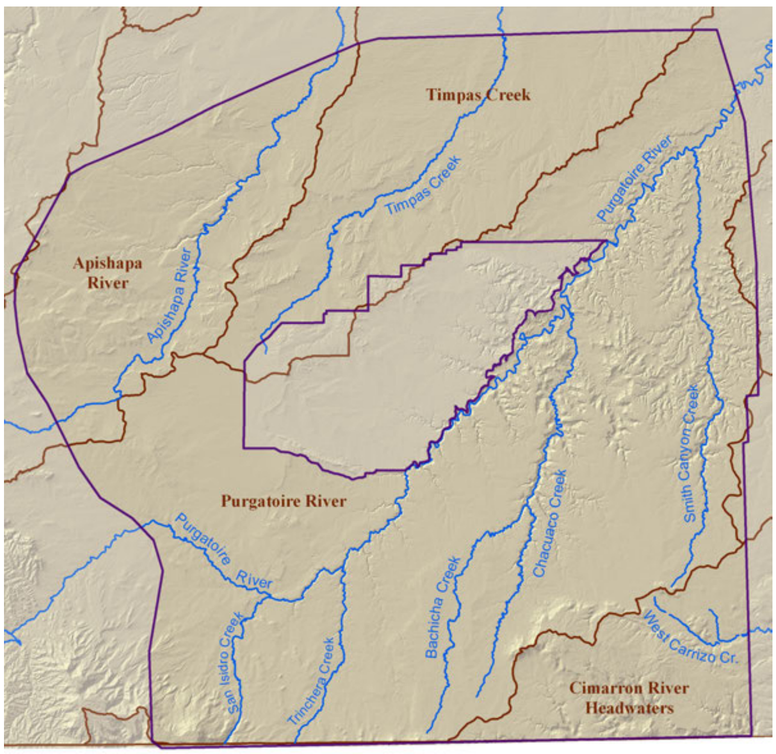


Figure 3. Watersheds in Southeast Colorado Project Area.

Climate

The climate of the study area is semi-arid, with generally low relative humidity, abundant sunshine, light rainfall, and a wide daily temperature range (NOAA 1985). Estimated annual precipitation totals are fairly uniform across much of the area, decreasing gradually from southwest to northeast, with the highest amounts received on the Raton Mesa (Figure 4). For the period of record (1978-1993) at the Timpas station, average annual precipitation was 14.89 inches, while Branson recorded a similar average of 15.1 inches for the period 1948-1974. About half of the yearly precipitation is received during the months of May through August, largely from thunderstorm activity (WRCC 2008). Winter average minimum temperatures are in the range of 16-20 ºF, but the area averages 5-10 days below 0 ºF each year. Summer average maximum temperatures in July and August are near or above 90 ºF, with an extreme high of 107 ºF recorded at Timpas in May 1990 (WRCC 2008).

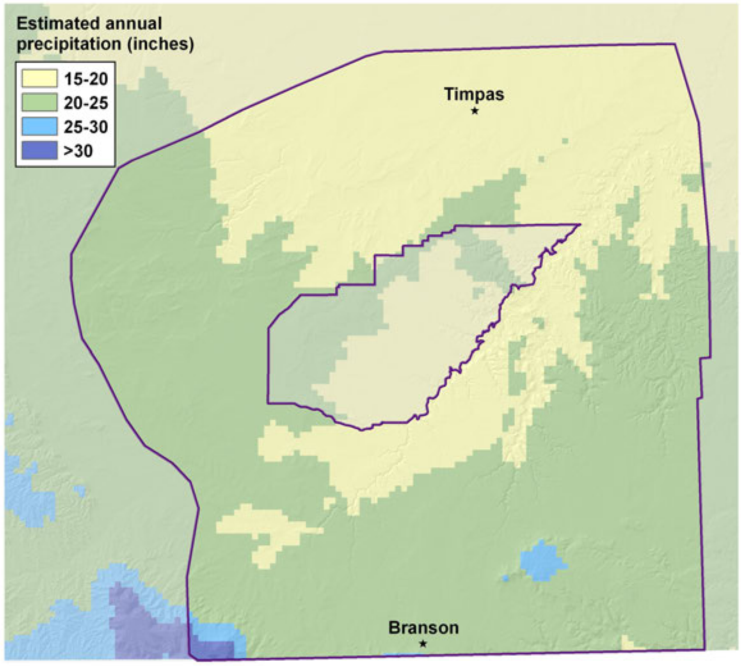


Figure 4. Annual Precipitation in Southeast Colorado Project Area.

Geology

Over most of the study area, the Arkansas River tributaries have excavated considerable amounts of the Tertiary piedmont deposits and exposed Cretaceous marine rocks from Cañon City to the Kansas and New Mexico borders (Trimble 1980). Geology of the study area (Figure 5) has been mapped at a scale of 1:250,000 by Scott (1968) and Johnson (1969). The oldest strata (of Permian and Triassic age) are exposed in the canyon of the Purgatoire, near its junction with the Chacuaco Creek drainage, and on the southern slope of the Mesa de Maya where substrates are found. Jurassic strata of the Morrison formation are above these, and include the extensive Picketwire Canyonlands dinosaur trackway exposed on USDA Forest Service lands in the drainage of the Purgatoire. Canyon walls of the Apishapa, Purgatoire and their tributaries are largely formed in the oldest of the Cretaceous layers present in the area: members of the Purgatoire Formation, topped by Dakota sandstone. With increasing distance from the canyon, younger Cretaceous layers of the Carlile Shale, Greenhorn Limestone and Graneros Shale cover extensive areas. These in turn are overlain in the western and northern portions of the study area by breaks and hills of gray shale and limestone belonging to the Niobrara Formation. Quaternary deposits of alluvium and sand obscure the Niobrara in the northern portion of the area. At the southern corners of the area, basalts of Tertiary age form Raton Mesa and Mesa de Maya as they intrude through the Cretaceous layers.

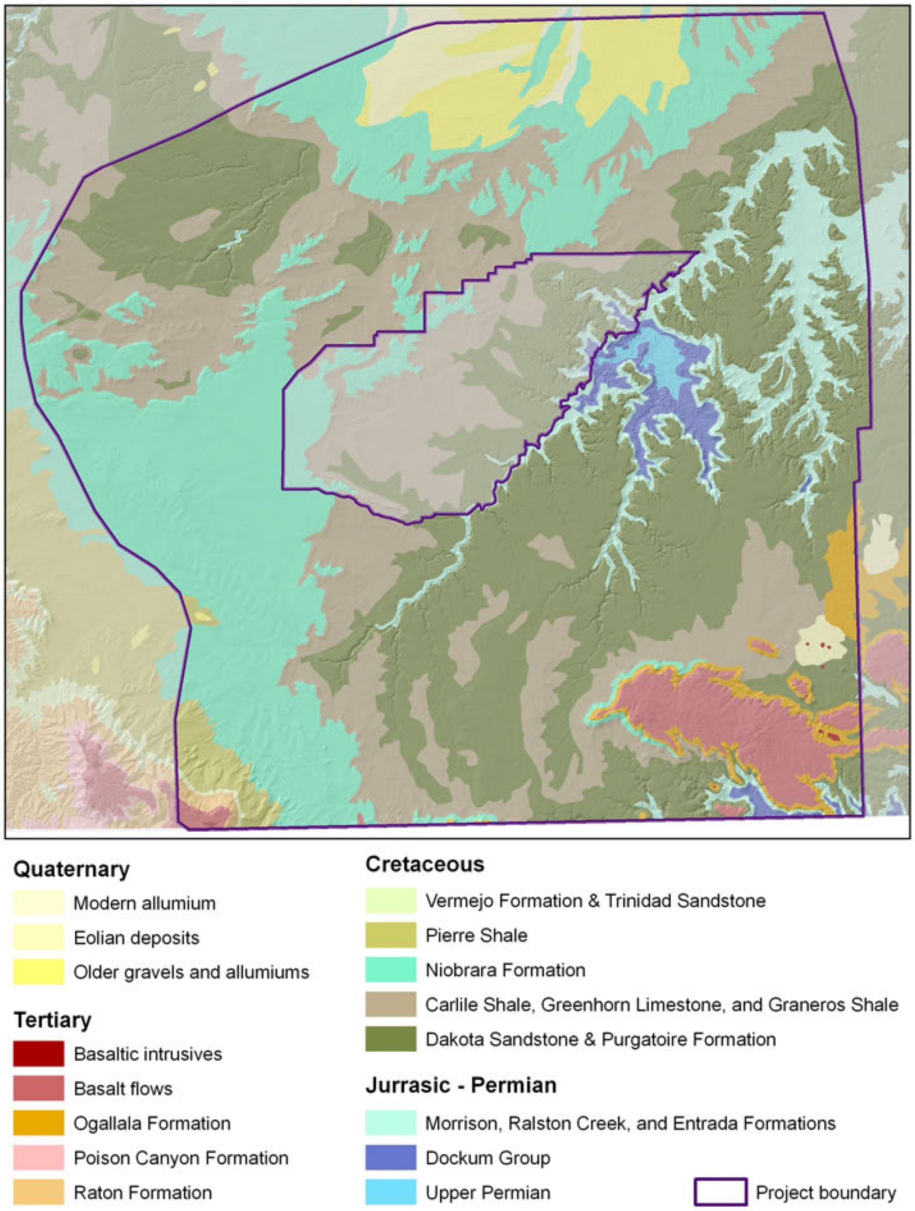


Figure 5. Geology of Southeast Colorado Project Area.

Population and Land Ownership

Populations in the two primary counties within the study area show opposite trends. Las Animas County had a 2006 estimated population of 15,564 with a growth rate of 2.3%, while Otero County's 2006 estimated population was 19,452, and was declining by 4.2%. The study area itself is sparsely populated: Branson, with a 2000 census population of 77, is the only incorporated town. The town of Kim, just outside the eastern boundary of the area, had a 2000 census population of 65. About 80% of the land in the study area is privately owned (Figure 6). Of this, around 3% is currently under conservation easement (Wilcox et al. 2007). U.S. Forest

Service lands of the Cimarron National Grasslands and Colorado State Landboard holdings account for nearly 10% each of the study area. Small Bureau of Land Management parcels and Apishapa State Wildlife Area (Colorado Division of Wildlife) total less than 1% of the area.

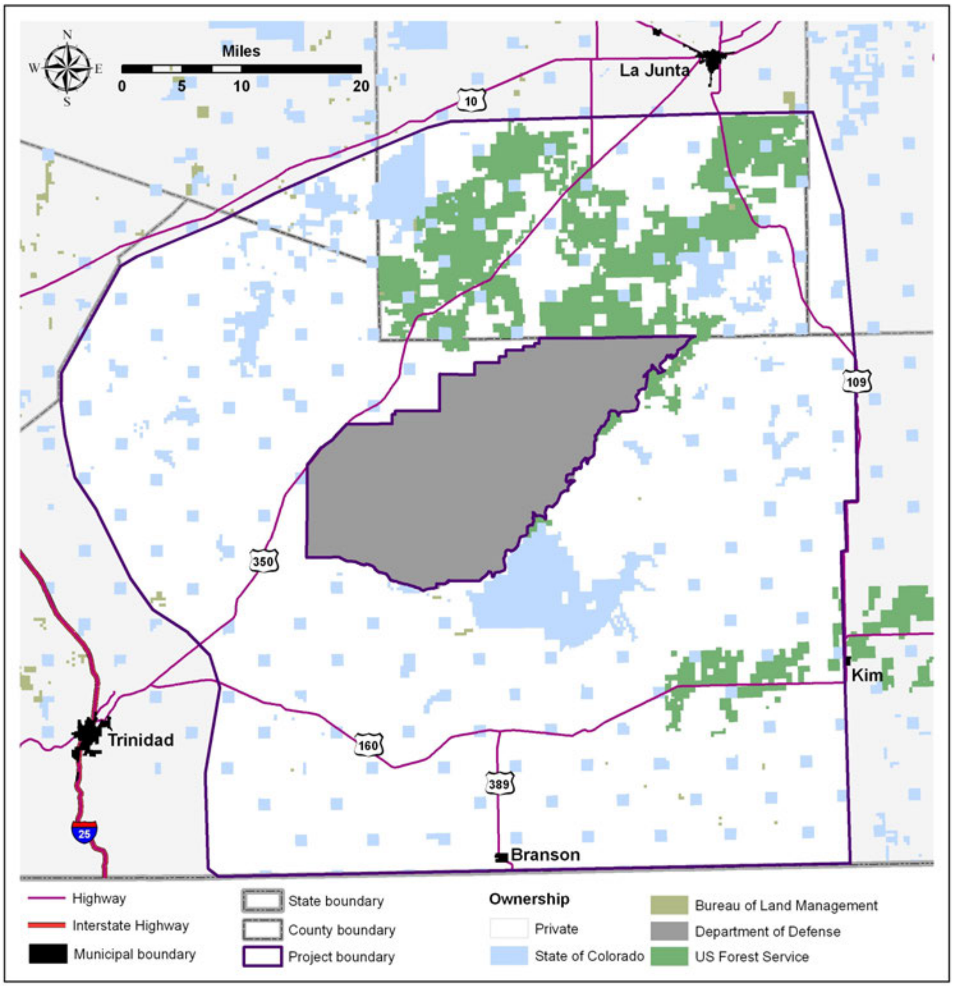


Figure 6. Land Ownership in Southeast Colorado.

Land Use

The lands south of the Arkansas River, including the area covered by this study, first became part of the United States of America as a consequence of the Mexican-American War in 1848. Originally part of the Territory of New Mexico, in 1861 the area was incorporated into the newly created Colorado Territory as part of Huerfano County. Las Animas County was separated from Huerfano in 1866, and Colorado achieved statehood ten years later. Early travel in the area was via the Mountain Branch of the Santa Fe Trail, which paralleled the Purgatoire River from its junction with the Arkansas south towards Raton Pass (Friedman 1985). With the advent of homesteading in the area, sheep and cattle ranching became the primary economic activity in the area. Although many of the early settlers raised both sheep and cattle on small tracts, this gradually evolved into large-scale cattle ranching on consolidated ranches (Friedman 1985).

Livestock production remains the primary economic land use in the area, along with a minimal amount of crop or forage production. The area is immediately adjacent to the Pinyon Canyon Maneuver Site. To date energy development in the study area has been minimal; oil and gas production is prominent to the west, while several wind energy facilities have been constructed to the east. The area has been identified as a potential solar power generation development area by the Task Force on Renewable Resource Generation Development Areas (Renewable Resource Generation Development Areas Task Force. 2007). US Forest Service lands of the Comanche National Grassland are available for recreational use.

Ecological Systems

Ecological systems are dynamic assemblages or complexes of plant and/or animal communities that 1) occur together on the landscape; 2) are tied together by similar ecological processes, underlying abiotic environmental factors or gradients; and 3) form a readily identifiable unit on the ground (Comer et al. 2003). An ecological system is characterized as belonging to one of four types: matrix-forming, large patch, small patch, or linear (Anderson et al. 1999). The type to which a system belongs may differ across its range. Matrix-forming systems are dominant over extensive areas, occur under a broad range of environmental conditions, and are important habitats for wide-ranging fauna. Patch type systems are typically nested within these matrix communities, have more distinct boundaries, and more closely linked to environmental conditions. Large patch types may cover extensive areas, but their boundaries are usually correlated with specific environmental factors or processes. Small patch types require specific environmental conditions, and occur only where those conditions are exactly appropriate. Linear systems are similar to small patch types, but occur in comparatively narrow strips, such as riparian areas along streams.

Ecological systems found in the study area are shown in Figure 7, and briefly discussed below. Systems are arranged in descending order of their acreage within the study area. More detailed information about the characteristic vegetation, ecology, and dynamics of these systems is found in the Ecological System Profiles section, beginning on page 164.

<u>Western Great Plains Shortgrass Prairie</u>

Shortgrass prairie is by far the most prevalent ecological system in the study area, where it accounts for around 70% of the total acreage. This system is found primarily in the western half of the Western Great Plains, in the rainshadow of the Rocky Mountains and ranges from the Nebraska Panhandle south into Texas and New Mexico. It occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey. In much of its range, vegetation is dominated by *Bouteloua gracilis*. Although a variety of mid-height grass species may be present, especially on more mesic aspects and soils, they are secondary in importance to the sod-forming short grasses. Scattered shrub and dwarf-dwarf species such as *Artemisia filifolia*, *Artemisia frigida*, *Artemisia tridentata*, *Atriplex canescens*, *Eriogonum effusum*, *Gutierrezia sarothrae*, and *Lycium pallidum* may also be present. Xeric climate conditions can decrease the fuel load and thus the relative fire frequency within the system. However, historically, fires that did occur were often very expansive. The short grasses that dominate this system are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing. This system in combination with associated wetland systems represents one of the richest areas for mammals and birds.

Southern Rocky Mountain Juniper Woodland and Savanna

The Juniper Woodland and Savanna ecological system occupies lower and warmer elevations, primarily along the eastern and southern edge of the southern Rockies and Arizona-New Mexico mountains. Juniper woodlands and savannas are usually found just below the lower elevational range of *Pinus ponderosa* and often intermingle with grasslands and shrublands. Stands have an open canopy of either Rocky Mountain juniper (*Juniperus scopulorum*) or one-seed juniper (*J. monosperma*), and have a grassy understory. In the canyons and tablelands of the southern Great Plains this system forms extensive cover at some distance from the mountain front. In Colorado, this system is largely confined to the southeastern plains. It is the second most prevalent type in the study area, where it covers about 16% of the area

Western Great Plains Foothill and Piedmont Grassland

Foothill and Piedmont Grasslands are found at the extreme western edge of the Great Plains, where increasing elevation and precipitation facilitate the development of mixed to tallgrass associations on certain soils. This large patch system typically occurs between 5,250 and 7,200 feet (1,600-2,200 m) in elevation. It is best characterized as a mixed-grass to tallgrass prairie on mostly moderate to gentle slopes, usually at the base of foothill slopes such as the hogbacks of the Rocky Mountain Front Range, where it typically occurs as a relatively narrow elevational band between montane woodlands and shrublands and the shortgrass steppe. Typical species include *Andropogon gerardii, Schizachyrium scoparium, Muhlenbergia montana, Nassella viridula, Pascopyrum smithii, Sporobolus cryptandrus, Bouteloua gracilis, Hesperostipa comata*, or *Hesperostipa neomexicana*. This is the second most common type of grassland in the study area, where it occupies some 70,000 acres.

Southern Rocky Mountain Pinyon-Juniper Woodland

This ecological system occurs on dry mountains and foothills in southern Colorado, in mountains and plateaus of northern New Mexico and Arizona, and in scattered patches on breaks in the Great Plains. Stands are dominated by *Pinus edulis* with either *Juniperus scopulorum* or *Juniperus monosperma.* In the canyons and tablelands of southeastern Colorado, *Pinus edulis* is generally absent, and this system is replaced by the Southern Rocky Mountain Juniper Woodland and Savanna system.

Rocky Mountain Gambel Oak-Mixed Montane Shrubland

This large patch ecological system occurs in the mountains, plateaus, and foothills in the southern Rocky Mountains and Colorado Plateau ecoregions. These shrublands are most commonly found along dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 6,500 to 9,500 ft (2,000-2,900 m) in elevation, and are often situated above pinyon-juniper woodlands. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a relatively minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics.

Inter-Mountain Basins Mixed Salt Desert Scrub

This ecological system includes open-canopied shrublands of typically saline desert basins, alluvial slopes and plains across the intermountain western U.S. Considered a matrix forming system to the west of Colorado, this type also extends in limited distribution into the plains of southeastern Colorado, where it is a large patch system. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species.

Western Great Plains Sandhill Shrubland

These sandsage (*Artemisia filifolia*) dominated communities are found primarily in the south-central areas of the Western Great Plains Division. The greater part of the system occurs in the Central Shortgrass Prairie Ecoregion in eastern Colorado, western Kansas and southwestern Nebraska. Throughout its range it is closely tied to sandy soils, an edaphic restriction characteristic of large patch systems. In addition, this system is likely to intergrade closely with shortgrass prairie, perhaps forming a locally patchy sandsage/shortgrass matrix, and therefore it may be difficult to delimit as a distinct ecological system in places.

Inter-Mountain Basins Greasewood Flat

These greasewood (*Sarcobatus vermiculatus*) dominated communities are found throughout much of the western U.S. in intermountain basins and extends onto the western Great Plains. In eastern Colorado, occurrences are primarily in the southwestern portion of plains. Large occurrences are also found in the lower elevations of Colorado's western valleys and throughout much of the San Luis Valley. Greasewood flats are large patch systems confined to specific environments defined by hydrologic regime, soil salinity and soil texture.

Rocky Mountain Ponderosa Pine Woodland

This widespread ecological system is most common throughout the cordillera of the Rocky Mountains, but is also found in the Colorado Plateau region, west into scattered locations in the Great Basin, and north into southern British Columbia. These matrix-forming woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. *Pinus ponderosa* is the predominant conifer; *Pseudotsuga menziesii*, *Pinus edulis*, and *Juniperus* spp. may be present in the tree canopy.

Rocky Mountain Lower Montane-Foothill Shrubland

This large patch ecological system is found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and ranges from southern New Mexico extending north into Wyoming, and west into the Intermountain region. It is common where *Quercus gambelii* is absent such as the northern Colorado Front Range and in drier foothills and prairie hills. It may occur as a mosaic of two or three plant associations often surrounded by grasslands or woodlands. Shrub species include *Cercocarpus montanus*, *Artemisia frigida*, *Prunus* spp., *Rhus trilobata*, and others.

Inter-Mountain Basins Semi-Desert Shrub Steppe

These grass-dominated communites with an open to moderately dense shrub layer occur throughout the intermountain western U.S., typically at lower elevations on alluvial fans and flats with moderate to deep soils. In Colorado, this system is generally a large-patch type, except in the San Luis Valley, where it is matrix forming. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer. Shrub species may include *Atriplex canescens, Gutierrezia sarothrae*, *Krascheninnikovia lanata* and others. Pinyon-juniper woodlands and sagebrush shrublands commonly are adjacent to this system at the upper elevations

Western Great Plains Riparian Woodland and Shrubland

This system is found in the riparian areas of medium and small rivers and streams throughout the Western Great Plains. In Colorado it is found throughout the eastern plains. Streams of the Western Great Plains include both major rivers and perennial to intermittent or ephemeral streams that flow only during part of the year. The vast majority of streams included in the Western Great Plains Riparian and Woodland ecological system have their headwaters on the plains, and are driven primarily by local precipitation and groundwater inflow. While most prairie streams follow this pattern, at the western edge of the Great Plains, the lower reaches of streams that originate in the mountains may extend for some distance out onto the plains, where they share characteristics with the prairie streams. Dominant vegetation overlaps broadly with portions of large river floodplain systems, but the overall abundance of vegetation is generally lower. Vegetation may be a mosaic of communities that are not always tree or shrub dominated. Communities within this system range from riparian forests and shrublands to tallgrass wet meadows and gravel/sand flats.

Western Great Plains Cliff, Outcrop, and Shale Barren

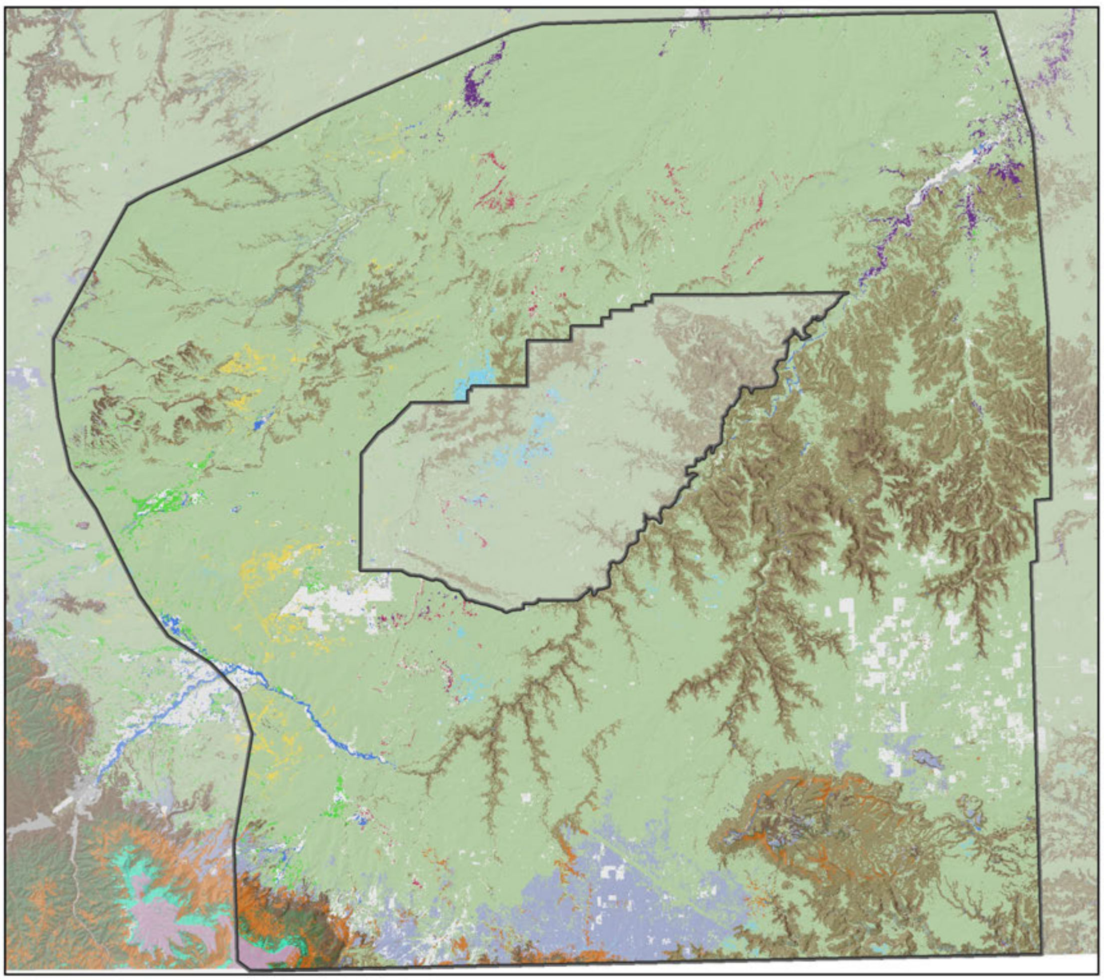
The Western Great Plains landscape is generally characterized by relatively low topographic relief, but does include numerous scattered outcrops and erosional features that interrupt the relative flatness of the landscape. This system includes cliffs and outcrops throughout the Western Great Plains. Substrates range from sandstone to limestone. Vegetation is typically restricted to shelves, cracks and crevices in the rock, and may include sparse cover of *Juniperus* spp., shrubs such as *Cercocarpus montanus* or *Rhus trilobata*, and species from adjacent grasslands. In some locations, a "cushion plant" community forms. These areas often support regionally rare species.

Southern Rocky Mountain Montane-Subalpine Grassland

These are typically grasslands of forest openings and park-like expanses in the montane and subalpine coniferous forests. These large patch grasslands are intermixed with forests of spruce-fir, lodgepole, ponderosa pine, mixed conifers, and aspen. In limited circumstances (e.g., South Park in Colorado) they form the "matrix" of high-elevation plateaus. Although the largest occurrences are primarily within Colorado, examples are scattered throughout the region from Wyoming to New Mexico. Dominant species vary with factors such as slope, aspect, precipitation, etc., but generally lower elevation montane grasslands are more xeric and dominated by *Muhlenbergia* spp., *Pseudoroegneria spicata, Festuca arizonica*, and *Festuca idahoensis*, while upper montane or subalpine grasslands are more mesic and may be dominated by *Festuca thurberi* or *Danthonia intermedia*.

Rocky Mountain Montane Dry-Mesic and Mesic Mixed Conifer Forest and Woodland

These are mixed-conifer forests occurring on all aspects at elevations ranging from 4,000 to 10,800 ft (1,200-3,300 m). The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence. *Pseudotsuga menziesii* and *Abies concolor* are most common canopy dominants, but *Picea engelmannii*, *Picea pungens*, or *Pinus ponderosa* may be present to codominant. This system was undoubtedly characterized by a mixed severity fire regime in its "natural condition," with a high degree of variability in lethality and return interval.



- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Western Great Plains Cliff and Outcrop
- Western Great Plains Foothill and Piedmont Grassland
- Western Great Plains Riparian Woodland and Shrubland
- Western Great Plains Sandhill Shrubland
- Western Great Plains Shortgrass Prairie
- Other, not natural vegetation
- Southern Rocky Mountain Juniper Woodland and Savanna
- Southern Rocky Mountain Montane-Subalpine Grassland
- Southern Rocky Mountain Pinyon-Juniper Woodland
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Rocky Mountain Lower Montane-Foothill Shrubland
- Rocky Mountain Montane Dry-Mesic and Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Ponderosa Pine Woodland

Figure 7. Ecological Systems in Southeast Colorado Project Area.

Fauna

The study area is comprised mostly of shortgrass prairie and juniper savanna/woodland habitats, both of which are characterized by semi-arid climatic conditions. Species utilizing this study area have adapted to drought conditions and have unique specializations, such as toads with "spade feet" (genus *Spea*) for digging themselves deep into the ground during dry times, and kangaroo rats (genus *Dipodomys*) that get all of their water from the vegetation they eat. The primary ecological process in grassland habitats is grazing, which dictates the vegetation structure available for different species. Some species such as the mountain plover (*Charadrius montanus*) need short grass and bare ground to detect predators, while others like the Cassin's sparrow (*Aimophila cassinii*) prefer higher grass. Today, most grasslands are grazed by domestic cattle, which have largely filled the niche of the native bison (*Bison bison*). Other native grazers such as the prairie dog (*Cynomys ludovicianus*), pronghorn (*Antilocapra americana)*, deer (*Odocoileus sp*.), and elk (*Cervus canadensis)* also play very important roles. For example, the prairie dog, a keystone species, creates a natural community of its own. It provides habitat for other species such as the burrowing owl (*Athene cunicularia*) and mountain plover, and is also a food resource for the ferruginous hawk (*Buteo regalis*) and the swift fox (*Vulpes velox*). Juniper habitats in the study area also host species adapted to drought conditions. These unique woodlands embedded in the prairie play host to species such as the southern plains woodrat (*Neotoma micropus*), the triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*), and the gray vireo (*Vireo vicinior*).

Aside from the shortgrass prairie and juniper, there are smaller habitats that, despite being less abundant, provide unique niches. The cliff and outcrop habitats provide nesting areas for species such as the peregrine (*Falco peregrinus anatum*) and prairie falcons (*Falco mexicanus*). The caves and mine habitats, often in the canyons, provide roosting habitat for the Townsend's big eared bat (*Plecotus townsendii pallescens*) and other bat species. The riparian woodlands not only provide a water source for many of the more mobile species, but also create habitats for many bird species and amphibians such as the plains leopard frog (*Rana blairi*). Upland hardwoods such as the scrub oak are important for the band-tailed pigeon (*Columba fasciata*), and the salt scrub host the loggerhead shrike (*Lanius ludovicianus*). The animal diversity of the study area is remarkable for a region without abundant water resources. In addition, the expansive intact landscape can support self-sustaining populations of both narrow and wide ranging species, a characteristic that is becoming increasingly rare in the state.

METHODS

The methods for assessing and prioritizing conservation needs over a large area, such as the Southeastern Colorado Inventory area, are necessarily diverse. CNHP follows a general method that is continuously being developed specifically for this purpose. The *Southeast Colorado Survey of Critical Biological Resources 2007* was conducted in several steps as summarized below.

Collect Available Information

CNHP databases were updated with information regarding the known locations of species and significant plant communities within the project area. A variety of sources were searched for this information. The Colorado State University museums and herbarium were searched, as were plant and animal collections at the University of Colorado, Rocky Mountain Herbarium, and local private collections. Both general and specific literature sources were incorporated into CNHP databases, either in the form of locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage elements. Such information covers basic species and community biology including range, habitat, phenology (reproductive timing), food sources, and substrates. This information was also entered into CNHP databases. DOW riparian maps were used as additional tools for identification of wetland and riparian habitats.

Identify Elements of Biological Diversity with Potential to Occur in Southeast Colorado

The information collected in the previous step was used to refine a list of potential species and natural plant communities and to refine our search areas. In general, species and plant communities that have been recorded from the project area or from adjacent lands are included in this list. Over 160 rare species and significant plant communities were targeted in this survey. Given the limited amount of time and funding, a specific subset of species and communities were the priority of our inventory efforts. These elements were considered to be a priority because of their high level of biological significance (G1-G3 or S1-S3).

Identify Targeted Inventory Areas

Potential survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities. Previously documented locations were targeted, and additional potential areas were chosen using available information sources. Areas with potentially high natural values were selected using aerial photographs, soil surveys, geology maps, vegetation surveys, personal recommendations from knowledgeable local residents, and numerous roadside surveys by our field scientists. Additionally, we used models of potential species distribution for many target species. Using these resources together with the biological information stored in the CNHP databases, areas having the highest potential for supporting specific elements were identified. The areas chosen for survey sites appeared to be in the most natural condition. In general, this means those sites with native vegetation and little surface disturbance were identified.

Due to the size of the study area and the relatively small amount of previous survey information from the area, the selection of potential survey sites was not focused on strictly circumscribed

Targeted Inventory Areas (TIAs), as has been the practice with previous CNHP surveys. The above information was used to identify informally defined TIAs that were believed to have relatively high probability of harboring significant biological resources. These areas focused on private lands and provided a general framework to guide our survey of the overall project area. Additional TIAs were identified by the many participating landowners we worked with in Southeast Colorado. Other areas were opportunistically surveyed as field observations and conditions warranted.

The TIAs developed to guide our search efforts included specific sites based on existing location data, and a large number of more generalized locations based on assessment of environmental information and distribution modeling. Specific targets were developed from existing PCAs and element occurrence records for animals, plants, and natural communities. Generalized target sites included systematic transects for birds, systematic points on river reaches for fishes, and large generalized polygons for prairie dogs, ferns, shale-loving plants, and other elements. The various survey focus areas used to guide the field work are presented in Figures 8 through 12.

The immense size of the project area, the overwhelming number of potential sites, and limited resources necessitated that surveys for all elements were prioritized by the degree of imperilment. For example, species with Natural Heritage ranks of G1-G3 or S1-S3 were the primary target of our field inventory efforts. Although species with lower Natural Heritage ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented as they were encountered.

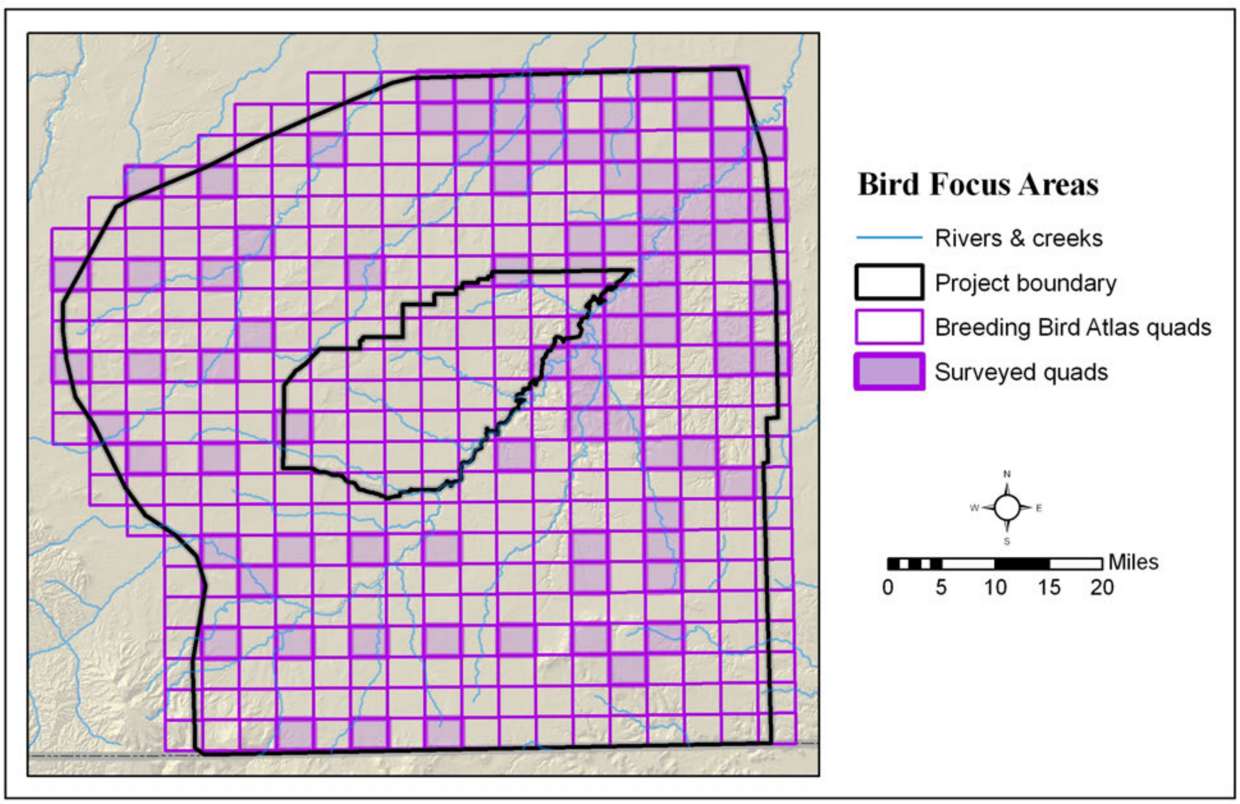


Figure 8. Bird Survey Focus Areas

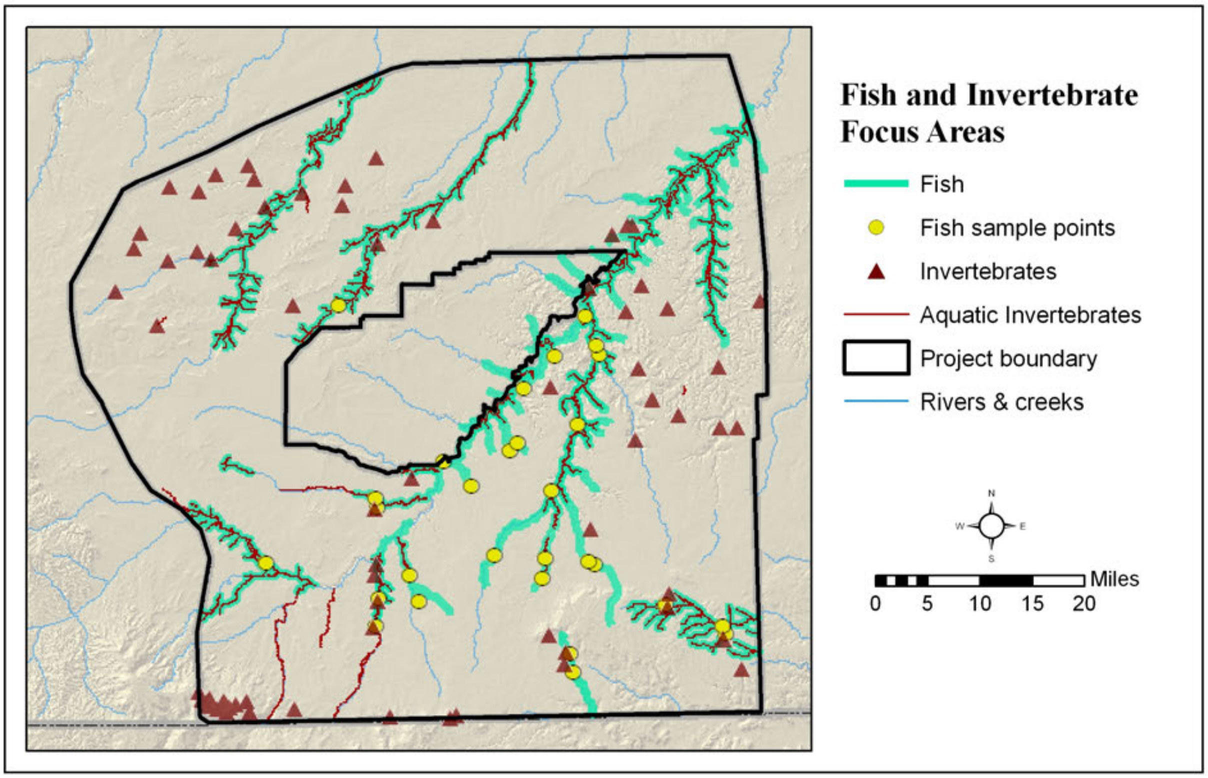


Figure 9. Fish and Invertebrate Survey Focus Areas

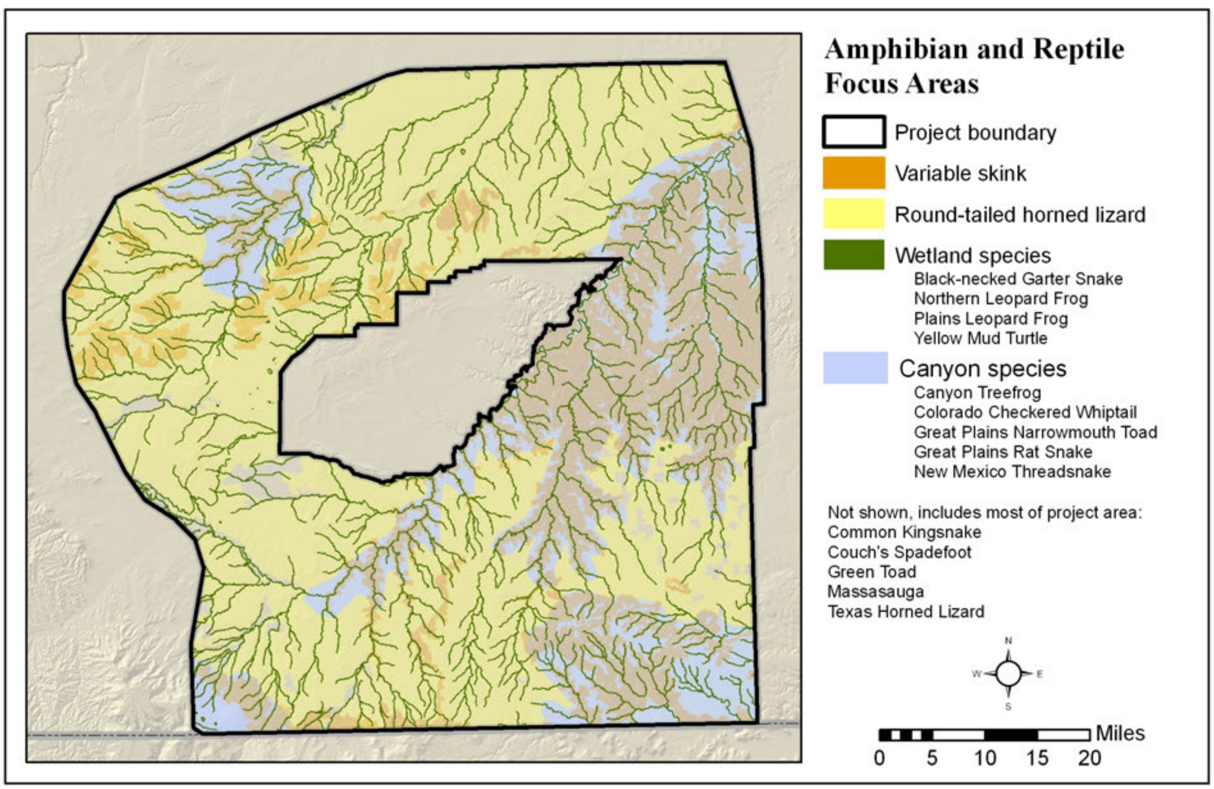


Figure 10. Amphibian and Reptile Survey Focus Areas

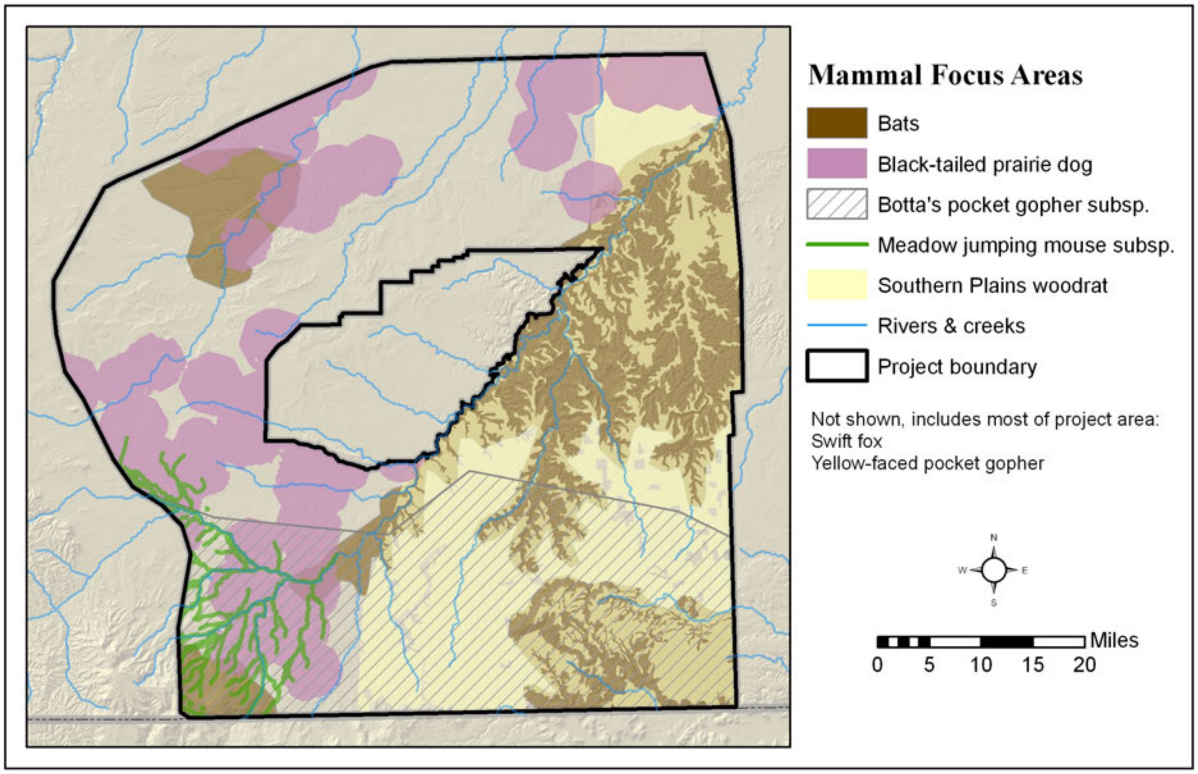


Figure 11. Mammal Survey Focus Areas

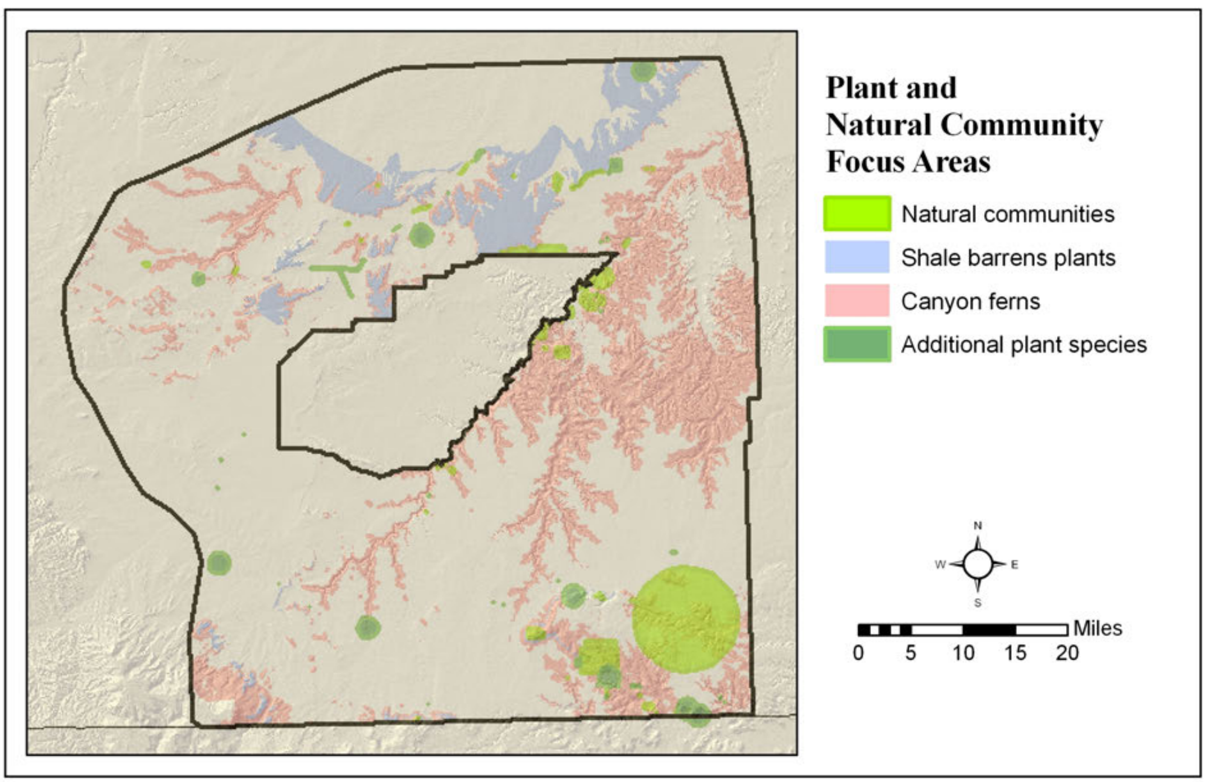


Figure 12. Plants and Natural Communities Survey Focus Areas

Contact Landowners

In conjunction with choosing survey sites, scoping meetings were held with the Colorado Cattleman's Agricultural Land Trust and many of the landowners to obtain permission for land access and to gain local knowledge about TIA sites. Other landowners were then either contacted by phone or in person.

Conduct Field Surveys

Survey sites where access could be obtained were visited at the appropriate time as dictated by the seasonal occurrence (or phenology) of the individual elements. It was essential that surveys took place during a time when the targeted elements were detectable. For instance, breeding birds cannot be surveyed outside of the breeding season, and plants are often not identifiable without flowers or fruit that are only present during certain times of the year. The methods used in the surveys vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Some types of organisms require special techniques to document their presence. These are summarized below:

- Plants: visual observation
- Plant communities: visual observation
- Amphibians: visual observation and capture using aquatic dip nets
- Birds: visual observation or identification by song or call
- Invertebrates: sweep netting
- Mammals: visual observation, live trapping, and mist-netting for bats
- Fish: capture using seine nets, aquatic dip nets, and electro-shocking.

Where necessary and permitted, voucher specimens are collected and deposited in local university museums and herbaria. When a rare species or significant plant community is discovered, its precise location and known extent are typically recorded with a global positioning system (GPS) unit. Concerns of some individual landowners over using GPS to record information necessitated that we estimate locations from topographic maps and transfer and utilize those coordinates. Other data recorded at each occurrence include numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the size of the population or community, the condition or naturalness of the habitat, and the landscape context (its connectivity and its ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. For more about element occurrence ranking, see the previous section on Natural Heritage Program Methodology.

Assessment of TIAs and other site visits are conducted on the following two levels:

1). On-site assessments. On-site assessments are the primary and preferred method, as it is the only technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common natural communities. On-site assessments are also the most resource intensive because of the effort required by biologists to actively search the area and identify species. In a few cases where on-site assessments were desired, they could not be conducted because CNHP was unable to contact the landowner during the time frame of this study.

2). Roadside or adjacent land assessments. Some of the potential survey sites can be viewed at a distance from a public road. While on the ground the field scientist can see, even from a distance, many features not apparent on maps and aerial photos. Road assessments determined the extent of human and livestock impacts on the site, which can include ditching, plant species indicative of intensive livestock use, stream bank destabilization, major hydrologic alterations, extensive cover of non-native plant species, or new construction. Sites with one or more of these characteristics were generally excluded as potential survey areas and no extensive data were gathered at these areas. Other sites without significant human impacts were documented as site for potential future follow up assessment.

The following types of information are typically collected from locations where element occurrences are identified.

General Field Information

- A list of all animal and plant species, and plant associations in the TIA, including the amount of area covered by plant communities using International Classification of Terrestial Vegetation (Comer et al. 2003) or CNHP's Statewide Wetland Classification (Carsey et al. 2003a)
- Vegetation data for each major plant association were collected using ocular estimates of species cover in a representative portion of the plant association
- A polygon indicating the site layout, with distribution of plants, animals and plant community types (this was generally marked on the 7.5-min. USGS topographic map, but occasionally for clarity a separate map was drawn on the site survey form)
- UTM coordinates from Garmin GPSmap 76Cx Personal Navigator and/or topographic maps
- Elevation (from 7.5-min. USGS topographic maps and GPS)
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent
- Notes on geology and geomorphology
- Reference photos of the site
- Indicators of disturbance such as logging, grazing, off-road use, flooding, etc.

Natural Heritage Information

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

- Proposed conservation area boundaries or site information that will allow biologist to define a PCA boundary at a later date

Delineate Potential Conservation Areas

The objective for this survey was to identify the biological resources of the project area. Once the biological inventory has identified species, plant communities, and ecological systems in the study area, it is necessary to interpret these data from a conservation planning standpoint. In order to do this, CNHP has developed methods to delineate the local geographic areas that are necessary to maintain long-term persistence of the species and plant communities of interest. Potential Conservation Areas (PCAs) are delineated to focus attention on species and plant communities of highest conservation priority at global and statewide levels (see The Natural Heritage Ranking Method for details on PCA methods). The purpose of the PCA is to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- ecological processes necessary to maintain or improve existing conditions
- species movement and migration corridors
- maintenance of surface water quality within the PCA and surrounding watershed
- maintenance of the hydrologic integrity of the groundwater
- land intended to buffer the PCA against future changes in the use of surrounding lands
- exclusion or control of invasive exotic species
- land necessary for management or monitoring activities.

RESULTS AND DISCUSSION

Results of the Southeastern Colorado Survey of Critical Biological Resources indicate that the southeastern Colorado project area possesses high biological significance. The landscape includes a mosaic of high quality examples of ecological systems representative of this part of the Central Shortgrass Prairie Ecoregion. The suite of plant associations and plant and animal species identified is typical of those ecological systems. Numerous globally and state imperiled or endemic animals, plants, and plant communities were identified within the various ecological systems.

Field work for the survey started in late May, 2007 and continued through late July, 2007. Additional field work began in early September, 2007 and continued through early October, 2007, and as long as late November, 2007 for rare fishes. We utilized a number of staff on a full and part time basis to complete the survey work, including six botanist/ecologists, six to eight mammalogists, two ornithologists, and three ichthyologists. Ornithologists and ichthyologists were hired under subcontract to the Rocky Mountain Bird Observatory and the CSU Larval Fish Lab, respectively.

Targeted Inventory Areas

In conducting the survey, a total of 181 elements of biodiversity were targeted over the roughly two million acre project area. These included 56 vascular plants, 51 natural communities, 19 birds, 17 insects, 15 mammals, 11 reptiles, 6 amphibians, 4 fish, and 2 mollusks. The global and state imperilment ranks for these elements ranged from G1S1 to G5S5. While our survey effort and priorities focused on elements with higher imperilment ranks (G1-G3), elements with lower imperilment ranks (G4-G5) were often documented when occurrences were encountered.

With the assistance of CCALT and the stakeholders, CNHP was successful in obtaining permission from landowners to conduct surveys on most private ranches in the project area. Because we had effective support from the stakeholders, almost all of the ranches we approached were aware of the survey and were supportive of our work. Due to the average size of the typical ranch in the southeastern Colorado project area, we quickly had access to more acres than was possible to sample in a single season. The large size of the survey area and the timing of access to various landowners' properties often necessitated that we take advantage of access privileges and survey where we could rather than specifically where we had planned. For reasons such as time limitation and the ability to access large, previously un-surveyed parcels, not all of the TIAs were visited. Despite this, we did survey a large portion of the project area and documented a large number of significant element occurrences.

Significant Elements Documented in Southeast Colorado

The areas surveyed in summer 2007 yielded a large number of EOs. A typical county level field survey will yield approximately 70 to 80 Element Occurrence Records (EORs) for plants, animals, and natural communities. Of those, about one third are typically new and two thirds are typically updates of existing EORs. In contrast, the Southeast Colorado Survey (this project) yielded 150 EORs, 131 of which were new and 19 were updates. The actual number of mapped locations, which represent the number of places we visited and documented a species or community observation, totaled 341, of which 236 were new.

A portion of that success is due to the fact that funding to conduct the survey was in place early enough in the season to start the field work in time to identify early blooming plants and most of the breeding birds. We were also fortunate in that the weather during the winter of 2006-2007, as well as spring and summer of 2007, provided enough precipitation to ensure productive growth and reproduction of the vegetation, and allow easier identification of target species and communities. The significant elements documented in southeast Colorado during the 2007 summer field survey are presented below by taxon.

Animals

Results of the biological survey confirm that there are numerous animal species of conservation concern within the project area. Altogether, 38 animals that are rare, imperiled or vulnerable globally or within the state of Colorado were documented within the project area (Table 7). Of these 38 animals, 30 are tracked by CNHP and the remaining 8 are watchlisted by the program. There were 223 individual occurrences of the 30 tracked animal species, and 74 occurrences of the eight watchlisted species documented within the study area. This high diversity of animals is a testament to the ecological integrity of the project area.

The main ecological systems sustaining the animal diversity include the Western Great Plains Shortgrass Prairie, Western Great Plains Riparian Woodland and Shrubland, and Southern Rocky Mountain Juniper Woodland and Savanna. The shortgrass prairie is important to a number of bird and mammal species; some of the more significant from a conservation standpoint include the mountain plover, long-billed curlew, ferruginous hawk, black-tailed prarie dog, and swift fox. The canyonlands and drainages containing wetlands, rivers, riparian habitat, and floodplains are important to numerous species. Some of these are the plains leopard frog, canyon treefrog, suckermouth minnow, peregrine falcon, and prairie falcon. The juniper woodlands support the triploid Colorado checkered whiptail, gray vireo, and rufous-crowned sparrow among other species.

Amphibians

Five of the animals of conservation concern were amphibians (Table 7). The highest priority amphibian recorded from the project area was the state rare (G5S1) Couch’s spadefoot, which was observed at three locations. The state rare (G5S2) canyon treefrog was documented from one location in the area. This was the first verified observation in Southeastern Colorado of this rare amphibian in over 100 years. The state vulnerable (G5S3) plains leopard frog was widely distributed within the project area with 16 occurrences recorded from multiple canyons including Purgatoire, Chacuaco, and Cow Canyons and their tributaries, and the Carrizo Creek drainage. This represents one of the highest concentrations of plains leopard frogs in CNHP’s database and indicates that the aquatic integrity of the canyons is still intact. The scarcity of bullfrogs (*Rana catesbeiana*) within the canyon systems of the project area is also significant. Bullfrogs are not native to Colorado, are larger than most of Colorado's native amphibians, and impact native species through intense predation (Kiesecker and Blaustein 1996). Bullfogs have been implicated in the decline of certain native frogs in western North America (Kupferberg 1997), including northern and plains leopard frogs in Colorado (Hammerson 1999). Bullfrogs were recorded from Lunning Arroyo and Trementina Canyon. The viability of the rare amphibians documented in this report will depend on maintaining the aquatic integrity of the canyon systems and prairie wetlands, and prevention of the spread and introduction of bullfrogs.

Birds

A diverse community of rare birds, 16 species in all (Table 7), was recorded from within the project boundary. The highest priority bird recorded was the globally vulnerable (G2S2) mountain plover, which occurs at 15 locations within the shortgrass prairie of the project area. Other shortgrass prairie priority birds recorded from the area include the burrowing owl (24 occurrences), long-billed curlew (16 occurrences), and McCown's longspur (4 occurrences). A large portion of the project area contains juniper woodland. Two state rare (G5S2) birds that are associated with these habitats, the gray vireo (10 occurrences) and rufous-crowned sparrow (9 occurrences), were present. Priority raptors recorded from the area include the bald eagle (1 occurrence), ferruginous hawk (4 occurrences), peregrine falcon (1 occurrence), and prairie falcon (3 occurrences). Priority birds inhabiting shrublands and riparian zones of the project area include the Cassin's sparrow (24 occurrences), curve-billed thrasher (7 occurrences), Lewis's woodpecker (17 occurrences), sage sparrow (3 occurrences), and short-eared owl (1 occurrence). The rich community of rare birds is representative of the ecological types present in the study area and suggests that there are large secure areas of shortgrass prairie, shrublands, and juniper woodland that have not been altered significantly by human activities. Habitat loss and habitat alteration are the main threats with potential to affect the bird community (Partners in Flight 2000). Since the habitats are still intact within the study area, conservation of these habitats in their current states is required if the bird species are to be maintained over the long term within the area. Long-term conservation success lies with private landowners, and the current ranching activities of the area are compatible with conservation of these birds.

Fish

A healthy community of mostly native fish was recorded from the project area. In total, 13 species of fish were documented within the project boundary. Two of these are rare in Colorado, the suckermouth minnow (2 occurrences) and flathead chub (3 occurrences) (Table 7). Populations of these two fish were recorded only from the Purgatoire River, which flows throughout the year. The primary ecological processes that support the aquatic systems include precipitation, hydrological dynamics, groundwater availability and outputs, nutrient inputs, pH, and aquatic community composition (Neeley et al 2006). Water impoundments and groundwater withdrawal can affect the amount of water available to the intermittent pools that dominate the canyon tributaries of the area. That native fish still persist in these pools suggests the hydrologic function and integrity of the aquatic system has not been overly compromised by past levels of water use. Aquatic fish assemblages have often been altered by the additions of non-native sport-fish, often predatory fish, into native streams and rivers, but that is not the case within the project area. Exotic fish species can result in the loss of native species through competition and predation (Knopf and Samson 1997). Long-term conservation of the native fish is inextricably tied to sound management of the region's streams by private landowners and water-right holders (Neeley et al. 2006).

Invertebrates

Five insect species of conservation concern were recorded from within the project boundary (Table 7). The rarest species documented was the globally rare (G2S2) Colorado blue butterfly. Three populations of this rare butterfly were recorded from within the project area. A number of other state rare and vulnerable insects were recorded from the area, including two butterflies, the northern oak hairstreak (1 occurrence) and simius roadside skipper (1 occurrence), a sphinx moth (1 occurrence), and the sulphur-tipped clubtail dragonfly (3 occurrences). Habitat loss and habitat alteration are the main threats with potential to affect the insects of the project area (Samson and Knopf 1996). Habitat preservation will sustain the insect populations within the study area. Increases in floristic diversity resulting from low-to-moderate intensity grazing by native species or cattle promote insect diversity (Curry 1994, Samson and Knopf 1997). For the Colorado blue butterfly, some level of grazing is necessary to prevent grasses from crowding out the various species of buckwheat (*Eriogonum* spp.) which are the butterflies' host plant. Consequently, compatible grazing will help preserve the priority insects of the project area.

Mammals

Five mammalian species of conservation concern were recorded from within the project during completion of 2007 field work. The swift fox, a globally vulnerable species (G3S3) was the rarest mammal recorded. In total, four occurrences of swift fox were recorded from shortgrass prairie in the southern and northern portions of the project area. These records indicate that a large and viable population of swift fox inhabits the area. A maternity colony of the state rare Townsend's big-eared bat (G4T4S2) was discovered in an abandoned mine within the project area. This is the only Townsend's maternity colony known from Southeastern Colorado; only a few dozen maternity colonies of this rare bat are recorded from the entire state. Two state vulnerable (G5S3) mammals, the black-tailed prairie dog (14 occurrences) and the southern plains woodrat (2 occurrences) were also recorded in the area, as was the yellow-faced pocket gopher (G5S4) (6 occurrences). Sustaining the viability of the priority mammal species observed within the project area will require maintaining undisturbed habitats dominated by native vegetation. Shortgrass prairie is important to the black-tailed prairie dog, swift fox, and yellow-faced pocket gopher. Conservation of the project area's grasslands will maintain populations of these mammals. The swift fox and other shortgrass prairie inhabitants require a mosaic of habitats created by varying rates of grazing. Therefore, rotational grazing or deferred grazing can be beneficial to swift fox. The Townsend's big-eared bat is associated with the juniper woodlands and canyons, while the southern plains woodrat inhabits desert shrubland, particularly shortgrass-cholla shrubland. The project area contains large expanses of these ecological systems that are secure and without disturbance or with marginal disturbance. The current activity of livestock ranching is compatible with continued viability of these mammals within the project area. Consequently, conservation of these ecological systems in their current state will protect the viability of these populations.

Reptiles

Three snakes and two lizards of conservation concern were recorded from within the project boundary. The reptiles observed included the blackneck garter snake (7 occurrences), triploid Colorado checkered whiptail (16 occurrences), massasauga rattlesnake (4 occurrences), New Mexico threadsnake (1 occurrence), and Texas horned lizard (36 occurrences). The triploid Colorado checkered whiptail (G2G3S2), the rarest reptile recorded, inhabits juniper woodland on both the east and west sides of the project area. The globally vulnerable massasauga (G3G4S2) was recorded from four locations, all of which were in shortgrass prairie. The Texas horned lizard, a state vulnerable (G4G5S3) reptile, was also found in the shortgrass prairie, and occurred throughout the project area. Two state rare snakes, the blackneck garter snake (G5S2?) and the New Mexico threadsnake (G4G5S1) were recorded from riparian habitats and shortgrass prairie, respectively. Habitat loss and alteration are the threats for the triploid Colorado checkered whiptail. The whiptail is tolerant of a great deal of disturbance, but is intolerant of areas converted to cultivation and urban development (Hammerson 1999). Preservation of juniper woodland will sustain the populations of triploid Colorado checkered whiptails currently inhabiting the project area. Conservation of the other priority reptiles found in the area will require protection of wetlands, riparian habitats, and shortgrass prairie. In southeastern Colorado, these habitats have not been altered significantly by human activities. If they are conserved in their current state they will continue to sustain populations of these reptiles indefinitely. Fire and grazing of shortgrass prairie seems to be beneficial to reptiles with greater numbers and diversity of reptiles reported in shortgrass prairie that has been grazed or burned (Samson and Knopf 1996, Mushinsky 1985). The use of fire and grazing as management tools should benefit reptile diversity in the project area.

Plants

A total of 36 of different plant occurrences were documented across the ecological system types that comprise the landscape of southeastern Colorado (Table 7). Within the juniper woodland ecological system types we documented occurrences of numerous state rare ferns, as well as the long hood milkweed (*Asclepias macrotis*, G4S2), the dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*, G3G4T2T3S2), Reichenbach's hedgehog cactus (*Echinocereus reichenbachii*, G5T4?S1), and the prairie violet (*Viola pedatifida*, G5S2).

The rocky canyons provide extensive habitat for a rich assemblage of state rare ferns. The relatively deep and narrow canyons contain fissured and eroded sandstone bedrock over large areas, providing sheltered habitat for a number of different species of fern. State rare ferns we documented in the project area included Fendler cloak-fern (*Argyrochosma fendleri*, G3S3), southern maidenhair fern (*Adiantum capillus-veneris*, G5S2), ebony spleenwort (*Asplenium platyneuron*, G5S1), black stem spleenwort (*Asplenium resiliens*, G5S1), Eaton's lipfern (*Cheilanthes eatonii*) (G5?S2), Wooton's lacefern (*Cheilanthes wootonii*, G5S1), and the purple-stem cliffbrake (*Pellaea atropurpurea*, G5S2S3). Other species we anticipated locating but failed to document include Wright's cliffbrake, *Pellaea wrightiana*, G5S2), smooth cliffbrake (*Pellaea glabella* ssp. *simplex*, G5T4?S2), star cloakfern (*Notholaena standleyi*, G4S1), and New Mexico cliff fern (*Woodsia neomexicana*, G4?S2). Given the extensive nature of the canyons system in the project area, it is likely these species could also be documented with additional search effort. Five occurrences of Reichenbach's hedgehog cactus (*Echinocereus reichenbachii* var. *perbellus*, G5T4?S1), another state rare species, were documented from these same rocky open woodland areas.

On the Mesa de Maya, in open juniper woodlands on calcareous soils of the Richmond series, we documented one occurrence of the Rocky Mountain Bladderpod (*Lesquerella calcicola*) a globally imperiled (G2S2) species. This species is restricted to the eroding gravelly calcareous soils found on steeper hillslopes. Also in the open juniper woodlands, but on the more gradual slopes and rimrock tops we documented two occurrences of the dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*) a state imperiled (G3G4T2T3) subspecies, and eight occurrences of the long-hood milkweed (*Asclepias macrotis*) a state rare (G4S2) species. One occurrence of the prairie violet (*Viola pedatifida*), a state rare (G5S2) species, was documented in a small side valley high on the Mesa de Maya.

In the shortgrass prairie ecological system types, we documented four state rare species. Six occurrences of the globally imperiled Arkansas valley evening primrose (*Oenothera harringtonii*, G2G3S1S2) were documented. Two occurrences of the state rare James' penstemon (*Penstemon jamesii*, G4S1), which reportedly had not been seen in the area since the 1940's (pers comm Dina Clark 2007), were documented blooming in areas dominated by short and mid grass prairie. Three occurrences of the state rare Texas greasebush (*Glossopetalon planiterum*, G4S1) were documented in the south central portion of the project area. Four occurrences of the single head golden weed (*Oonopsis foliosa var. monocephala,* G3G4T2 S2) were documented from shale bearing soils within the shortgrass prairie types.

Plant Communities

The Central Shortgrass Prairie ecoregion includes a mosaic of grassland, shrubland, and woodland ecological system types. Within the grassland ecological system are a variety of shortgrass, mid-grass, and tallgrass plant associations. While extensive high quality examples of common grassland associations extend over much of the area, we documented one occurrence of the globally vulnerable (G2G4S3) Blue Grama-Galleta Shortgrass Prairie community. Within the grasslands that dominate the southern portion of the project area we documented three occurrences of the globally vulnerable (G3S3) New Mexico Feathergrass Mixed Grass Prairie community.

The Juniper Woodland Ecological System includes the globally vulnerable (G2S2) Mountain Mahogany-New Mexico Feathergrass shrubland community. We documented one occurrence of this type in the canyon country on the lower Purgatoire River in the more northern portion of the project area. Two occurrences of the globally vulnerable (G3S3) One-seed Juniper-New Mexico Feathergrass Woodland community were identified in the area of the lower Purgatoire River as well.

Table 7 presents CNHP elements of biological significance known to occur in or associated with the Potential Conservation Areas (PCAs) in this report. This is not a comprehensive list of all elements of biological significance known to occur in Southeast Colorado, but rather it includes only those elements significant enough to be documented in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS) or CNHP's Observation Database. For a key to Federal and State Status Codes, please refer to the table of Federal and State Agency special designations for rare species, within the section of the report entitled "The Natural Heritage Network and Ranking System".

Table 7. Elements of Biological Diversity Known From Southeast Colorado Project Area.

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Amphibians						
Bufo debilis	Green toad	G5	S2			
Hyla arenicolor	Canyon treefrog	G5	S2		BLM	
Rana blairi	Plains leopard frog	G5	S3		BLM USFS	SC
Rana pipiens	Northern leopard frog	G5	S3		BLM USFS	SC
Scaphiopus couchii	Couch's spadefoot	G5	S1			SC
Birds						
Amphispiza belli	Sage sparrow	G5	S3B			
Aimophila cassinii	Cassin’s sparrow	G5	S4B		USFS	
Aimophila ruficeps	Rufous-crowned sparrow	G5	S2			
Asio flammeus	Short-eared owl	G5	S2B		USFS	
Athene cunicularia	Burrowing owl	G4	S4B		USFS	ST
Buteo regalis	Ferruginous hawk	G4	S3B,S4N		BLM USFS	SC
Calcarius mccownii	McCown's longspur	G4	S2B		USFS	
Charadrius montanus	Mountain plover	G2	S2B		BLM USFS	SC
Falco mexicanus	Prairie falcon	G5	S4B			
Falco peregrinus anatum	American peregrine falcon	G4	S2B		USFS	SC
Haliaeetus leucocephalus	Bald eagle	G5	S1B,S3N	LT, PDL		ST
Melanerpes lewis	Lewis's woodpecker	G4	S4		USFS	
Numenius americanus	Long-billed curlew	G5	S2B		BLM USFS	SC
Phalaropus tricolor	Wilson’s phalarope	G5	S4B,S4N			
Toxostoma curvirostre	Curve-billed phrasher	G5	S3			
Vireo vicinior	Gray vireo	G4	S2B			
Fish						
Phenocobius mirabilis	Suckermouth minnow	G5	S2			SE
Platygobio gracilis	Flathead chub	G5	S3		BLM USFS	SC
Insects						
Amblyscirtes simius	Simius roadside-Skipper	G4	S3			
Gomphus militaris	Sulphur-tipped clubtail	G5	S2			
Euphilotes rita coloradensis	Colorado blue	G3G4T2T3	S2			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Satyrium favonius ontario	Northern oak hairstreak	G4T4	S1			
Sagenosoma elsa	A sphinx moth	G4	S1?			
Mammals						
Corynorhhinus townsendii pallescens	Pale lump-nosed bat	G4T4	S2		BLM USFS	SC
Cynomys ludovicianus	Black-tailed prairie dog	G4	S3		USFS	SC
Neotoma micropus	Southern plains woodrat	G5	S3			
Pappogeomys castanops	Yellow-faced pocket gopher	G5	S4			
Vulpes velox	Swift fox	G3	S3		USFS	SC
Reptiles						
Aspidoscelis neotesselata	Triploid Colorado checkered whiptail	G2G3	S2			SC
Leptotyphlops dissectus	New Mexico threadsnake	G4G5	S1			SC
Phrynosoma cornutum	Texas horned lizard	G4G5	S3		BLM	SC
Sistrurus catenatus	Massasauga	G3G4	S2	C	BLM USFS	SC
Thamnophis cyrtopsis	Blackneck garter snake	G5	S2?			
Plants						
Adiantum capillus-veneris	Southern maidenhair fern	G5	S2			
Agastache foeniculum	Blue giant-hyssop	G4G5	S1			
Amorpha nana	Fragrant indigobush	G5	S2S3			
Argyrochosma fendleri	Fendler cloak-fern	G3	S3			
Asclepias macrotis	Long-hood milkweed	G4	S2			
Asclepias oenotheroides	Zizotes milkweed	G4G5	S1			
Asclepias uncialis ssp. uncialis	Dwarf milkweed	G3G4T 2T3	S2		BLM USFS	
Asplenium platyneuron	Ebony spleenwort	G5	S1			
Asplenium resiliens	Black-stem spleenwort	G5	S1			
Castilleja lineata	Marsh-meadow Indian-paintbrush	G4?	S1			
Cheilanthes eatonii	Eaton's lipfern	G5?	S2			
Cheilanthes wootonii	Wooton's lacefern	G5	S1			
Chenopodium cycloides	Sandhill goosefoot	G3G4	S1		USFS	
Draba smithii	Smith's whitlow-grass	G2	S2		USFS	
Echinocereus reichenbachii var.	Reiuchenbach's hedgehog cactus	G5T4?	S1			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
perbellus						
Frasera coloradensis	Colorado gentian	G3	S3			
Grindelia inornata	Colorado gumweed	G2	S2			
Herrickia horrida	Horrid herrickia	G2?	S1			
Lesquerella calcicola	Rocky mountain bladderpod	G2	S2			
Liatris ligulistylis	Strap-style gayfeather	G5?	S1S2			
Lomatium foeniculaceum ssp. macdougalii	Desert-parsley	G5T4T5	S1			
Mirabilis rotundifolia	Round-leaf four-o'clock	G2	S2			
Nolina texana	Texas bear-grass	G5	S1			
Notholaena standleyi	Star cloakfern	G4	S1			
Oenothera harringtonii	Arkansas Valley evening-primrose	G2	S2		USFS	
Oonopsis foliosa var. monocephala	Single-head goldenweed	G2G3T2	S2			
Parthenium tetraneuris	Barneby's feverfew	G3	S3			
Pellaea atropurpurea	Purple-stem cliffbrake	G5	S2S3			
Pellaea glabella ssp. simplex	Smooth cliffbrake	G5T4?	S2			
Pellaea wrightiana	Wright's cliffbrake	G5	S2			
Portulaca halimoides	Desert portulaca	G5	S1			
Sapindus saponaria var. drummondii	Western soapberry	G5T5	S1			
Sarcostemma crispum	Wavy-leaf twinevine	G4G5	S1			
Viola pedatifida	Prairie violet	G5	S2			
Woodsia neomexicana	New Mexico cliff fern	G4?	S2			
Plant Communities						
Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation	Western Bluestem Tallgrass Prairie	G2?	S2			
Artemisia bigelovii / Achnatherum hymenoides Shrubland	Flat Sagebrush / Indian Ricegrass Shrubland	G3Q	S3Q			
Bothriochloa laguroides ssp. torreyana Herbaceous Vegetation	Silver Beard Grass	G2Q	S1			
Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation	Black Grama - Galleta Shortgrass Prairie	G3	SU			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation	Blue Grama - Sideoats Grama Shortgrass Prairie	G5	SU			
Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation	Blue Grama - Buffalograss Shortgrass Prairie	G4	S2?			
Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Blue Grama - Galleta Shortgrass Prairie	G2G4	S3			
Bouteloua gracilis Herbaceous Vegetation	Blue Grama Shortgrass Prairie	G4Q	S4			
Cercocarpus montanus - Rhus trilobata / Andropogon gerardii Shrubland		G2G3	S2S3			
Cercocarpus montanus / Hesperostipa comata Shrubland		G2	S2			
Cercocarpus montanus / Hesperostipa neomexicana Shrubland		G2G3	S2S3			
Distichlis spicata Heraceous Vegetation	Inland Saltgrass Saline Prairie	G5	S3			
Eleocharis palustris Heraceous Vegetation	Creeping Spikerush Wet Meadow	G5	S4			
Hesperostipa neomexicana Heraceous Vegetation	New Mexico Feathergrass Mixedgrass Prairie	G3	S3			
Juniperus monosperma - (Pinus edulis) / Cercocarpus montanus / Schizachyrium scoparium Woodland		GU	SU			
Juniperus monosperma / Bouteloua curtipendula Woodland	One-seed Juniper / Sideoats Grama Woodland	G5	S3S4			
Juniperus monosperma / Bouteloua eriopoda Woodland	One-seed Juniper / Black Grama Woodland	GNR	S2S3			
Juniperus monosperma / Bouteloua gracilis Woodland	One-seed Juniper / Blue Grama Woodland	G5	S3S4			
Juniperus monosperma / Hesperostipa neomexicana Woodland	One-seed Juniper / New MexicoFeathergrass Woodland	G4	S3			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Juniperus scopulorum / Cercocarpus montanus - Rhus trilobata Woodland	Scarp Woodlands	GU	SU			
Muhlenbergia asperifolia Heraceous Vegetation		GU	S3			
Nolina texana Shrubland		GU	S1			
Pascopyrum smithii Heraceous Vegetation	Western Wheatgrass Mixedgrass Prairie	G3G5 Q	S2			
Pinus edulis / Quercus X pauciloba Woodland	Pinyon Pine / Wavyleaf Oak Woodland	G5	S2			
Pinus ponderosa / Bouteloua gracilis Woodland	Ponderosa Pine / Blue Grama Woodland	G4	S4			
Populus angustifolia / Pascopyrum smithii Forest	Narrowleaf Cottonwood/western Wheatgrass	G1Q	S1			
Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior) Woodland	Cottonwood - Peachleaf Willow Floodplain Woodland	G3G4	S3			
Populus deltoides / Pascopyrum smithii - Panicum obtusum Forest	Plains Cottonwood/western Wheatgrass-vine Mesquite	G2	S2			
Populus deltoides / Sporobolus airoides Forest	Plains Cottonwood/alkali Sacaton	G3	S2			
Populus deltoides / Sporobolus cryptandrus Forest	Plains Cottonwood/Sand Dropseed	G1G2 Q	S1S2			
Rhus trilobata - Philadelphus microphyllus Shrubland	Shrubland	GU	S2			
Salix exigua / Barren Shrubland		G5	S5			
Salix exigua / Eleocharis palustris Shrubland	Coyote Willow/spikerush	GU	S2S4			
Salix exigua / Mesic Graminoids Shrubland	Sandbar Willow / Mesic Graminoids Shrubland	G5	S5			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Salix exigua / Schoenoplectus pungens Shrubland	Coyote Willow/bulrush	GU	S2S4			
Sarcobatus vermiculatus / Bouteloua gracilis Shrubland	Black Greasewood / Blue Grama	G1Q	SU			
Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Heraceous Vegetation	Western Great Plains Little Bluestem Mixedgrass Prairie	G3	S2			
Schoenoplectus pungens Heraceous Vegetation	Bulrush Wet Meadow	G3G4	S3			
Sporobolus airoides - Panicum obtusum Heraceous Vegetation		G2	S2			
Sporobolus airoides Southern Plains Heraceous Vegetation	Alkali Sacaton Southern Plains Grassland	G3Q	S3			
Stipa comata - Bouteloua gracilis Heraceous Vegetation	Needle-and-Thread - Blue Grama Mixedgrass Prairie	G5	S2S3			

Sites of Biodiversity Significance

There are a total of 34 Potential Conservation Areas (PCAs) within or overlapping the Southeast Colorado project area (Table 8, Figures 13 and 14). Of those 34 PCAs, 21 are either new or have been updated based on the 2007 field work and are highlighted in this report. Of the 21 highlighted here, 13 are new and were based entirely on the 2007 inventory work, while another 8 were preexisting and were updated with data from the 2007 work. While all 34 of the PCAs in the project area are listed in this report, only the 21 that are new or updated have been highlighted. Additional information is needed to evaluate and revise the other PCAs listed.

Of the 21 PCAs highlighted in the report:

- Nine are of very high biodiversity significance (B2),
- Eight are of high biodiversity significance (B3),
- One is of moderate biodiversity significance (B4), and
- Three are of general biodiversity significance (B5).

The nine B2 PCAs, support excellent to good occurrences of the following globally imperiled (G2) animals, plants, plant communities:

- East Table Breaks—Arkansas Valley evening-primrose (*Oenothera harringtonii*) and single-head golden weed (*Oonopsis foliosa var. monocephala*),

- Luning Promontory— Arkansas Valley evening-primrose (*Oenothera harringtonii*),
- Picketwire Canyon— mountain plover (*Charadrius montanus*) and triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*),
- Poitrey Arroyo— Arkansas Valley evening-primrose (*Oenothera harringtonii*) and single-head golden weed (*Oonopsis foliosa var. monocephala*),
- Purgatoire Canyon— triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*),
- Smith Hollow— Colorado blue butterfly (*Euphilotes rita coloradensis*),
- Timpas South— Arkansas Valley evening-primrose (*Oenothera harringtonii*) and single-head golden weed (*Oonopsis foliosa var. monocephala*),
- Upper Averson Canyon— Colorado blue butterfly (*Euphilotes rita coloradensis*), and
- West Point— Rocky Mountain bladderpod (*Lesquerella calcicola*) and xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation).

The eight B3 PCAs, support excellent to poor occurrences of the following globally vulnerable (G3) animals, plants, plant communities:

- Carrizo Tributary Canyon— Fendler cloak-fern (*Argyrochosma fendleri*),
- Chacuaco Rimrock— dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*),
- Comanche Grassland— mountain plover (*Charadrius montanus*), swift fox (*Vulpes velox*), long-billed curlew (*Numenius americanus*), and black-tailed prairie dog (*Cynomys ludovicianus*),
- Purgatoire Mesas— mountain mahogany shrubland community (*Cercocarpus montanus / Hesperostipa comata*), mountain mahogany shrubland community (*Cercocarpus montanus / Hesperostipa neomexicana*), silver beard grass grassland community, (*Bothriochloa laguroides* ssp. *torreyana*), shortgrass prairie, (*Bouteloua eriopoda - Pleuraphis jamesii*),
- Purgatoire River and Tributaries— plains leopard frog (*Rana blairi*), Fendler cloak-fern (*Argyrochosma fendleri*),
- Round Top Hill— single-head goldenweed (*Oonopsis foliosa* var. *monocephala*),
- Southern Purgatoire— mountain plover (*Charadrius montanus*), swift fox (*Vulpes velox*), and
- Upper Bachicha Creek— Arkansas Valley evening-primrose (*Oenothera harringtonii*).

The four B4 and B5 PCAs, support good to fair occurrences of the following globally secure (G4-G5) animals, plants, plant communities:

- Perly Uplands— New Mexico feathergrass grassland community (*Hesperostipa neomexicana*),
- Flathead Canyon— canyon treefrog (*Hyla arenicolor*), plains leopard frog (*Rana blairi*),
- Stormy Point— green toad (*Bufo debilis*), Couch's Spadefoot (*Scaphiopus couchii*)
- Tobe Headwaters— prairie violet (*Viola pedatifid*a).

Table 8. Potential Conservation Areas in Southeast Colorado.

Potential Conservation Area	Biodiversity Rank
East Table Breaks	B2
Luning Promontory	B2
Picketwire Canyon	B2
Poitrey Arroyo	B2
Purgatoire Canyon	B2
Smith Hollow	B2
Timpas South	B2
Upper Averson Canyon	B2
West Point	B2
Carrizo Tributary Canyon	B3
Chacuaco Rimrock	B3
Comanche Grassland	B3
Purgatoire Mesas	B3
Purgatoire River and Tributaries	B3
Round Top Hill	B3
Southern Purgatoire	B3
Upper Bachicha Creek	B3
Perly Uplands	B4
Flathead Canyon	B5
Stormy Point	B5
Tobe Headwaters	B5
Not presented in this report:	
Cobert Mesa	B2
Jesus Mesa	B2
Southwest Pinon Canyon Maneuver Site	B2
Central Arkansas Playas	B3
Dinosaur Track Greasewood Flat	B3
Gotera Canyon	B3
Gotera Rincon	B3
Model	B3
Packers Gap North	B3
Vogel Canyon	B3
Cobert Canyon	B4
Arkansas River	B5

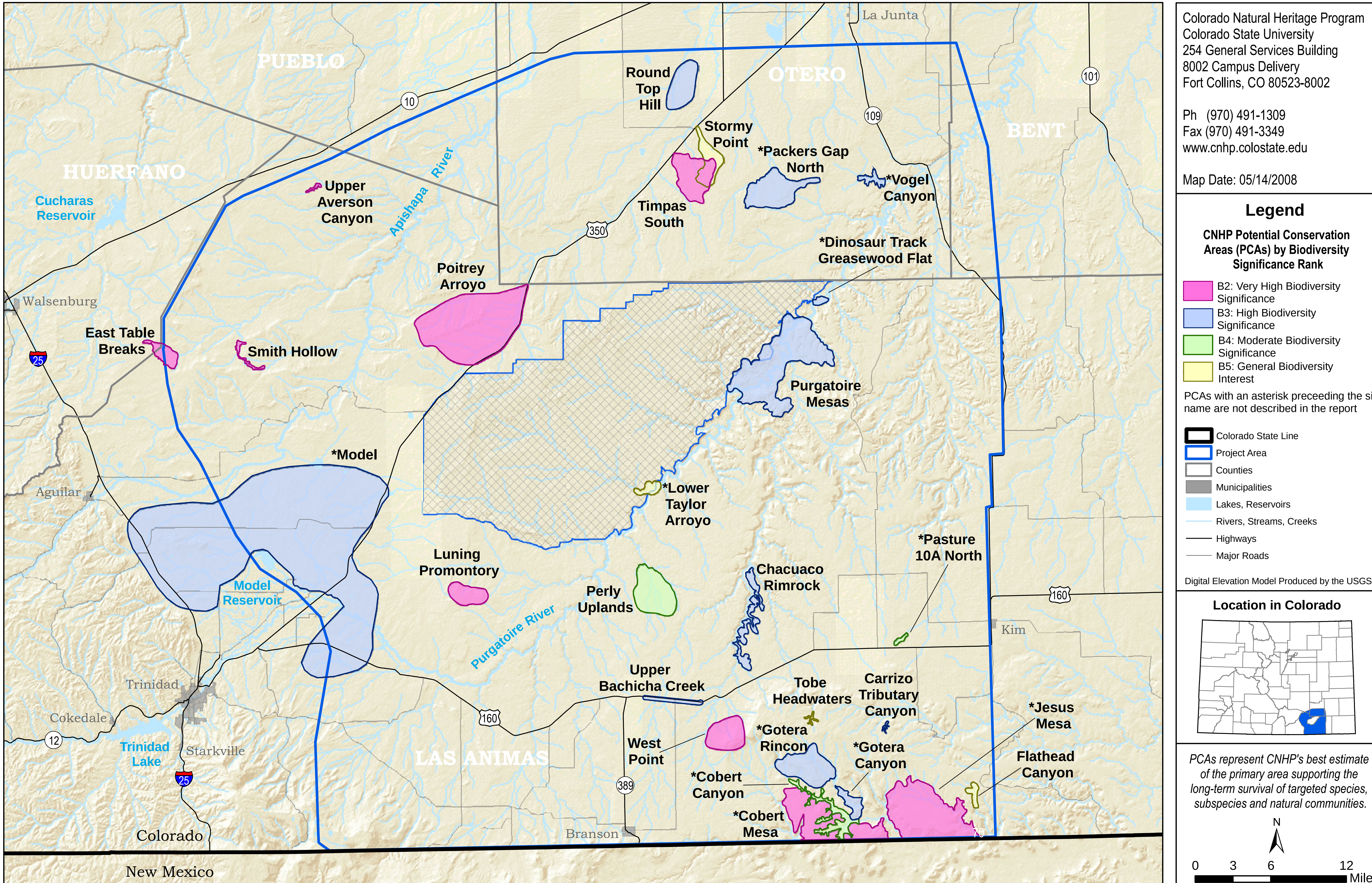


Figure 13a. CNHP Potential Conservation Areas (see Figure 13b for larger sized PCAs).

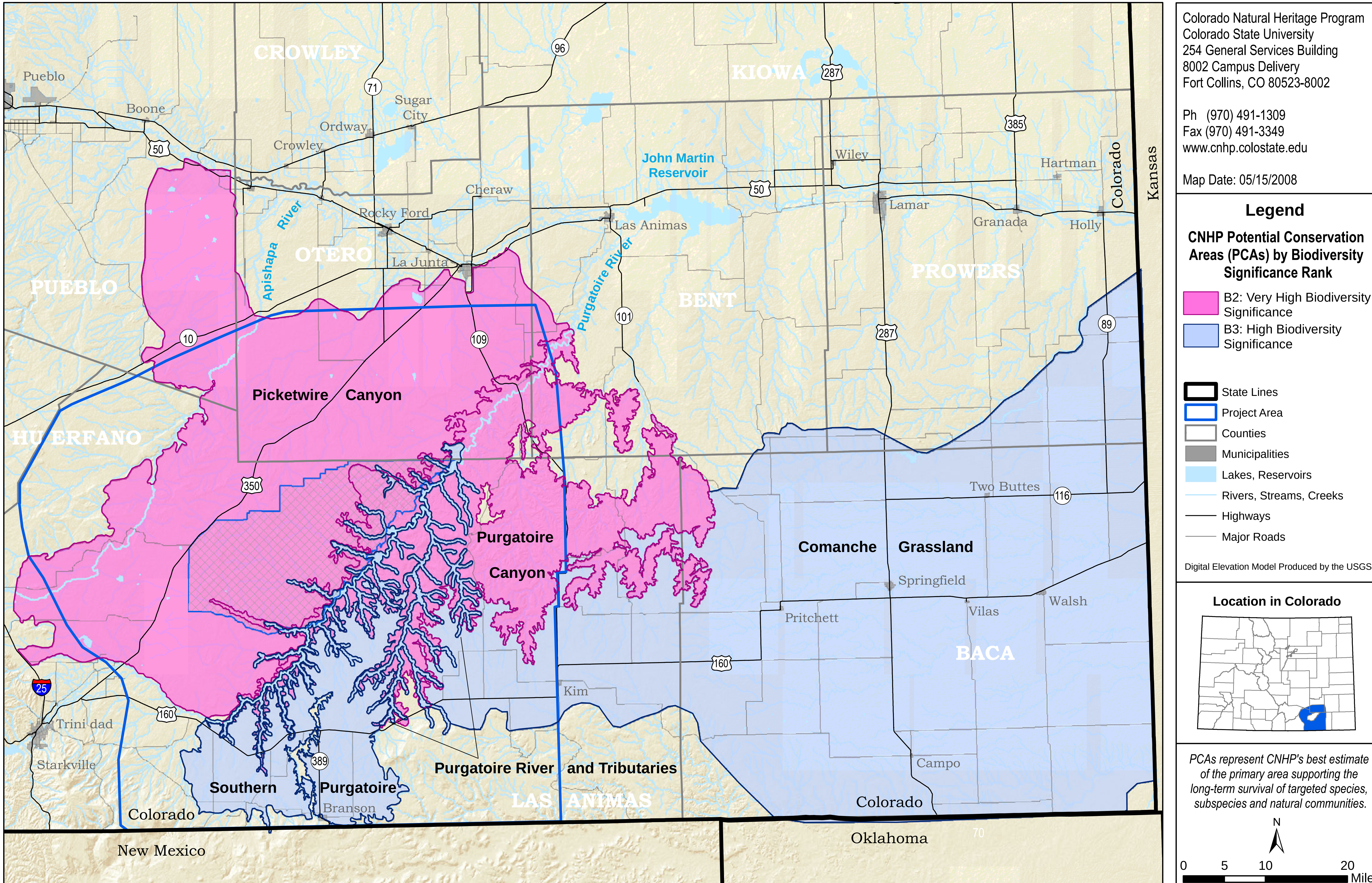


Figure 13b. CNHP Potential Conservation Areas (see Figure 13a for smaller sized PCAs).

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

Biodiversity Rank: B#
The overall significance of the PCA in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see *Natural Heritage Ranking System* section for more details.
Protection Urgency Rank: P#
A summary of major land ownership issues that may affect the long-term viability of the PCA and the element(s).
Management Urgency Rank: M#
A summary of major management issues that may affect the long-term viability of the PCA and the element(s).

USGS 7.5-minute Quadrangle name(s): A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.
Size: Expressed in acres.
***Elevation:** Expressed in feet.
General Description: A brief narrative of the topography, hydrology, vegetation, and current use of the potential conservation area.
***Key Environmental Factors:** A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.
***Climate Description:** Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, temperature and precipitation patterns is included.
***Land Use History:** General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.
***Cultural Features:** Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.
Biodiversity Significance Rank Comments: A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the PCA, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 1 for explanations of ranks and Table 2 for legal designations.
Boundary Justification: Justification for the location of the proposed PCA boundary delineated in this report, which includes all known occurrences of natural heritage resources and, in some cases, adjacent lands required for their protection.
***Protection Urgency Rank Comments:** Brief comments to justify the urgency rating assigned to the PCA.
***Protection Comments:** Brief comments to indicate protection needs assigned to the PCA.

***Management Urgency Rank Comments:** Brief comments to justify the urgency rating assigned to the PCA.
***Management Needs Comments:** Brief comments to justify the management needs assigned to the PCA.
***Land Use Comments**: Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.
***Natural Hazard Comments**: If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.
***Exotic Species Comments**: A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance, and their potential effect on the viability of the targeted elements within the PCA.
***Offsite Considerations:** Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.
***Information Needs**: A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

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

East Table Breaks

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Pryor SE

Size: 1,728 acres (699 ha) **Elevation:** 6,200 - 6,500 ft. (1,890 - 1,981 m)

General Description: The site occupies the top, side slope and valley bottom of a northeast facing topographic break at the headwaters of the box canyon tributary of the Tejano Arroyo. The tableland to the west breaks at the headwater divide of the box canyon tributaries which create the valley that forms the east side of the site. Vegetation is a mix of shortgrass prairie and rocky shrubland.

Key Environmental Factors: Surficial geology is calcareous Niobrara shale (Tweto 1979). The soil type includes the Manzanola, Valent, and Kim series. These three series are described as very deep, well drained soils that formed in alluvial and eolian materials derived from sedimentary rock. Specifically, "the Valent series consists of very deep excessively drained soils that formed in mixed eolian sands. The Manzanola series consists of very deep, well drained soils that formed in alluvial materials derived from sedimentary rock. The Kim series consists of very deep, moderately permeable, well drained soils that formed in alluvium and mixed eolian and alluvial material derived from sandstone and shale" (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The private ranch owner continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of the globally imperiled (G2G3/S2S3) Arkansas Valley evening primrose (*Oenothera harringtonii*) and a good (B-ranked) occurrence of the globally imperiled (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*).

Natural Heritage element occurrences at the East Table Breaks PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G2G3	S2S3			USFS	B	2007-08-07
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2007-08-07

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

Boundary Justification: The boundary is drawn to encompass the rare plants and the topographic and edaphic features upon which they depend. It includes the escarpment from the top of the tableland down across a portion of the valley floor. Although suitable habitat is nearby, this boundary as drawn represents the minimum area required to protect these occurrences.

Protection Urgency Rank Comments (P4): The site is on private ranch land. The current livestock grazing regimes appear compatible with the continued viability of the rare plants. Protection of the elements could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements, etc.).

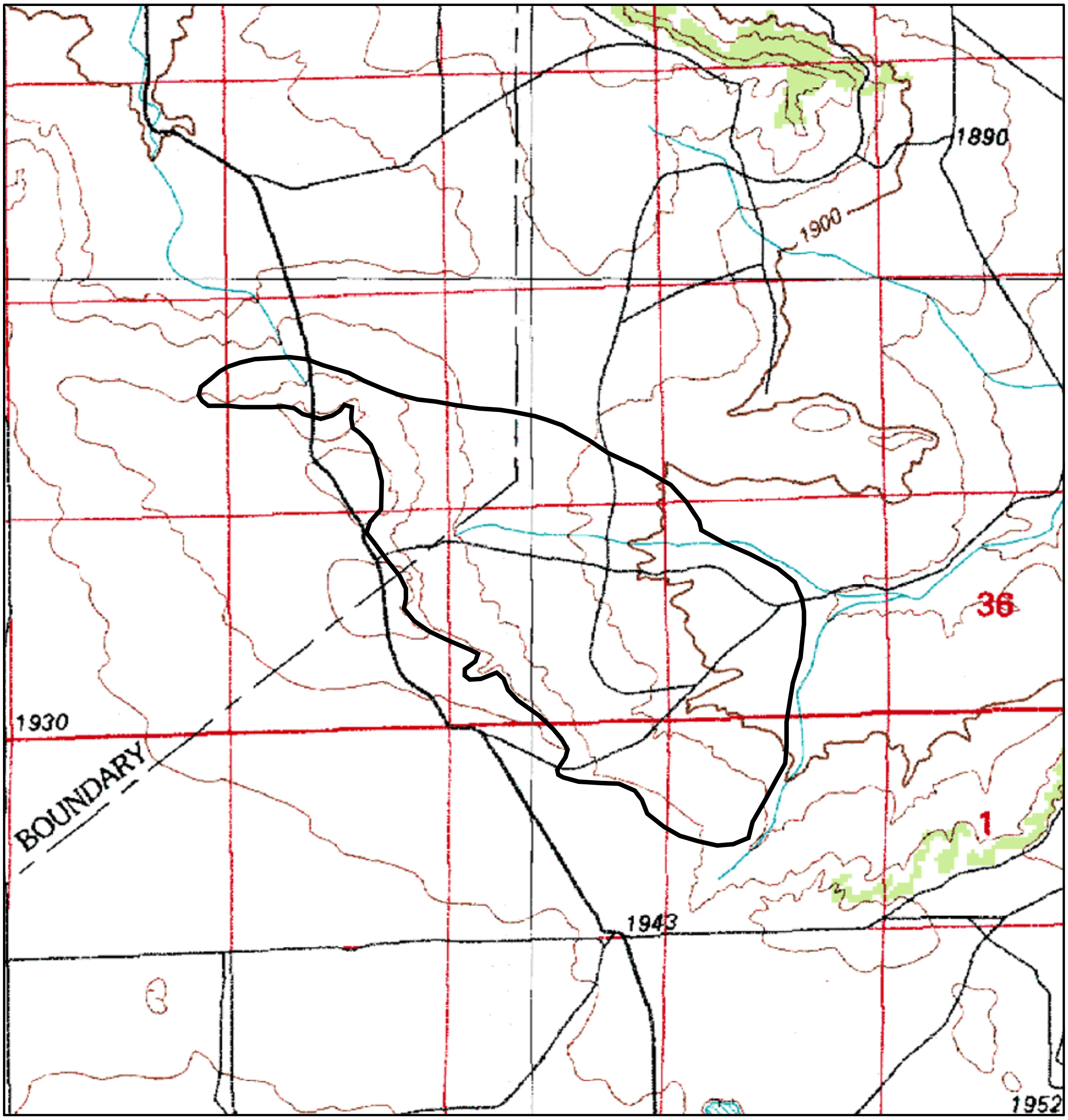
Management Urgency Rank Comments (M4): The current dominant land use of livestock grazing appears compatible with continued viability of the biological resources.

Management Needs: Removal or thinning of juniper woodlands should only be conducted when clear indications exist that the density and extent of the woodlands are well outside the normal range of variation for that community type. When and if undertaken, such actions should be conducted to minimize soil disturbance, propagation of non-native exotics, fragmentation or direct destruction of the elements of concern.

Land Use Comments: The existing land use of livestock grazing appears compatible with the continued viability of the element. Appropriate timing, intensity of grazing and periodic prescribed burning can be valuable and necessary management tools.

Version Author: Stevens, J.E.

Version Date: 04/04/2008



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Map Date: 04/03/2008

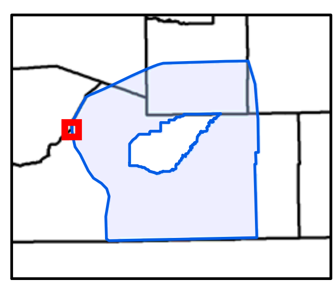
Legend

PCA Boundary

Walsenburg, 37104-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 1. East Table Breaks Potential Conservation Area, B2: Very High Biodiversity Significance

Luning Promontory

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Lambing Spring, Model

Size: 2,665 acres (1,079 ha) **Elevation:** 5,400 - 5,675 ft. (1,646 - 1,730 m)

General Description: Luning Promontory occupies the top and upper erosional slopes of a flat topped outcrop of the Niobrara formation that rises above the surrounding landscape south of Luning Arroyo. The site is underlain by layers of the Carlile and Graneros shales and the Greenhorn limestone formations. The expression and ongoing erosion of these calcareous formations provides the edaphic characteristics favorable to the rare plants.

Key Environmental Factors: Surficial geology is a combination of calcareous shales and limestones and influences soil characteristics and hence vegetation (Tweto 1979). Soil type is limited to the Manzanola and Kim series, both of which are described as very deep, well drained soils that formed in alluvial materials derived from sandstones and shales (SCS 1994). Both the Manzanola and Kim Series soils are calcareous.

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The current private ranch owner continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B2): The site supports an excellent (A-ranked) occurrence of the globally imperiled (G2G3/S2S3) Arkansas Valley evening primrose (*Oenothera harringtonii*).

Natural Heritage element occurrences at the Luning Promontory PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G2G3	S2S3			USFS	A	2007-08-02

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

Boundary Justification: The boundary is drawn to contain the gravelly shale bearing upper slopes of the topographic rise that supports the rare plants. Although the shaliferous geology thought to be important to this species (Carlisle and Carneros shale and Greenhorn limestone) also occurs outside of the site, the boundary as drawn covers the minimum extent needed to maintain the known occurrence.

Protection Urgency Rank Comments (P4): The site is on private land. Current livestock grazing regimes appear compatible with the continued viability of the rare plants. Protection of the element could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements, etc.).

Management Urgency Rank Comments (M4): The current dominant land use of livestock grazing appears compatible with continued viability of the biological resources. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock.

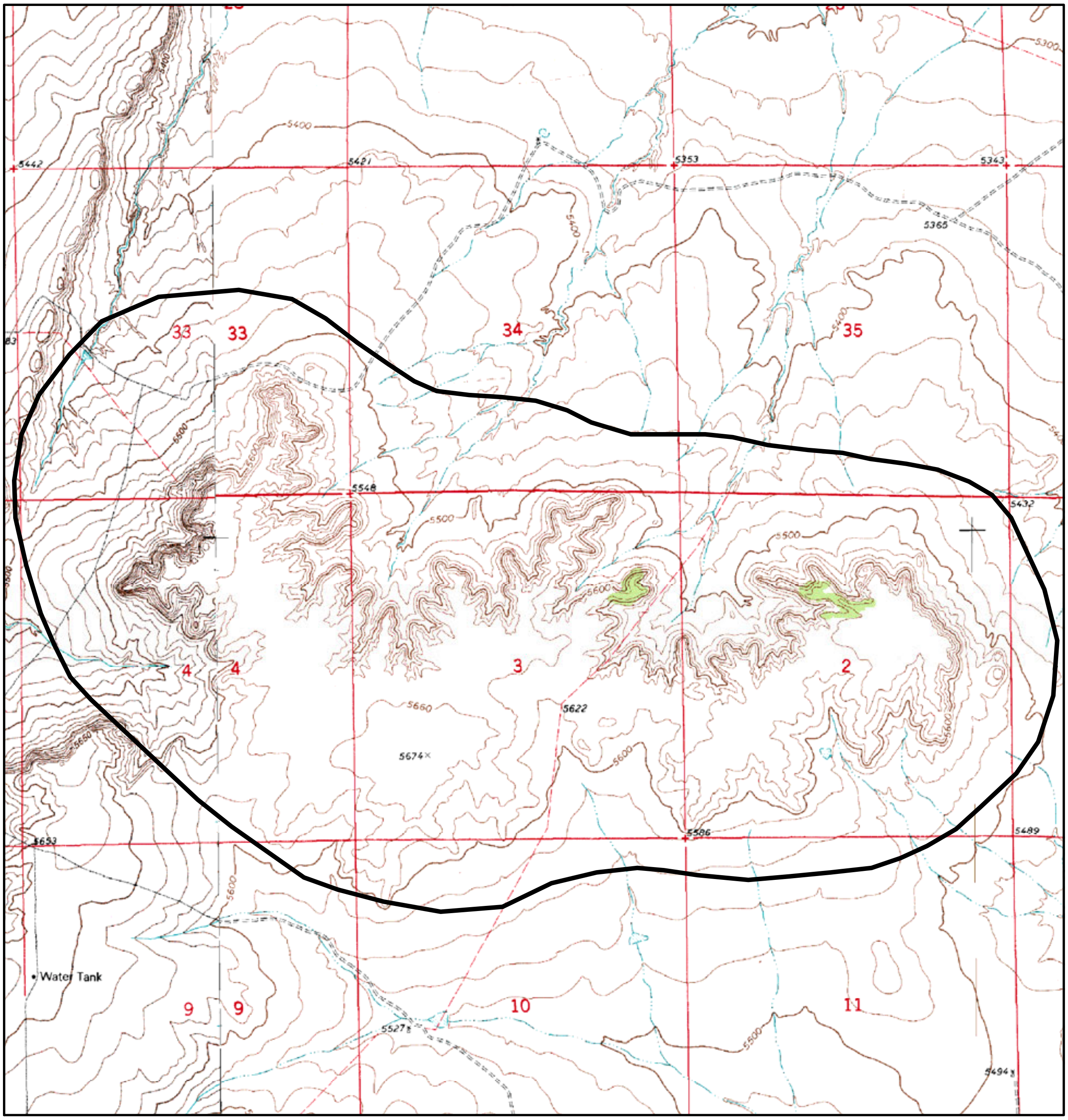
Management Needs: Manage the site to prevent direct physical destruction of the habitat. Mining or other excavation of the soils and rock should be avoided.

Land Use Comments: Dominant land use is livestock grazing. Continue appropriate grazing regime. Appropriate timing, intensity of grazing and possibly periodic prescribed burning can be valuable and necessary management tools.

Information Needs: There are anecdotal indications that a very large occurrence of the globally imperiled rayless goldenweed (*Oonopsis foliosa* var. *monocephala*) also occurs throughout the area. Additional survey work to verify the existence and character of the occurrence is needed.

Version Author: Stevens, J.E.

Version Date: 04/03/2008



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Map Date: 04/03/2008

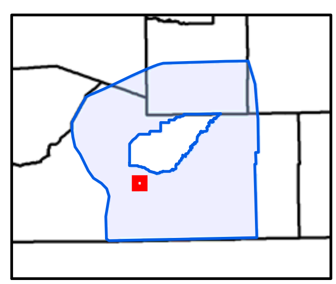
Legend

PCA Boundary

Lambing Spring, 37104-C1
Model, 37104-C2

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 2. Luning Promontory Potential Conservation Area, B2: Very High Biodiversity Significance

Picketwire Canyon

Biodiversity Rank - B2: Very High Biodiversity Significance

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

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

U.S.G.S. 7.5-minute quadrangles: Apishapa Bridge, Bates Lake, Bloom, Brown Sheep Camp, Delhi, Doss Canyon North, Doss Canyon South, Earl, Hackamore Ranch, Hawley, Hidden Valley Ranch, Higbee, Hoehne, Jones Lake Spring, La Junta, La Junta SE, La Junta SW, Lambing Spring, Little Dome, Lockwood Arroyo, Ludlow, Model, Myers Canyon, O V Mesa, Packers Gap, Painted Canyon, Patterson Crossing, Riley Canyon, Rock Crossing, Sanford Hills, Seven Lakes Reservoir, Sheep Canyon, Snowden Lake, Stage Canyon, Sun Valley Ranch, Thatcher, The Hogback, Thompson Arroyo, Timpas, Timpas NE, Timpas NW, Timpas SW, Trementina Canyon, Trinchera Cave, Turkey Canyon, Tyrone, Vega Corral, Yellowbank Creek

Size: 1,215,079 acres (491,727 ha) **Elevation:** 4,020 - 6,450 ft. (1,225 - 1,966 m)

General Description: The site is dominated by rolling grasslands with hills of juniper that also contain occasional stands of pinon pine. It is approximately 72% grassland or grass/forb/cacti mix, with moderate amounts of mixed shrubland (roughly 16%), small amounts of pinon - juniper (roughly 5%) and trace amounts of greasewood, riparian/open water and agricultural land. Mountain plover, ferruginous hawk, Cassin's sparrow, long-billed curlew, burrowing owl, McCown's longspur, Lewis's woodpecker, triploid Colorado checkered whiptail, massasauga, and a maternity colony of Townsends big-eared bats have been observed within the site. Numerous colonies of black-tailed prairie dogs are scattered throughout as are records of swift fox, a predator of prairie dogs. Priority plant communities in the area include alkali sacaton - vine mesquite (*Sporobolus airoides - Panicum obtusum*), Great Plains mixed grass prairie (*Bouteloua curtipendula - Schizachyrium scoparium* - (*Eriogonum flavum* and *Schizachyrium scoparium - Bouteloua curtipendula*) and shortgrass prairie (*Bouteloua gracilis - Hilaria jamesii* and *Atriplex canescens / Bouteloua gracilis*). Three rare butterflies have been observed and include the Colorado blue, simius roadside skipper, and rhesus skipper. A State rare reptile, the Texas horned lizard, has also been documented.

Key Environmental Factors: The rich diversity of species and plant communities is mostly attributable to the presence of an unfragmented native shortgrass prairie that has experienced minimal disturbance.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ^{o}F, and summer average maximum temperatures in July and August are near or above 90 ^{o}F (HPRCC 2008).

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of the Purgatoire Canyon is believed to have been inhabited by people for as long as 5,000 years, and many native tribes lived in or visited the area. The first people of European descent to enter the area were with the Coronado expedition of 1540. Although considered part of Spain, the area remained sparsely populated by Euro-Americans until about 1821 when Mexico received independence from Spain and trade began between Santa Fe and Missouri. Soon thereafter, Spanish émigrés began to colonize the larger canyons. They built small settlements and ranches and raised herds of goats and sheep. The Purgatoire Canyon itself became an alternate trade route, and European settlement increased to a peak of about 400 people in the canyon by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dry-land-farming homesteaders fenced the land. In the 1920s and 1930s, the Purgatoire Canyon area was affected by the Dust Bowl and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continued on most private lands. The creation of the Department of the Army's Pinon Canyon Maneuver Site in the 1980s removed grazing from that site, however, cattle grazing continues as the primary land use on adjacent private lands.

Biodiversity Significance Rank Comments (B2): The biodiversity rank is based on excellent to good (AB-ranked) and good (B-ranked) occurrences of the triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*), a globally imperiled (G2G3/S2) lizard. The site also supports good to fair (BC-ranked) and extant occurrences of the globally imperiled (G2/S2) mountain plover (*Charadrius montanus*), good (B-ranked) and extant occurrences of the globally vulnerable (G3/S3) swift fox (*Vulpes velox*), excellent (A-ranked) and good (B-ranked) occurrences of the state rare (G4/S3) black-tailed prairie dog (*Cynomys ludovicianus*), excellent (A-ranked) and good (B-ranked) occurrences of the state rare (G4/S3B) ferruginous hawk (*Buteo regalis*), and good (B-ranked) and extant occurrences of the state rare (G5/S2B) long-billed curlew (*Numenius americanus*).

Natural Heritage element occurrences at the Picketwire Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	BC	2003-05-99
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1988-07-25
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1992-06-30
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-05-99
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-08-24
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1995-05-21
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	2003-05-12
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	2003-08-17
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	2007-06-17
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	A	1998-07-24
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	B	1998-07-24
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	B	2003-04-31
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	C	2007-06-19
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	C	2007-07-15
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1988-06-15
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1988-99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1989-06-03
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1992-06-04
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1992-06-05
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1993-05-26

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	E	1995-07-01
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	E	1997-07-04
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	E	1998-07-24
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	E	1998-07-26
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	E	2003-06-16
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	F	1995-07-01
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	H	1977-99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	H	1978-99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	H	1979-99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS	X	1979-99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS		1995-07-07
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S4N		SC	BLM/USFS		1996-06-05
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/USFS	B	2007-07-26
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/USFS	E	2007-06-17
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	B	2004-09-17
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	B	2007-08-09
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	1995-08-04
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2002-06-11
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2002-06-28
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2002-06-29

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2002-07-20
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2003-06-04
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	B	2002-06-11
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	B	2002-06-26
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	B	2007-07-24
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	B	2007-07-25
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	C	2002-06-28
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	C	2007-07-25
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	C?	2004-01-15
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	CD	2004-01-15
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	CD	2007-06-25
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	D	2002-06-11
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	D	2002-06-26
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	D	2002-07-18
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	D	2002-07-19
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	D	2007-06-25
Natural Communities	Bouteloua gracilis Herbaceous Vegetation	Blue Grama Short Grass Prairie	G4Q	S4				B	2002-08-07
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		AB	2007-07-16

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2002-06-28
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		E	1991-07-14
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		E	1994-06-06
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		E	2002-09-29

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

Boundary Justification: The boundary is drawn with a number of species in mind including mountain plover, swift fox, ferruginous hawk, long-billed curlew, and triploid Colorado checkered whiptail. Prairie dog towns in the grasslands and hills of sparse juniper are included, as well as swift fox, a predator of the prairie dogs. To the east and south the boundary is defined by the Purgatoire Canyon, which acts as sufficient barrier to the dispersal of swift fox. Boundary was drawn using Landsat ETM+ satellite imagery and 25m Colorado Vegetation Classification data (CDOW).

Protection Urgency Rank Comments (P3): The site is a mixture of private land, State land, USFS land (Comanche National Grassland) and Department of Army land (PCMS). The publicly owned parcels are ostensibly protected. Protection on private parcels could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

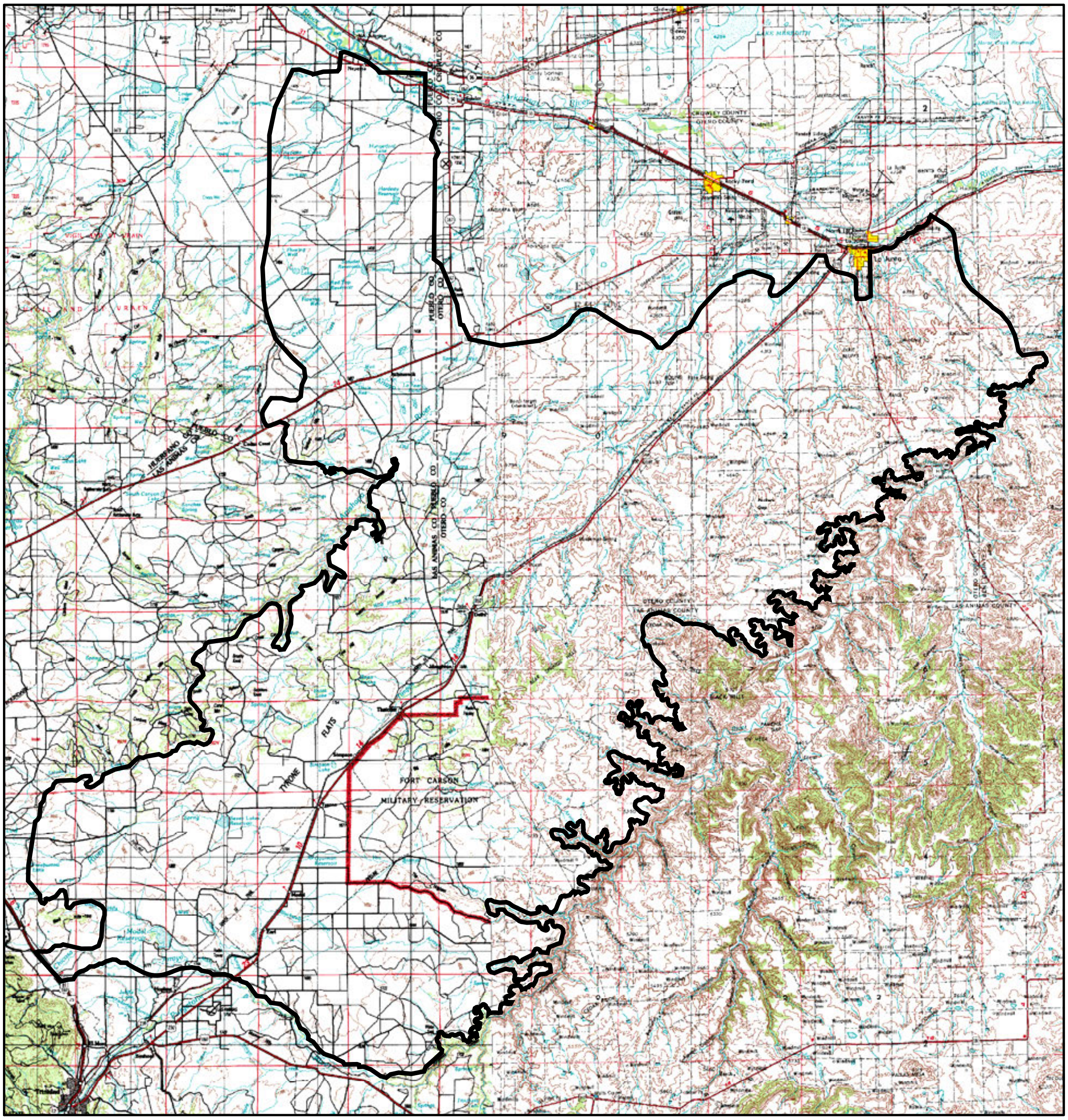
Protection Comments: The area has multiple land owners, including Department of Army lands in Pinon Canyon Maneuver Site and an abundance of large, privately owned ranches. The existing land use is largely compatible with the rare species documented in the site.

Management Urgency Rank Comments (M4): Conservation of the Colorado checkered whiptail population is dependent upon preventing large scale disturbances to the juniper woodland (e.g. logging or catastrophic crown fire). Mountain plover populations require grasslands where the vegetation is short in height as is maintained through grazing by wildlife, livestock, or prairie dogs or by fires. The removal of grazing with subsequent increases in vegetation height results in habitat that is unsuitable for plover.

Management Needs: Protection of the Colorado checkered whiptail requires preservation of the juniper and pinon - juniper woodland. Large scale disturbances to the woodland including logging, the building of roads or structures should be avoided. Changes in fire regime that bring about an increase in fire extent or frequency would be detrimental to the whiptail. As is the case in many other areas, the driving conservation issues in the shortgrass prairie are habitat loss and habitat alteration. Ferruginous hawk and swift fox are very sensitive to disturbance and need big, unfragmented landscapes (CSP Bird Working Group 2004). Consequently, conversion of the remaining shortgrass prairie to other land forms should be prevented as should fragmentation of the existing large acreages of shortgrass prairie. Management should replicate the timing, intensity, and landscape distribution of the natural disturbances that shaped the shortgrass prairie including grazing and fire. In practice, however, modern agriculture tends to spread out grazing intensity evenly, producing a comparatively homogeneous landscape and fire has been nearly eliminated from the landscape. For the purposes of bird conservation, some grassland parcels should be grazed heavily and others not at all, to replicate the heterogeneous landscape historically created by climate and native species grazing. Currently, fire suppression and certain grazing patterns in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. Protecting the nest sites of the ferruginous hawk from disturbance during nesting, maintaining populations of black-tailed prairie dogs (major prey of ferruginous hawk) is important. During winter, SE Colorado becomes important for maintaining ferruginous hawk that prey on prairie dog colonies (CSP Bird Working Group 2004).

Land Use Comments: Historically the area was grazed, especially by cattle, but some sheep grazing previously occurred. Part of this site is currently a U.S. Army training area.

Version Author: Sovell, J.R.
Version Date: 04/16/2008



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Map Date: 04/18/2008

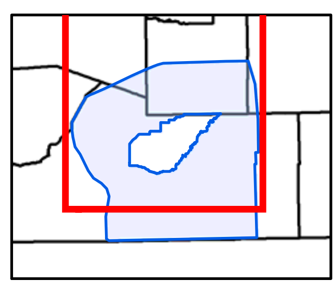
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1
Lamar, 38102-A1
Pueblo, 38104-A1

1x2 Degree Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 3. Picketwire Canyon Potential Conservation Area, B2: Very High Biodiversity Significance

Poitrey Arroyo

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Bates Lake, Delhi, Sun Valley Ranch, Thatcher

Size: 23,144 acres (9,366 ha) **Elevation:** 5,000 - 5,820 ft. (1,524 - 1,774 m)

General Description: This site is a mix of short and mid grass prairie and open juniper woodlands located primarily on the Walking Y Ranch. It is bordered on the northeast and north by dirt surface county roads. The eastern edge is bounded by Colorado Highway 350. It is centered on the rise known as Tyler Hill and includes the headwater portions of numerous intermittent streams that drain to the north and east. The habitat in the northern and eastern portions of the site are comprised of silty soil grasslands. The western side of the site that includes the top and upper slopes of Tyler Hill is comprised of a coarse textured gravelly shale soil. Plants occur along roads and throughout grasslands and woodlands and are extremely abundant.

Key Environmental Factors: Surficial geology is a combination of calcareous shales and limestones and heavily influences soil characteristics and hence vegetation (Tweto 1979). Soil type is limited to the Manzanola Series, which are described as very deep, well drained soils that formed in alluvial materials derived from sedimentary rock (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ^{o}F occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The Walking Y Ranch continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B2): The site supports an excellent (A-ranked) occurrence of the globally imperiled (G2G3/S2S3) Arkansas Valley evening primrose (*Oenothera harringtonii*), an excellent (A-ranked) occurrence of the globally imperiled (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var.

monocephala), fair (C-ranked) and poor (D-ranked) occurrences of the state imperiled (G5T4?/S1) lace hedgehog cactus (*Echinocereus reichenbachii* var. *perbellus*) and a fair (C-ranked) occurrence of the state rare (G4/S2) long-hood milkweed (*Asclepias macrotis*).

Natural Heritage element occurrences at the Poitrey Arroyo PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G2G3	S2S3			USFS	A	2007-06-16
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				A	2007-06-16
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2				C	2007-06-17
Vascular Plants	Echinocereus reichenbachii var. perbellus	lace hedgehog cactus	G5T4?	S1				B	2007-06-16
Vascular Plants	Echinocereus reichenbachii var. perbellus	lace hedgehog cactus	G5T4?	S1				C	2007-06-15

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

Boundary Justification: The boundary is drawn to encompass the rare plants and the surrounding potential habitat formed by the shale and limestone derived soils. Although the geology thought to be important to these elements also occurs outside of the site, the boundary as drawn covers the minimum extent needed to maintain these known populations.

Protection Urgency Rank Comments (P4): The current livestock grazing regimes appear compatible with the continued viability of the biological resources. The site is on private land and currently does not provide any formal protection for the elements. Protection of the elements could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements). Because this site is entirely on private land, conservation protection could be relatively simple.

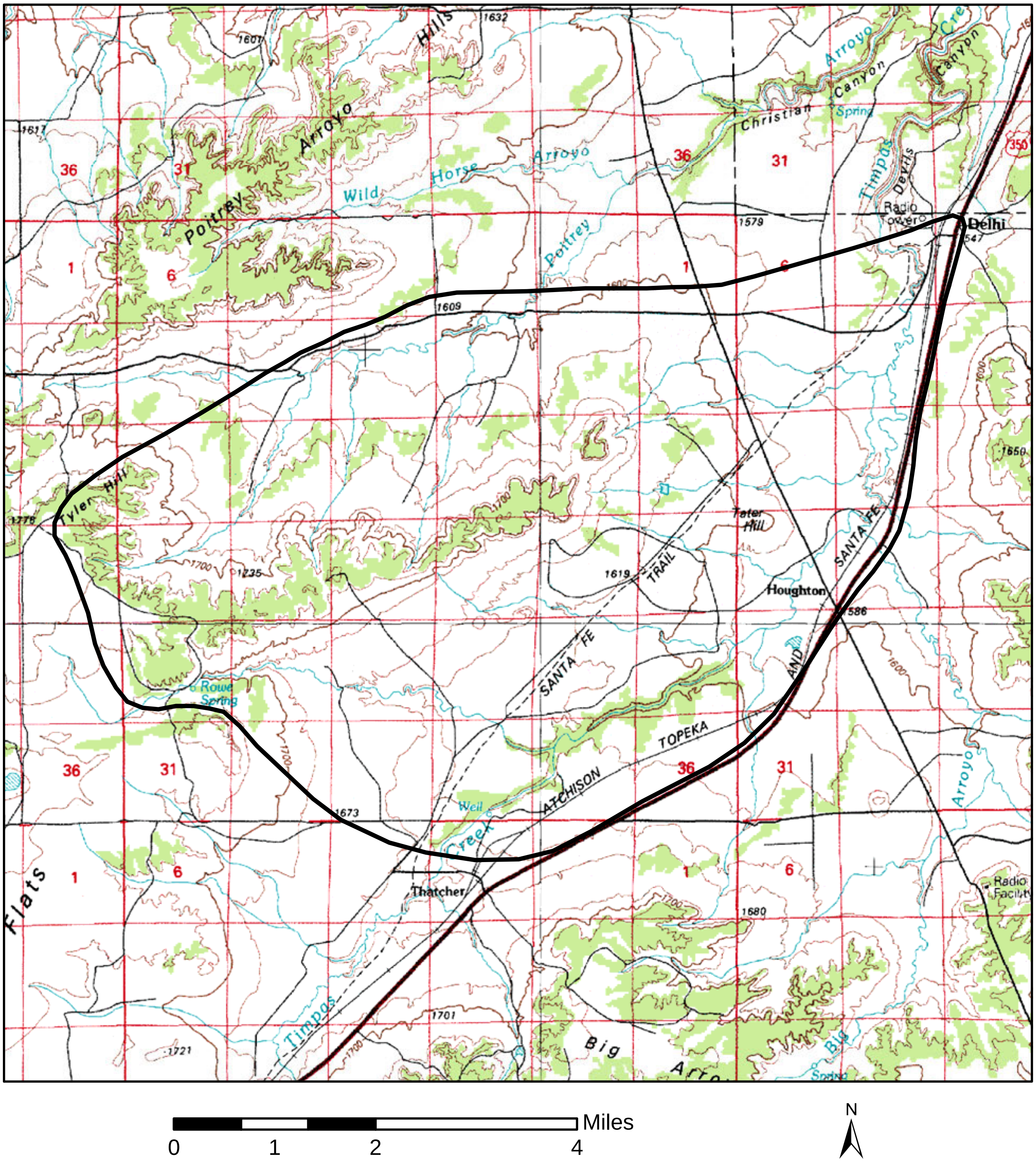
Management Urgency Rank Comments (M4): The current livestock grazing regimes appear compatible with the continued viability of the biological resources. Manage the site to prevent direct physical destruction of the habitat. Mining or other excavation of the soils and rock should be avoided. Maintaining rates of erosion and surface disturbance within the natural range of variation will prevent degradation of the characteristics that support continued viability of the elements. Harvest or thinning of juniper woodlands should only be conducted when clear indications exist that the density and extent of the woodlands are well outside the normal range of variation for that community type. When and if undertaken, such actions should be conducted to minimize soil disturbance, propagation of non-native exotics, fragmentation or direct destruction of the elements of concern.

Management Needs: Although not currently needed, management action may be needed in the future to maintain current quality of element occurrences. Manage the site to prevent direct physical destruction of the habitat. Appropriate timing and intensity of grazing and periodic prescribed burning may be valuable and necessary management tools.

Land Use Comments: Continue appropriate grazing regimes or incorporate periodic burning to stimulate regeneration and maintain species composition.

Version Author: Stevens, J.E.

Version Date: 04/02/2008



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Map Date: 04/03/2008

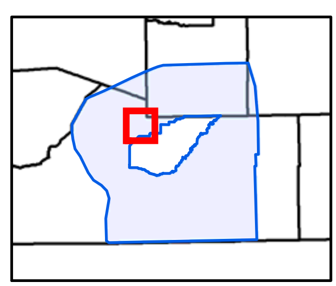
Legend

PCA Boundary

Walsenburg, 37104-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 4. Poitrey Arroyo Potential Conservation Area, B2: Very High Biodiversity Significance

Purgatoire Canyon

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Beaty Canyon, Box Ranch, Brown Canyon, Brown Sheep Camp, Buck Canyon, Cherry Canyon, Clay Ranch, Corbin Canyon, Deora, Doss Canyon North, Doss Canyon South, Higbee, Humbar Spring, Icehouse Canyon, Johnson Canyon, Kim North, La Junta SE, Lambing Spring, Lost Canyon, Miners Peak, Ninaview, O V Mesa, Packers Gap, Painted Canyon, Plug Hat Ranch, Plum Canyon, Riley Canyon, Robbers Roost Canyon, Rock Canyon, Rock Crossing, Sheep Canyon, Stage Canyon, Table Mesa, Tobe, Toonerville, Trementina Canyon, Trinchera, Trinchera Cave, Turkey Canyon, Villegreen, Walker Canyon

Size: 602,990 acres (244,022 ha) **Elevation:** 4,040 - 6,730 ft. (1,231 - 2,051 m)

General Description: The extensive canyon and juniper hills region of southern plains are surprising to the visitor to the area. Rolling grasslands with small ridges suddenly give way to an extensive canyon system. Historical occupation of the area is documented from at least 1,000 years before present. A world class dinosaur trackway illustrates that the area has been biologically significant for many millions of years. The site is bisected by the Purgatoire River, which forms the remarkable Purgatoire Canyon. Side streams have dissected their own smaller canyons. The surrounding hills are covered with juniper woodlands and savannas, often with abundant pinon pine. While the main canyon has largely been utilized heavily by livestock, the side canyons are often relics of time prior to Euro-American occupation of the landscape. To be in Purgatoire Canyon is to be rewarded with abundant solitude. Vegetation is approximately 46% pinon - juniper, 28% grassland or mixed grasses/forbs/cacti, 21% shrubland or shrubs mixed with grass and juniper, 4% greasewood and trace amounts of open water, riparian areas and agricultural lands. Along with gray vireo the site supports populations of the long-billed curlew, rufus-crowned sparrow, triploid Colorado checkered whiptail, a nesting peregrine falcon pair, and Texas horned lizards.

Key Environmental Factors: The pinon - juniper woodland is the key environmental characteristic for both the triploid Colorado checkered whiptail and the gray vireo. Maintaining the ecological integrity of the woodland is important to both species and changes to the fire regime that cause increases in fire frequency would be detrimental to both species.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ºF, and summer average maximum temperatures in July and August are near or above 90 ºF (HPRCC 2008).

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of the Purgatoire Canyon is believed to have been inhabited by people for as long as 5,000 years, and many native tribes lived in or visited the area. The first people of European descent to enter the area were with the Coronado expedition of 1540. Although considered part of Spain, the area remained sparsely populated by Euro-Americans until about 1821 when Mexico received independence from Spain and trade began between Santa Fe and Missouri. Soon thereafter, Spanish émigrés began to colonize the larger canyons. They built small settlements and ranches and raised herds of goats and sheep. The Purgatoire Canyon itself became an alternate trade route, and European settlement increased to a peak of about 400 people in the canyon by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dry-land-farming homesteaders fenced the land. In the 1920s and 1930s, the Purgatoire Canyon area was affected by the Dust Bowl and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continued on most private lands. The creation of the Department of the Army's Pinon Canyon Maneuver Site in the 1980s removed grazing from that site, however, cattle grazing continues as the primary land use on adjacent private lands.

Biodiversity Significance Rank Comments (B2): The site supports numerous excellent (A-ranked) and good (B-ranked) occurrences of the triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*), a globally imperiled (G2G3/S2) lizard. There are also multiple fair (C-ranked) and extant occurrences of the state rare (G4/S2B) gray vireo (*Vireo vicinior*) and the state rare (G5/S2) rufous-crowned sparrow (*Aimophila ruficeps*).

Natural Heritage element occurrences at the Purgatoire Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Vireo vicinior	Gray Vireo	G4	S2B				B	2007-06-06
Birds	Vireo vicinior	Gray Vireo	G4	S2B				C	1994-07-10
Birds	Vireo vicinior	Gray Vireo	G4	S2B				C	2007-05-28
Birds	Vireo vicinior	Gray Vireo	G4	S2B				C	2007-07-29
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1990-06-03
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1991-06-13
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1993-06-08
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1993-06-30
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1993-07-17
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1994-07-14
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	1995-06-17
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	2007-05-30
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	2007-06-09
Birds	Vireo vicinior	Gray Vireo	G4	S2B				E	2007-06-22
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				C	1994-05-14
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				C	1994-05-15
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				C	1994-06-08
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				C	1994-07-07

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				E	2005-06-02
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				E	2007-06-02
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2				E	2007-06-17
Birds	Aimophila ruficeps	Rufous - crowned Sparrow	G5	S2					1994-07-07
Natural Communities	Juniperus monosperma / Bouteloua gracilis Woodland	Foothills Pinyon - Juniper Woodlands	G5	S3S4				AB	1985-07-09
Natural Communities	Juniperus monosperma - (Pinus edulis) / Cercocarpus montanus / Schizachyrium scoparium Woodland	Foothills Pinyon - Juniper Woodlands	GU	SU				B	1985-07-10
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		A	1998-07-25
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		A	2007-06-20
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		AC	2007-07-26
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2007-06-08
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2007-07-12

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2007-07-13
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2007-07-15
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		E	1988-07-09

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

Boundary Justification: The boundary includes the Purgatoire River, the canyon, its slopes and most of the juniper woodland ridges in the vicinity. It was drawn primarily for the triploid Colorado checkered whiptail and the gray vireo. Ecological processes that begin outside of the boundary are critical to the long term ecological health of the site. Boundary was refined using Landsat ETM+ satellite imagery and 25m Colorado Vegetation Classification data (CDOW).

Protection Urgency Rank Comments (P4): The site is mostly private with State lands scattered throughout. Pinon Canyon Maneuver Site also overlaps it to the west. The publicly owned parcels are ostensibly protected. Protection on private parcels could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

Protection Comments: The area has multiple land owners including U.S. Forest Service lands in the Comanche National Grassland, Colorado State Land Board parcels, Department of Army lands in Pinon Canyon Maneuver Site and an abundance of large, privately owned ranches. The existing land use is largely compatible with the rare animals and natural communities.

Management Urgency Rank Comments (M4): Current land uses dominated primarily by livestock grazing are compatible with continued viability of the biological resources. However, conservation of the triploid Colorado checkered whiptail population is dependent upon preventing large scale disturbances to the juniper and pinon - juniper woodland (e.g. logging or fire).

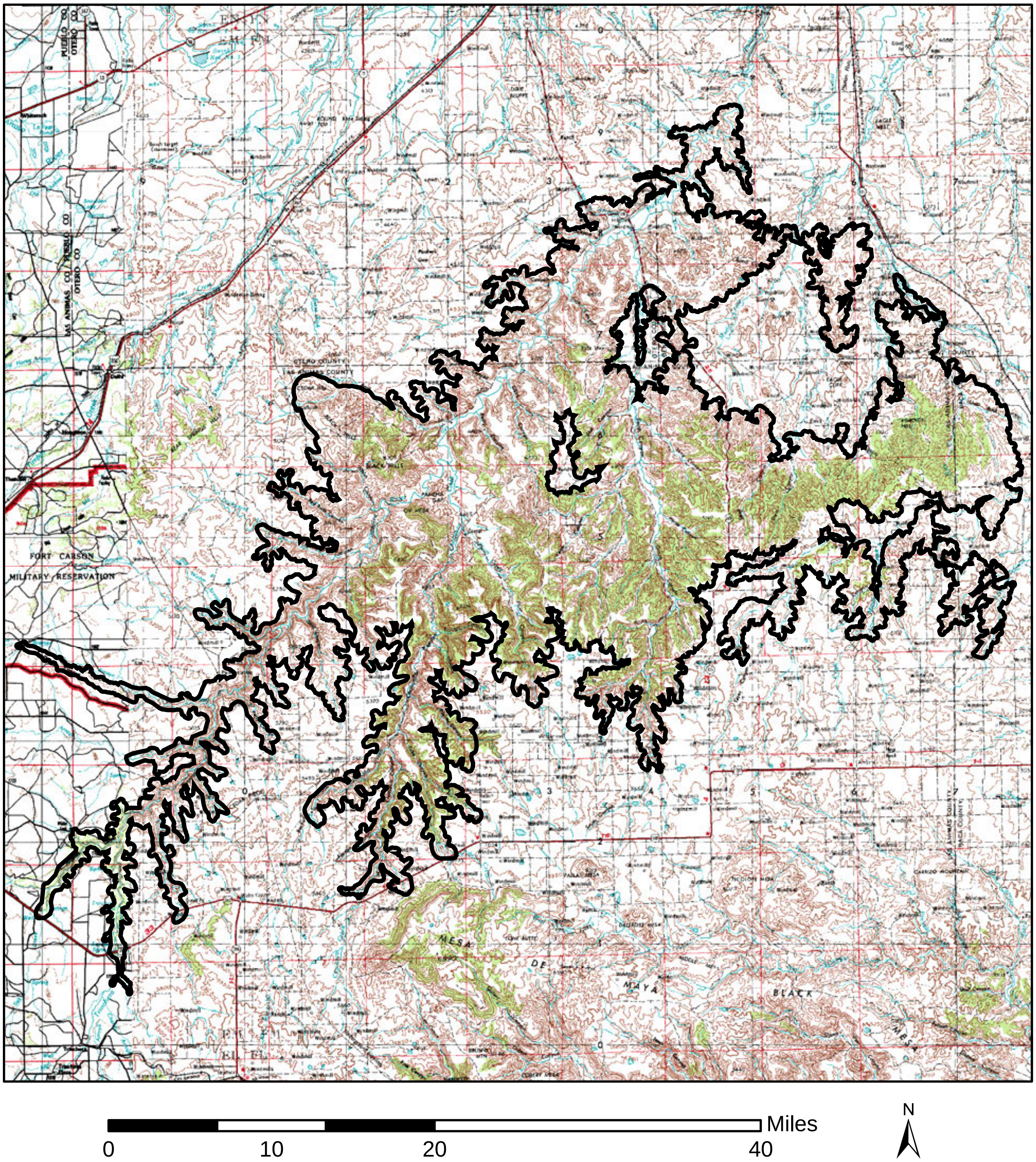
Management Needs: Prevent spread of exotic plants (*Bromus japonicus*, *Kosha*, *Salisola*, *Tamarix*, etc). This will likely require minimizing disturbance to the soil. Changes in fire regime that bring about an increase in fire extent or frequency would be detrimental to all of the animals inhabiting the site.

Land Use Comments: Historically the area was grazed, especially by cattle, but some sheep grazing previously occurred. Grazing disturbance, as seen in the quality of the natural communities, appears to have been less on the tops of the mesas and on slopes.

Natural Hazard Comments: Juniper uplands include steep slopes and cliffs and safety should be considered when hiking within these areas.

Information Needs: Additional surveys are needed on the eastern side of the site to determine the distributional extent of the triploid Colorado checkered whiptail. More information on the dynamics of juniper (*Juniperus monosperma*) woodlands and the effects of fire suppression and historical grazing on significant communities is needed. In addition, more information is needed on the local history of native ungulates and their relationship to more recent grazing by domestic livestock.

Version Author: Sovell, J.R.
Version Date: 04/16/2008



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Map Date: 04/18/2008

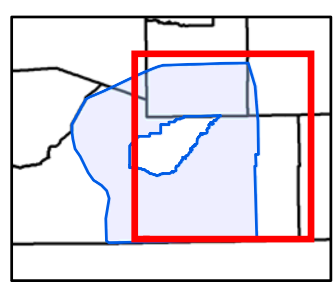
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 5. Purgatoire Canyon Potential Conservation Area, B2: Very High Biodiversity Significance

Smith Hollow

Biodiversity Rank - B2: Very High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Little Dome

Size: 478 acres (193 ha) **Elevation:** 5,560 - 5,760 ft. (1,695 - 1,756 m)

General Description: The topography of Smith Hollow and the surrounding area is striking and includes hills covered in juniper woodland that are imbedded in lower elevation areas of shortgrass prairie. There is a drainage at lower elevation that flows through the shortgrass prairie with rabbitbrush (*Chrysothamnus*), grasses, and forbs. There are three developed livestock ponds within the drainage that attract numerous species of butterfly. Within the juniper, the understory includes a great deal of rock and bare ground with sideoats gramma (*Bouteloua curtipendula*), other grasses, and numerous forbs including buckwheat *(Eriogonum* spp.), which is host plants for the Colorado blue butterfly (*Euphilotes rita coloradensis*), which inhabits the site. Buckwheat also occurs within the drainage. Occupation of the area dates back 100's of years and the site is currently used for ranching. Vegetation is approximately 20% pinon - juniper, 20% grassland or mixed grasses/forbs/cacti, 20% shrubland or shrubs with the rest covered in bare ground and rocks.

Key Environmental Factors: The Colorado blue is reported to inhabit undisturbed prairies, implying a lack of tolerance for disturbance. Prairie habitat within the range of the butterfly has been widely altered and remnants are threatened by suburban development, weed invasion, removal of livestock, and agricultural conversion. The larval host plant actually depends on some level of grazing to prevent competition from more aggressive plants.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ºF, and summer average maximum temperatures in July and August are near or above 90 ºF (HPRCC 2008).

Land Use History: The area has been inhabited by people for as long as 5,000 years, particularly areas further east within the Purgatoire Canyon. Apparently many native tribes lived in or visited the area. The site is within the vicinity of the Santa Fe Trail and by the early 1840s traders and Spanish emigres colonized the canyons and brought ranching to the area. Ranching was the dominant force until 1909 when dry-land-farming homesteaders fenced the land. The 1920s and 1930s brought the

"Dust Bowl" and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was discontinued in the 1950s, livestock continued to dominate. The creation of the Pinon Canyon Maneuver Site in the 1980s meant the end of grazing over a large portion of the area, while private lands continue to be grazed (Friedman 1985).

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of the globally imperiled (G3G4T2T3/S2) butterfly, Colorado blue (*Euphilotes rita coloradensis*).

Natural Heritage element occurrences at the Smith Hollow PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Insects	Euphilotes rita coloradensis	Colorado Blue	G3G4T2 T3	S2				B	2007-08-10

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

Boundary Justification: The boundary is intended to adequately protect areas currently occupied by Colorado blue (*Euphilotes rita coloradensis*) as well as adjacent areas of suitable habitat which have potential for colonization. The long-term persistence of *E. rita coloradensis* populations will be favored by the protection of an area larger than that which is occupied by the occurrence in any one year. Habitat heterogeneity may be related to long-term persistence in butterflies, a habitat component that is enhanced by a large protected area. Within this site, numerous terrace benches, low ridges, and drainages support a mosaic of habitat patches which have potential for *E. rita coloradensis* colonization.

Protection Urgency Rank Comments (P4): This site is located entirely on private ranchland and is inaccessible to the general public. It is under the ownership of one family making it possible to develop a conservation plan that would preserve the entire site. A number of legal tools exist to accomplish this, for example conservation easements, nomination of the state land board lands for Stewardship Trust designation, and cooperative management plans. The development of a conservation plan would assist with preservation of the imperiled butterfly species.

Management Urgency Rank Comments (M4): Current land uses dominated primarily by livestock grazing are compatible with continued viability of the biological resources. However, any significant change in the dominant land use might have the potential to impact the viability of the rare butterfly. The extent of impacts would depend upon the type and intensity of new land use activities.

Management Needs: The Colorado blue requires relatively non-degraded habitats. They do not migrate and have limited dispersal capability, so if isolated populations are extirpated, it is unlikely that they will be repopulated. Activities that improve the size, quality, and connectivity of suitable habitat should help to ensure long-term survival by reducing the probability of local extinctions, and increasing the probability of recolonization if local extinctions do occur. Suitable habitat containing the butterfly host plant, buckwheat, requires light to moderate grazing by wildlife or cattle to prevent competition from more aggressive plants.

Land Use Comments: Ranching is the current use of the land and cattle grazing currently occurs within the site. There are three developed cattle ponds within the drainage that makes up a portion of this site and these ponds attract numerous butterflies to them.

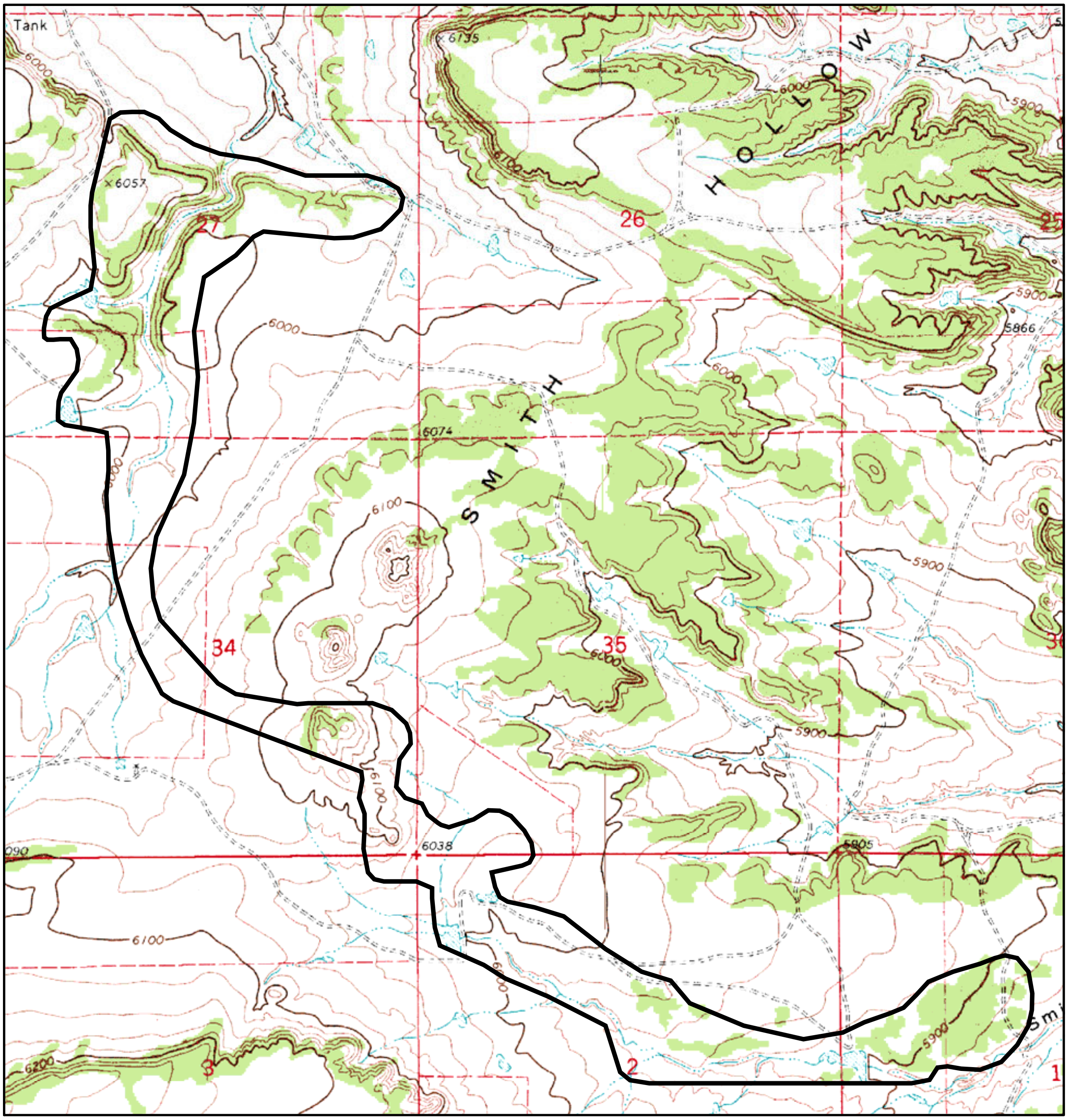
Natural Hazard Comments: The juniper uplands include steep slopes and cliffs and safety should be considered when hiking within these areas.

Exotic Species Comments: Tamarisk (*Tamarix pentandra*) occurs at the cattle ponds, but is not a threat to the viability of the Colorado blue population.

Information Needs: Additional information on the size of the Colorado blue populations would assist with management of the population.

Version Author: Sovell, J.R.

Version Date: 03/26/2008



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Map Date: 03/31/2008

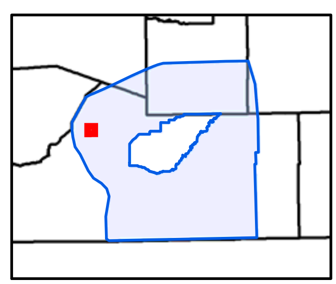
Legend

PCA Boundary

Little Dome, 37104-E4

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 6. Smith Hollow Potential Conservation Area, B2: Very High Biodiversity Significance

Timpas South

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: La Junta SW, Sheep Canyon, Timpas

Size: 5,797 acres (2,346 ha) **Elevation:** 4,550 - 4,850 ft. (1,387 - 1,478 m)

General Description: The site is a mix of short and mid grass prairie located on a patchwork of fee simple parcels and Comanche National Grassland parcels leased by the Edgar Ranch. It is bordered on the east and southwest by dirt surface county roads while the western side is bounded by Colorado Highway 350. It is centered on the rise known as Stormy Point and includes the headwater portions of numerous intermittent streams that drain to the north, south and east.

Key Environmental Factors: Surficial geology is a combination of calcareous shales and limestones and heavily influences soil characteristics and hence vegetation (Tweto 1979). Soil type is limited to the Manzanola series, which are described as very deep, well drained soils that formed in alluvial materials derived from sedimentary rock (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The Edgar Ranch continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of the globally imperiled Arkansas Valley evening primrose (*Oenothera harringtonii*) and a good (B-ranked) occurrence of the state imperiled (G5T4?/S1) lace hedgehog cactus (*Echinocereus reichenbachii* var. *perbellus*). Significant communities include a fair to poor (CD-ranked) occurrence of the globally imperiled to secure (G2G4/S3) *Bouteloua gracilis - Pleuraphis jamesii* shortgrass prairie, a good (B-ranked) occurrence of the globally vulnerable (G3/S3) *Hesperostipa neomexicana* Great Plains mixed grass prairie and a good to fair

(BC-ranked) occurrence of the state rare (G5/S3) *Distichlis spicata* salt meadows.

Natural Heritage element occurrences at the Timpas South PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G2G4	S3				CD	2007-06-18
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				B	2007-06-18
Natural Communities	Distichlis spicata Herbaceous Vegetation	Salt Meadows	G5	S3				BC	1995-06-26
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G2G3	S2S3			USFS	B	2007-06-18
Vascular Plants	Echinocereus reichenbachii var. perbellus	lace hedgehog cactus	G5T4?	S1				A	2007-06-18

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

Boundary Justification: The boundary is drawn to contain the gravelly shale barrens and upper slopes of the topographic rise that support the rare plants and grassland communities. Although the geology thought to be important to these elements also occurs outside of the site, the boundary as drawn covers the minimum extent needed to maintain these known occurrences.

Protection Urgency Rank Comments (P4): Protection of the elements could be improved by taking measures to increase the intent and tenure of legal protection. Because this site is partly on private land and partly on the Comanche National Grassland, conservation protection would require a collaborative effort between both landowners, but could be relatively simple. Possible mechanisms include special agency designations, perpetual conservation easements, natural area designations, and habitat conservation plans.

Management Urgency Rank Comments (M4): The current dominant land use of livestock grazing appears compatible with continued viability of the biological resources. Manage the site to prevent direct physical destruction of the habitat. Mining or other excavation of the soils and rock should be avoided. However, maintaining rates of erosion and surface disturbance within the natural range of variation will prevent degradation of the characteristics that support continued viability of the elements.

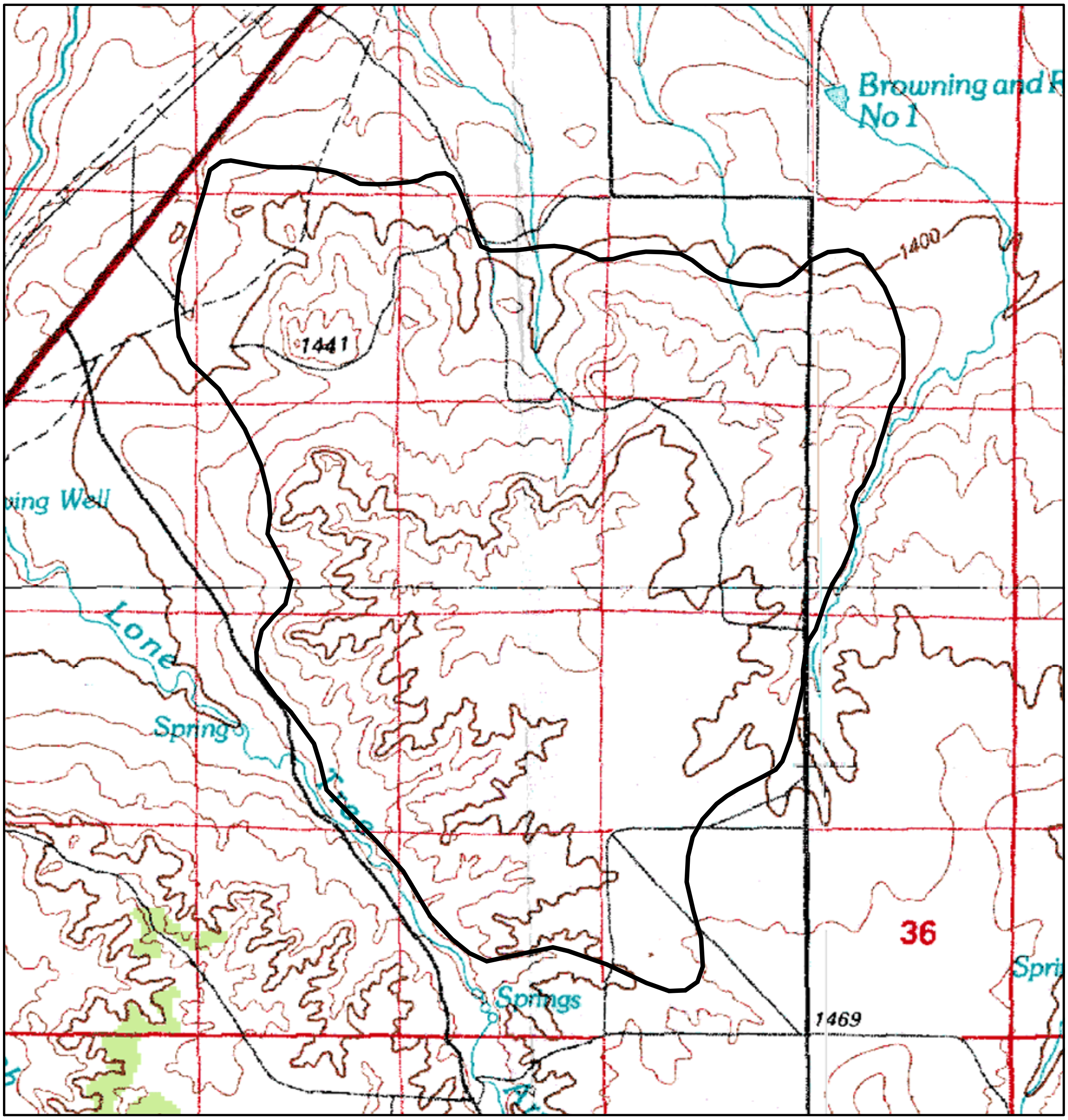
Management Needs: Not currently needed.

Land Use Comments: The current livestock grazing regimes appear compatible with the continued viability of the biological resources. Manage the site to prevent direct physical destruction of the habitat. Appropriate timing and intensity of grazing may be a valuable and necessary management tool.

Information Needs: The community elements, as well as *Artemisia biglovii* shrubland types, occur throughout the area. Further inventory could locate additional occurrences nearby. Very little is know about the role of fire in these types. Additional research into the role and effects of fire is needed.

Version Author: Stevens, J.E.

Version Date: 04/02/2008



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Map Date: 04/03/2008

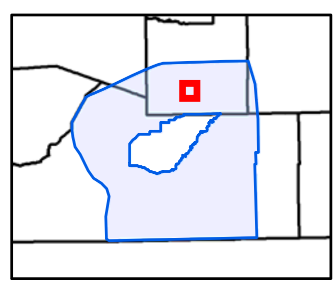
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 7. Timpas South Potential Conservation Area, B2: Very High Biodiversity Significance

Upper Averson Canyon

Biodiversity Rank - B2: Very High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Myers Canyon

Size: 166 acres (67 ha) **Elevation:** 5,760 - 5,560 ft. (1,756 - 1,695 m)

General Description: The topography of Averson Canyon is striking with red rock cliffs and deep canyon walls. The site includes the canyon as well as the juniper woodland on the escarpment along the canyon rim. Within the juniper, the understory includes a great deal of rock and bare ground with sideoats gramma (*Bouteloua curtipendula*), other grasses, and numerous forbs including buckwheats *(Eriogonum* spp.), which are host plants for the rare Colorado blue butterfly (*Euphilotes rita coloradensis*). There is a shrub intermediate layer of mountain mahogany (*Cercocarpus montanus*) and the ground cover also includes pasture sage (*Artemisia frigida*), broom snakeweed (*Gutierrezia sarothrae*), and cactus (*Opuntia*). Occupation of the area dates back 100's of years and the site is currently used for ranching. Vegetation is approximately 20% juniper, 20% grassland or mixed grasses/forbs/cacti, 20% shrubland or shrubs with the rest covered in bare ground and rocks.

Key Environmental Factors: The Colorado blue is reported to inhabit undisturbed prairies, implying a lack of tolerance for disturbance. Prairie habitat within the range of the butterfly has been widely altered and remnants are threatened by suburban development, weed invasion, removal of livestock, and agricultural conversion. The larval host plant actually depends on some level of grazing to prevent competition from more aggressive plants.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 °F, and summer average maximum temperatures in July and August are near or above 90 °F (HPRCC 2008).

Land Use History: The area has been inhabited by people for as long as 5,000 years, particularly areas further east within the Purgatoire Canyon. Apparently many native tribes lived in or visited the area. The site is within the vicinity of the Santa Fe Trail and by the early 1840s traders and Spanish emigres colonized the canyons and brought ranching to the area. Ranching was the dominant force until 1909 when dry-land-farming homesteaders fenced the land. The 1920s and 1930s brought the

"Dust Bowl" and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was discontinued in the 1950s, livestock continued to dominate. The creation of the Pinon Canyon Maneuver Site in the 1980s meant the end of grazing over a large portion of the area, while private lands continue to be grazed (Friedman 1985).

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of the globally imperiled (G3G4T2T3/S2) butterfly, Colorado blue (*Euphilotes rita coloradensis*).

Natural Heritage element occurrences at the Upper Averson Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Insects	Euphilotes rita coloradensis	Colorado Blue	G3G4T2 T3	S2				B	2007-08-10

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

Boundary Justification: The boundary is intended to adequately protect areas currently occupied by the Colorado blue (*Euphilotes rita coloradensis*) as well as adjacent areas of suitable habitat which have potential for colonization. The long-term persistence of *E. rita coloradensis* populations will be favored by the protection of an area larger than that which is occupied by the occurrence in any one year. Habitat heterogeneity may be related to long-term persistence in butterflies, a habitat component that is enhanced by a large protected area. Within this site, numerous terrace benches and the canyon drainage support a mosaic of habitat patches which have potential for *E. rita coloradensis* colonization.

Protection Urgency Rank Comments (P4): This site is located entirely on private ranchland and is inaccessible to the general public. It is under the ownership of one owner making it relatively simple to develop a conservation plan that would preserve the entire site. The development of a conservation plan would assist with preservation of the imperiled butterfly species.

Management Urgency Rank Comments (M4): Current land uses dominated primarily by livestock grazing are compatible with continued viability of the biological resources.

Management Needs: The Colorado blue requires relatively non-degraded habitats. They do not migrate and have limited dispersal capability, so if isolated populations are extirpated, it is unlikely that they will be repopulated. Activities that improve the size, quality, and connectivity of suitable habitat should help to ensure long-term survival by reducing the probability of local extinctions, and increasing the probability of recolonization if local extinctions do occur. Suitable habitat containing the butterfly host plant, buckwheat, require light to moderate grazing by wildlife or cattle to prevent competition from more aggressive plants.

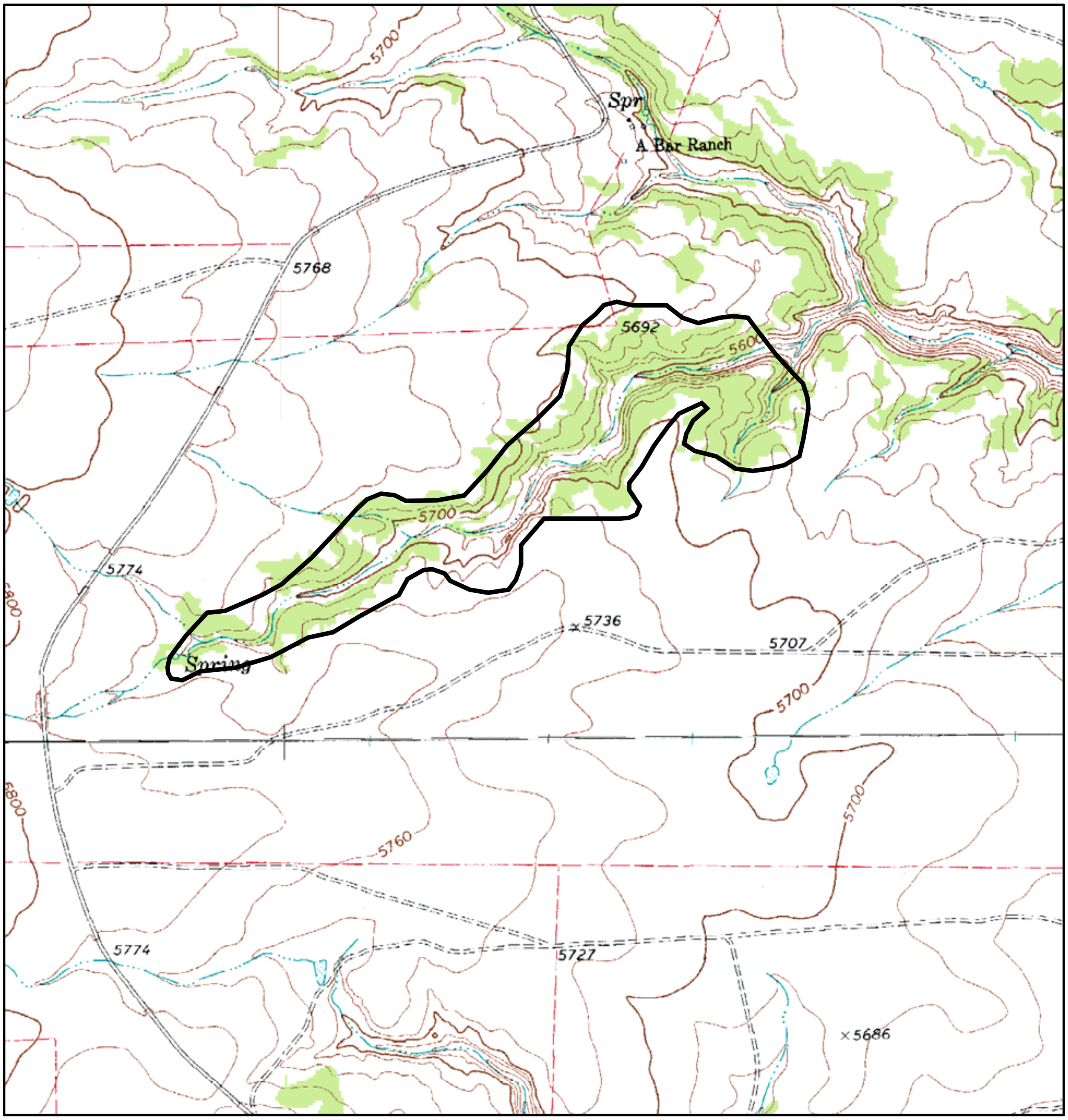
Land Use Comments: Ranching is the current use of the land and cattle grazing currently occurs within the site. There are three developed cattle ponds within the drainage that makes up a portion of this site and these ponds are attractive to numerous species of butterflies.

Natural Hazard Comments: The juniper uplands include steep slopes and cliffs and safety should be considered when hiking within these areas.

Information Needs: Additional information on the size of the Colorado blue populations would assist with management of the population.

Version Author: Sovell, J.R.

Version Date: 02/06/2008



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Map Date: 04/01/2008

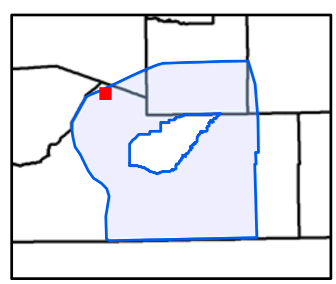
Legend

PCA Boundary

Myers Canyon, 37104-G3

7.5 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 8. Upper Averson Canyon Potential Conservation Area, B2: Very High Biodiversity Significance

West Point

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Box Ranch, Branson SE, Miners Peak, Pine Canyon

Size: 4,257 acres (1,723 ha) **Elevation:** 5,760 - 6,800 ft. (1,756 - 2,073 m)

General Description: West Point occupies the mesa top, cliff band, side slopes, and lower alluvial slopes on the narrow western end of the Mesa de Maya. The flat mesa top supports a xeric tallgrass and mixed grass community mosaic including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), galletta (*Pleuraphis jamesii*), prairie junegrass (*Koeleria macrantha*), and western wheatgrass (*Pascopyrum smithii*). The eroding layers of calcareous shale (Niobrara, Carlile, Graneros) and limestone (Greenhorn) exposed on the side slopes are dominated by sparse juniper woodlands and oak shrublands. The lower alluvial slopes are dominated by juniper woodlands and grasslands of mid and short grass species.

Key Environmental Factors: The top of the Mesa de Maya is formed by a basaltic caprock that resists erosion and has maintained the mesa while the surrounding landscape has been eroded away. Beneath this caprock layer are several layers of very calcareous shales and limestone (Tweto 1979). These calcareous shales and limestones heavily influence soil characteristics and hence vegetation. Soil types include the Richfield series and the Travissilla series. The Richfield series is described as very deep, well drained soils that formed in calcareous loess on tableland plains (SCS 1994). The Travissilla series is the basaltic outcrops that occur near the margin of the mesa top.

Climate Description: The Mesa de Maya is the tallest topographic feature in the area and likely receives more precipitation and experiences cooler annual temperatures than the surrounding high plains. Site specific data is not available for the top and side slopes of the Mesa de Maya and therefore values collected from the surrounding area are presented here. The climate on the southeastern plains that surround the site is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ^{o}F occurring on many days in July and August (HPRCC

2008).

Land Use History: Land use in the area, and on the mesa, has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The several ranches that make up the ownership of the mesa continue cattle ranching as the sole land use.

Cultural Features: Rock art found on and around the periphery of the mesa indicates that humans have historically occupied the area.

Biodiversity Significance Rank Comments (B2): The site includes a mixture of significant rare plants and plant communities. There is an excellent (A-ranked) occurrence of the globally imperiled (G2/S2) Rocky Mountain bladderpod (*Lesquerella calcicola*) and an excellent (A-ranked) occurrence of the state imperiled (G4/S1) James' beard-tongue (*Penstemon jamesii*). Significant community occurrences include a good (B-ranked) example of the globally vulnerable (G3/S3) Great Plains mixed grass prairie (*Hesperostipa neomexicana*), a good (B-ranked) occurrence of the state rare (G4/S3) foothills pinon - juniper woodland (*Juniperus monosperma / Hesperostipa neomexicana*), a fair (C-ranked) occurrence of the globally imperiled (G2?/S2) xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium*) and an unranked occurrence of scarp woodlands (*Juniperus scopulorum / Cercocarpus montanus - Rhus trilobata*) whose global imperilment rank is unknown (GU/SU) at this time.

Natural Heritage element occurrences at the West Point PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie	G2?	S2				C	1985-99-99
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				B	2007-06-05
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				B	2007-05-31
Natural Communities	Juniperus scopulorum / Cercocarpus montanus - Rhus trilobata Woodland	Scarp Woodlands	GU	SU					1985-99-99
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G2	S2				A	2007-06-05
Vascular Plants	Penstemon jamesii	James' beard - tongue	G4	S1			USFS	A	2007-06-05

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

Boundary Justification: The boundary is drawn to contain the elements and the geological features that support them, and to protect the substrates from direct physical disturbance. The mesa top, rim rock, and upper erosional slopes are important to maintaining the habitat for the Rocky Mountain bladderpod (*Lesquerella calcicola*), xeric tall grass community, and other communities. Maintaining rates of erosion and surface disturbance within the natural range of variation will prevent degradation of the characteristics that support continued viability of the elements.

Protection Urgency Rank Comments (P4): The site is on private land and currently does not include any formal protection for the rare plants and communities. The current land use of livestock grazing appears compatible with the continued viability of the rare plant. Because it is entirely on private land, conservation protection could be relatively simple. Possible mechanisms could include conservation easements, natural area designations, and habitat conservation plans.

Management Urgency Rank Comments (M4): The current livestock grazing regimes appear compatible with the continued viability of the biological resources. Manage the site to prevent direct physical destruction of the habitat. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock. Maintaining rates of erosion and surface disturbance within the natural range of variation will prevent degradation of the characteristics that support continued viability of the elements.

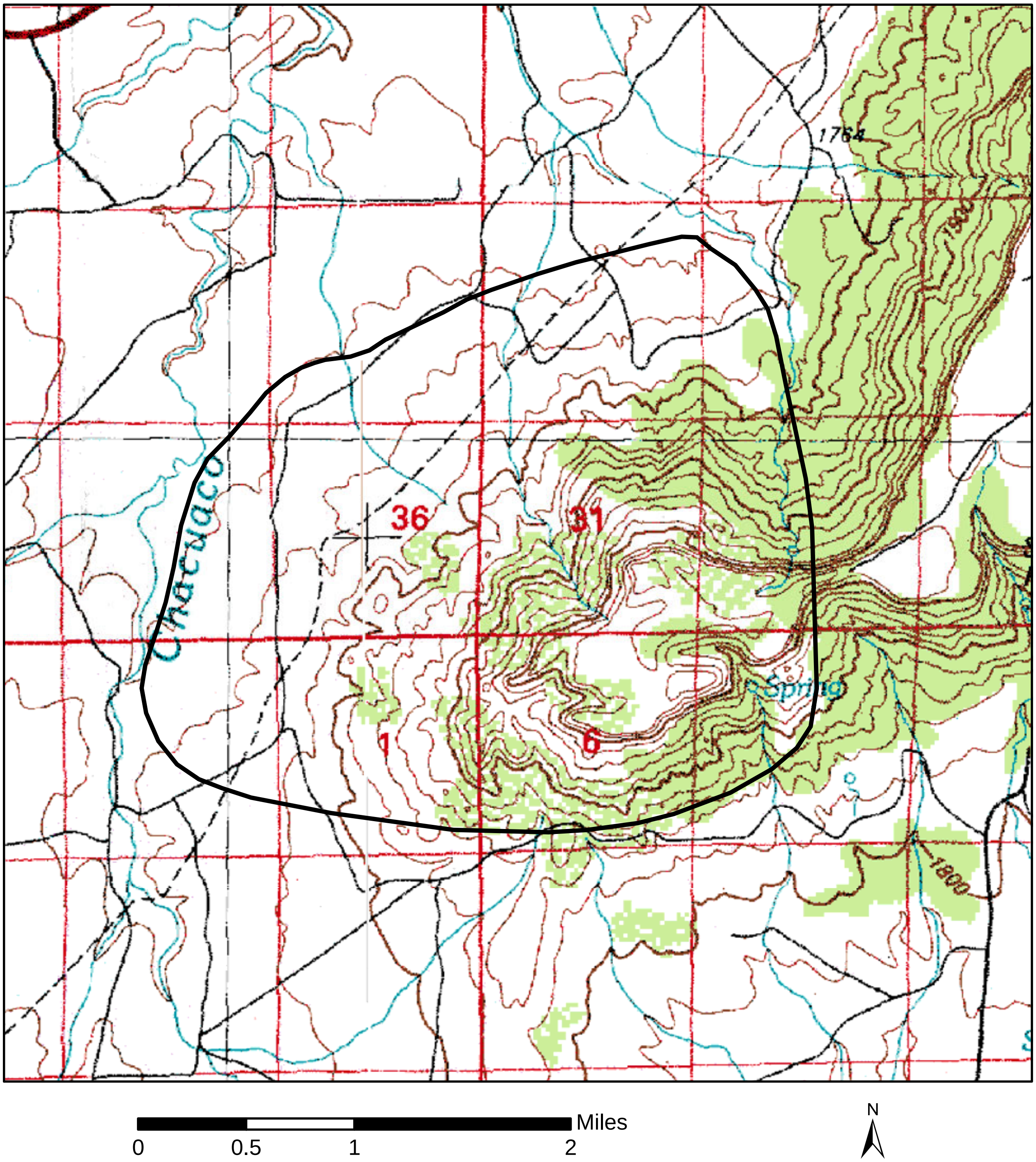
Management Needs: Manage the site to prevent direct physical destruction of the habitat. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock. Cheatgrass can occupy similar habitat and should be controlled. The xeric tall grass community is susceptible to encroachment by juniper woodlands in the absence of periodic fire. Fire management designed to facilitate viability of the tallgrass community is desirable.

Land Use Comments: The current livestock grazing regimes appear compatible with the continued viability of the biological resources.

Off-Site Considerations: Additional occurrences of James' beard-tongue have been documented approximately one mile to the southeast of the site. Other undocumented occurrences likely occur on similar habitats nearby, but additional field work is necessary to verify their existence.

Information Needs: The xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium*) and scarp woodland (*Juniperus scopulorum / Cercocarpus montanus - Rhus trilobata*) occurrences were not visited in 2007 due to inclement weather. Further surveys are needed to verify extent and quality of these occurrences.

Version Author: Stevens, J.E.
Version Date: 04/02/2008



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Map Date: 04/03/2008

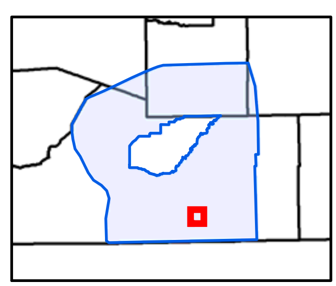
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 9. West Point Potential Conservation Area, B2: Very High Biodiversity Significance

Carrizo Tributary Canyon

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Cobert Mesa North, Tobe

Size: 103 acres (42 ha) **Elevation:** 5,900 - 6,200 ft. (1,798 - 1,890 m)

General Description: The site includes the relatively narrow north-facing canyon of an un-named tributary to West Carrizo Creek.

Key Environmental Factors: The cool north-facing aspect and the dense juniper woodland community combine with the rocky canyon topography to provide ideal habitat for the rare plant species.

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The private ranch owner continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*).

Natural Heritage element occurrences at the Carrizo Tributary Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Argyrochosma fendleri	Fendler cloak - fern	G3	S3				A	2007-05-16

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

Boundary Justification: The boundary is drawn to protect the plants from any possible direct physical destruction of the habitat and includes the canyon sides where the element is located and a small buffer above and below the canyon walls, the canyon mouth and the canyon top. This should provide adequate protection.

Protection Urgency Rank Comments (P4): The site is on private land and currently does not include any formal protection. The current land use of livestock grazing appears compatible with the continued viability of the rare plant. Because it is entirely on private land, conservation protection could be relatively simple. Possible mechanisms could include, for example, conservation easements, natural area designations, and habitat conservation plans.

Management Urgency Rank Comments (M3): The currently dominant land use of livestock grazing is compatible with continued viability of the rare plant. Exotic species such as cheatgrass (*Bromus tectorum*) and common mullein (*Verbascum thapsus*) have the potential to displace the fern from some of its habitat and should be controlled. The juniper woodlands should be maintained without attempts to thin or harvest.

Management Needs: Manage the site to prevent direct physical destruction of the habitat. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock. Cheatgrass and mullein can occupy similar habitat and should be controlled.

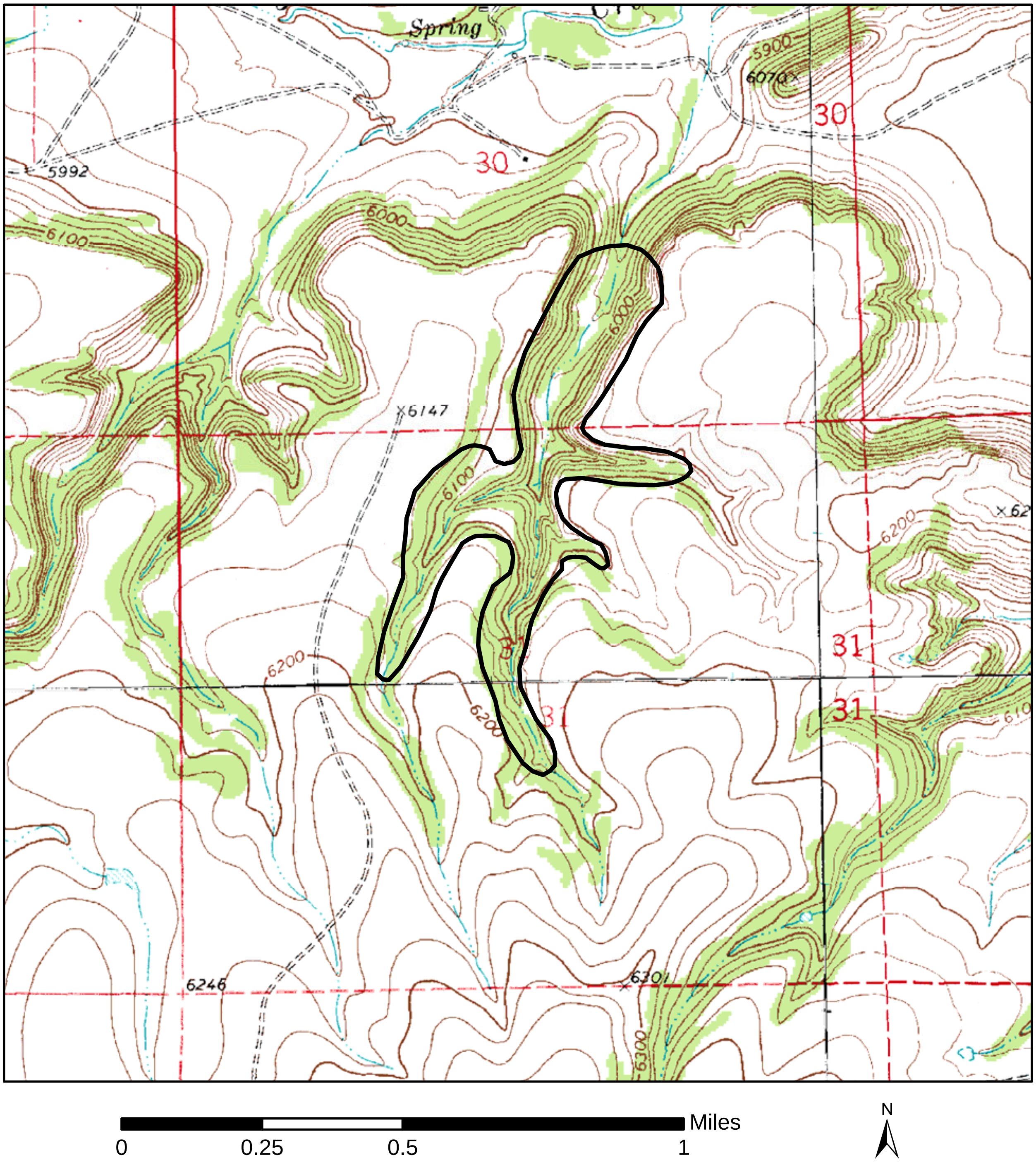
Land Use Comments: The existing land use of livestock grazing appears compatible with the continued viability of the element.

Exotic Species Comments: Cheatgrass and mullein can occupy similar habitat and should be controlled.

Off-Site Considerations: Additional north-facing tributary canyons exist in the vicinity and remain un-surveyed. Inclusion of those areas into this site at a future date may be warranted.

Version Author: Stevens, J.E.

Version Date: 04/04/2008



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Map Date: 04/03/2008

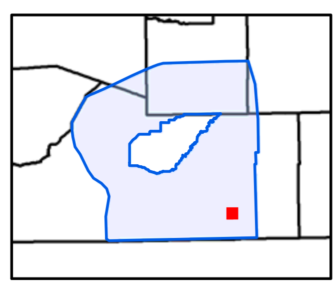
Legend

PCA Boundary

Cobert Mesa North, 37103-A5
Tobe, 37103-B5

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 10. Carrizo Tributary Canyon Potential Conservation Area, B3: High Biodiversity Significance

Chacuaco Rimrock

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Humbar Spring, Miners Peak

Size: 3,169 acres (1,283 ha) **Elevation:** 5,500 - 5,680 ft. (1,676 - 1,731 m)

General Description: Chacuaco Rimrock occupies the narrow open woodland on the west side of the large, nearly level top of land between Chacuaco and Tobe creeks. It is bounded on the west by the rimrock and the steep cliff and side slopes that drop to the Chacuaco Creek. The east side is bounded by the margin between the shortgrass prairie that covers the majority of the top and the sparse juniper woodlands where the rare plants are found.

Key Environmental Factors: The sparse gravelly soils and open woodlands between the edge of the rimrock and the open prairie provide ideal conditions for the rare plant species. The western exposure on the Chacuaco side of the interfluvial top may provide slightly hotter and drier conditions than the eastern exposure on the Tobe Creek side.

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The ranch owner continues cattle ranching as the primary land use. Other uses include rock picking for landscaping and building facades, and some private hunting and ecotourism.

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) and a fair (C-ranked) occurrence of the globally imperiled (G3G4T2T3/S2) dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*).

Natural Heritage element occurrences at the Chacuaco Rimrock PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2 T3	S2			BLM/ USFS	A	2007-06-05
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2 T3	S2			BLM/ USFS	C	2007-05-18

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

Boundary Justification: The sparse gravelly soils and open woodlands between the edge of the rimrock and the open shortgrass prairie provide ideal site conditions for dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*). The western exposure on the Chacuaco side of the interfluvial top may provide slightly hotter and drier conditions than the eastern exposure on the Tobe Creek side. The boundary follows the natural topographic features, encompassing the sparse juniper woodland that occupies the margin of this large interfluvial top. It is intended to protect the rare plants from direct physical disturbance, provide habitat for potential element occurrences, and protect the ecological processes that support them. Although the conditions thought to be important to this species also occur outside the site, the boundary as drawn covers the minimum extent needed to maintain these known occurrences.

Protection Urgency Rank Comments (P4): The site is entirely on private ranch land. The current livestock grazing regimes appear compatible with the continued viability of the rare plants. Protection of the element could be improved by taking measures to increase the intent and tenure of legal protection. Such measures may include voluntary designations for conservation, establishing perpetual easements, or establishing habitat conservation plans.

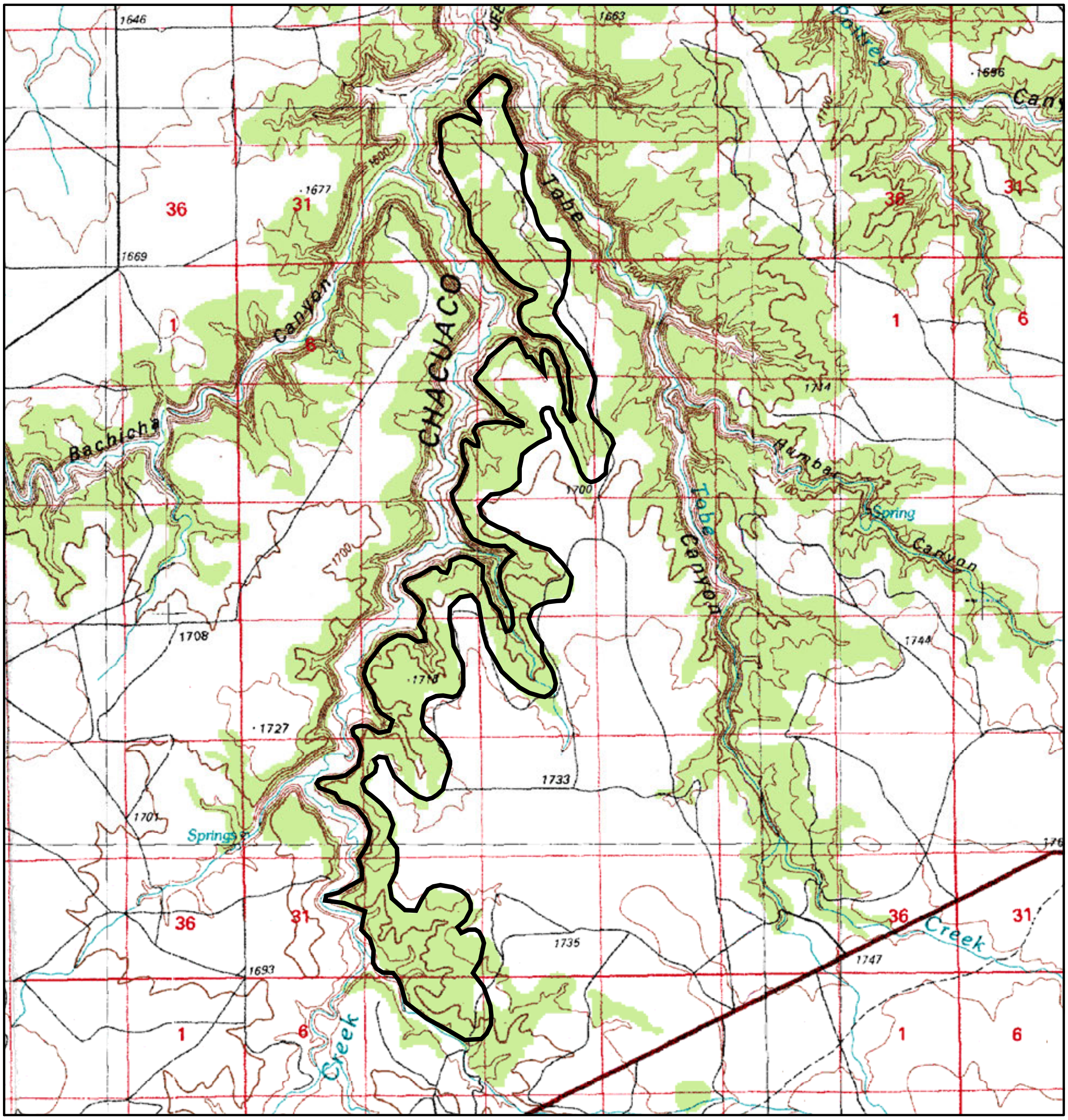
Management Urgency Rank Comments (M4): The current livestock grazing regimes appear compatible with the continued viability of the biological resources. Manage the site to prevent direct physical destruction of the habitat. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock.

Management Needs: To ensure the quality of the site and viability of the element over the long-term, maintain the viability and quality of the grassland and woodland communities. Such efforts might include simulating natural grazing and fire regimes through the use of prescribed burning and altered grazing rotations.

Land Use Comments: Continue appropriate grazing regimes or incorporate periodic burning to stimulate regeneration and maintain species composition. Appropriate timing, intensity of grazing and periodic prescribed burning can be valuable and necessary management tools.

Exotic Species Comments: Site had very few exotics.

Version Author: Stevens, J.E.
Version Date: 04/04/2008



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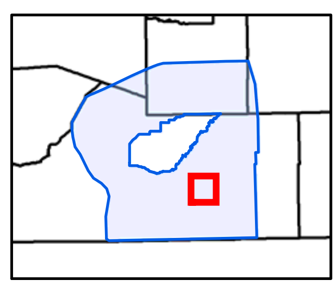
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 11. Chacuaco Rimrock Potential Conservation Area, B3: High Biodiversity Significance

Comanche Grassland

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Andrix, Autograph Cliff NW, Bartlett, Big Hole Canyon, Big Rock Grange, Bisonte, Buck Canyon, Campo, Campo NE, Campo NW, Campo SW, Carrizo Mountain, Cherry Canyon, Dalerose Mesa, Deora, Durkee Creek NE, Durkee Creek NW, Durkee Creek SE, Edler, Floating W Ranch, Furnish Canyon East, Harbord, Hasser Ranch, Horse Creek Springs, Humbar Spring, Icehouse Canyon, Kenton, Kenton NE, Keyes NE, Keyes NW, Kim North, Kim South, Lone Rock, Lycan, Lycan NE, Lycan SE, McEndree Ranch, Midway, Midway NE, Midway SE, Midway SW, Miners Peak, Moore Draw NE, Moore Draw NW, Moore Draw SE, Moore Draw SW, North Plum Creek SE, Pintada Creek, Pipe Spring, Plains Community, Plum Canyon, Pritchett, Pritchett NW, Razor Blade Mesa, Reader Lake, Robbers Roost Canyon, Saunders, Springfield East, Springfield SW, Springfield West, Stonington, Stonington SE, Sturgis, Sturgis NW, Table Mesa, Tobe, Tubs Springs, Two Butte Springs, Two Buttes, Two Buttes NW, Two Buttes Reservoir, Two Buttes SE, Utleyville, Vilas North, Vilas South, Villegreen, Walker Canyon, Walsh, Walsh SE, Webb

Size: 2,033,648 acres (822,991 ha) **Elevation:** 3,440 - 6,340 ft. (1,049 - 1,932 m)

General Description: The site is approximately 25% agricultural lands, 22% shrublands or mixed shrubs and 46% grasslands or mixed grasses, with trace amounts of pinon - juniper, riparian, open water and residential development. It was drawn to support populations of mountain plover, long-billed curlew, ferruginous hawk, black-tailed prairie dog and swift fox. Other species of biological significance include burrowing owl, lesser prairie-chicken, McCown's longspur, Lewis's woodpecker, Texas horned lizard, New Mexico threadsnake, Colorado green gentian, soapberry and purple cliff-brake.

Key Environmental Factors: The rich diversity of species and plant communities is mostly attributable to the presence of an unfragmented native shortgrass prairie that has experienced minimal disturbance.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ^{o}F, and summer average maximum temperatures in July and August are near or above 90 ^{o}F (HPRCC 2008).

Land Use History: This area of southeastern Colorado has a long history of human habitation with many native tribes having lived in or visited the area. European settlement began in the 1800s. Ranching was the dominant land use up until 1909 when dryland farming homesteaders fenced the land (Friedman 1985). Today activities include both ranching and farming.

Biodiversity Significance Rank Comments (B3): The site supports extant and poor (D-ranked) occurrences of the globally imperiled (G2/S2B) mountain plover, extant and fair (C-ranked) occurrences of the state vulnerable (G4/S3B) ferruginous hawk, numerous extant occurrences of the globally vulnerable (G3/S3) swift fox and state rare (G5/S2B) long-billed curlew, and excellent (A-ranked) and fair (C-ranked) occurrences of the state rare (G4/S3) black-tailed prairie dog (*Cynomys ludovicianus*). This area represents the best native habitat and highest densities of long-billed curlews in the state.

Natural Heritage element occurrences at the Comanche Grassland PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1995-04-28
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1995-04-29
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1995-06-16
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1996-05-29
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1996-05-31
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1996-06-02
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1996-06-12
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	D	1996-06-24
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1991-06-01
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1991-06-02
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1991-06-15
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1991-07-30
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1993-05-22
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1993-05-30
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1993-06-07
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-06-01
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-06-06
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-06-15
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1994-99-99
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	H	1905-04-11

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS		1995-04-27
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	C	2007-07-16
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1990-04-19
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1993-05-22
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1994-05-18
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1995-06-22
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1995-06-26
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1996-06-05
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	1997-06-14
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2002-05-16
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2002-05-23
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2002-05-26
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2002-06-06
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2002-06-25
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2003-05-20
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2003-05-23
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2003-05-26
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2003-06-05
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	E	2003-06-07
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	H	1977-06-08

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	H	1977- 99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	H	1978- 99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS	H	1979- 99-99
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1994- 06-22
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-19
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-21
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-22
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-23
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-24
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-26
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 06-28
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 07-08
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 07-09
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 07-14
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1995- 09-18
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1996- 06-06
Birds	Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		SC	BLM/ USFS		1996- 06-12
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	1995- 06-22
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	1996- 05-27
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	1997- 06-14

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2002-05-20
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2002-05-23
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2002-06-07
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2002-06-11
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-05-26
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-05-27
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-05-28
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-05
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-07
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-11
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-12
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-13
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-14
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2003-06-19
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2005-05-14
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2005-05-31
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	H	1974-05-99
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	H	1974-06-99
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	H	1975-06-24
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	H	1975-06-99

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS		1995-06-19
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS		1995-06-22
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS		1996-06-05
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS		1996-06-06
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	1994-09-13
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	1994-09-18
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	1996-12-19
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	2003-08-20
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	2004-10-25
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	2004-10-26
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	2004-11-04
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	A	2003-06-25
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	C	2003-06-26

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

Boundary Justification: The site was drawn primarily for mountain plover, long-billed curlew, ferruginous hawk, black-tailed prairie dog and swift fox. It includes the best native habitat with the highest densities of long-billed curlew in the state. Higher densities occur within Comanche National Grassland, with lower densities in agricultural lands (CSP Bird Working Group 2004); however, agricultural lands were included because they are important for foraging (Busby 2005). The western boundary ends at Chacuaco Canyon and Mesa de Maya which act as sufficient barriers to the dispersal of swift fox. There is an area of open landscape between the canyon and mesa along Highway 160 that may allow for some movement of swift fox between this site and the Southern Purgatoire site to the west. Movement of fox between these two sites, however, is probably infrequent. Boundary was drawn using Landsat ETM+ satellite imagery and 25m Colorado

Vegetation Classification data (CDOW).

Protection Urgency Rank Comments (P3): A conservation plan for this site has the potential to preserve an intact landscape dominated by native shortgrass prairie in an area that is rich in its diversity of animals, plants, and plant communities. This site is a mixture of private land, State land, USFS (Comanche National Grassland) and Department of Army land (PCMS). The publicly owned parcels are ostensibly protected. Protection on private parcels could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

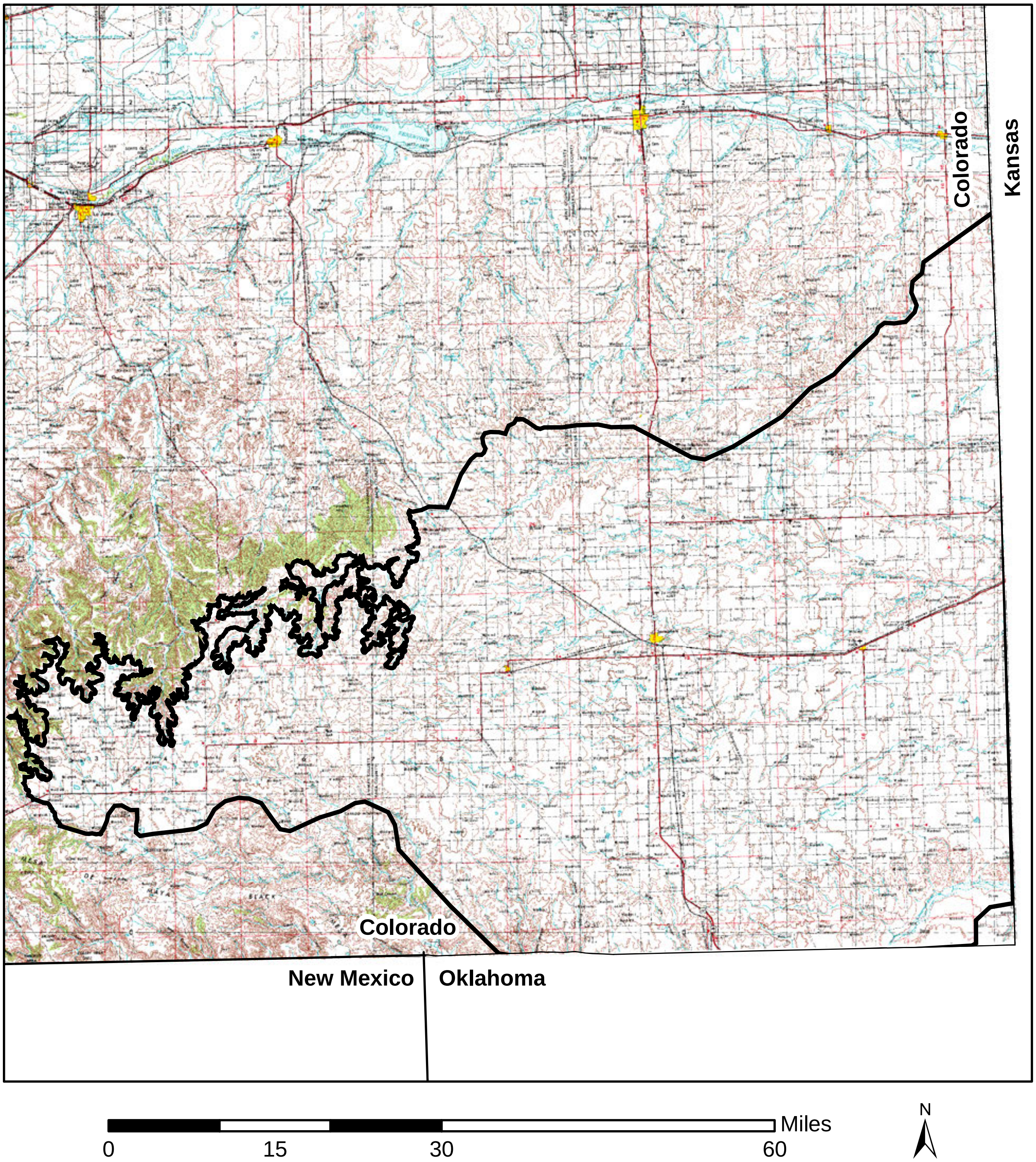
Management Urgency Rank Comments (M4): Large portions of the site are grazed by livestock, a use that is compatible with continued viability of the biological resources. Ranching lands have less adverse impacts on the elements than agricultural lands (CSP Bird Working Group 2004). Conservation of mountain plover require grasslands where the vegetation is short in height as is maintained through grazing by wildlife, livestock, or prairie dogs. The removal of grazing with subsequent increases in vegetation height results in habitat that is unsuitable for plover.

Management Needs: As is the case in many other areas, the driving conservation issues in the shortgrass prairie are habitat loss and habitat alteration. Ferruginous hawk and swift fox are very sensitive to disturbance and need big, unfragmented landscapes (CSP Bird Working Group 2004). Consequently, conversion of the remaining shortgrass prairie to other land forms should be prevented as should fragmentation of the existing large acreages of shortgrass prairie. Management should replicate the timing, intensity, and landscape distribution of the natural disturbances that shaped the shortgrass prairie including grazing and fire. In practice, however, modern agriculture tends to spread out grazing intensity evenly, producing a comparatively homogeneous landscape and fire has been nearly eliminated from the landscape. For the purposes of bird conservation, some grassland parcels should be grazed heavily and others not at all, to replicate the heterogeneous landscape historically created by climate and native species grazing. Currently, fire suppression and certain grazing patterns in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. The nest sites of the ferruginous hawk should be protected from disturbance during nesting, and their prey base should be maintained (black-tailed prairie dogs). During winter, SE Colorado becomes important for maintaining ferruginous hawk that prey on prairie dog colonies (CSP Bird Working Group 2004).

Land Use Comments: Grazing by livestock and farming occur. There are water developments including canals and impoundments found throughout the site that are associated with these activities.

Version Author: Sovell, J.R.

Version Date: 04/17/2008



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Map Date: 05/01/2008

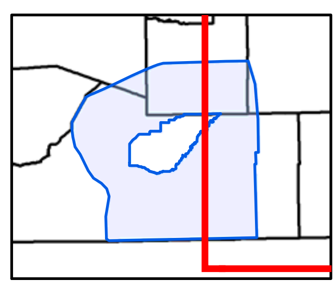
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 12. Comanche Grassland Potential Conservation Area, B3: High Biodiversity Significance

Purgatoire Mesas

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Beaty Canyon, Johnson Canyon, O V Mesa

Size: 18,045 acres (7,303 ha) **Elevation:** 4,400 - 5,400 ft. (1,341 - 1,646 m)

General Description: The site includes a complex of mesas and canyons overlooking the Purgatoire and Chacuaco river canyons and the red sandstone formations through which they have cut. Rising from the canyon floor to the top of the surrounding plateaus are river terraces of various size and steep rocky canyon walls and cliff faces. Within this setting are a series of mesas ranging from small to large. Numerous narrow side canyons dissect the mesas and plateaus and extend out away from the main canyons and the site perimeter. The floodplains of the Chacuaco and Purgatoire Rivers are broad and mostly dominated by weedy herbaceous vegetation, cholla cactus (*Opuntia imbricata*), and some small patches of cottonwood (*Populus deltoides*). In general, the steep slopes of the canyons and mesas are characterized by open woodlands and shrublands dominated by one-seeded juniper (*Juniperus monosperma*), mountain mahogany (*Cercocarpus montanus*), and skunkbrush (*Rhus trilobata*), and various native grass species. The mesa tops are dominated by a mosaic of cryptogamic soils and native mixed grass grasslands of New Mexico feathergrass (*Hesperostipa neomexicana*) or blue grama (*Bouteloua gracilis*) and galleta grass (*Hilaria jamesii*). Nearest to the rimrock and surrounding the grasslands are open woodlands of one-seeded juniper with native grass understories. Cholla, prickly-pear (*Opuntia polyacantha*), and other less common cacti, are also found on the slopes and mesa tops. Elevation ranges from about 4,400 feet near the river to slightly over 5,400 feet at the western end of OV Mesa. Several of the mesa tops and narrow side canyons are naturally isolated and have received little recent disturbance from human or livestock activity. Slightly more than half of this site is privately owned, while the remaining portions are within the Comanche National Grassland of the USFS, on State Land Board lands, and on the Department of the Army's Pinon Canyon Maneuver Site.

Key Environmental Factors: The key environmental factors operating at this site are the combination of steep rocky canyons and mesas and the hot dry climate.

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ^{o}F occurring on many days in July and August (HPRCC 2008).

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of the Purgatoire Canyon is believed to have been inhabited by people for as long as 5,000 years, and many native tribes lived in or visited the area. The first people of European descent to enter the area were with the Coronado expedition of 1540. Although considered part of Spain, the area remained sparsely populated by Euro-Americans until about 1821 when Mexico received independence from Spain and trade began between Santa Fe and Missouri. Soon thereafter, Spanish émigrés began to colonize the larger canyons. They built small settlements and ranches and raised herds of goats and sheep. The Purgatoire Canyon itself became an alternate trade route, and European settlement increased to a peak of about 400 people in the canyon by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dry-land-farming homesteaders fenced the land. In the 1920s and 1930s, the Purgatoire Canyon area was affected by the Dust Bowl and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continued on most private lands. The creation of the Department of the Army's Pinion Canyon Maneuver Site in the 1980s removed grazing from that site, however, cattle grazing continues as the primary land use on adjacent private lands.

Biodiversity Significance Rank Comments (B3): This site contains several globally rare plant communities and state rare plants. Most significant is a good to fair (BC-ranked) occurrence of a globally imperiled (G2/S2) shrubland community, *Cercocarpus montanus / Hesperostipa comata*, a fair (C-ranked) occurrence of a globally imperiled (G2G3/S2S3) shrubland community, *Cercocarpus montanus / Hesperostipa neomexicana*, a fair (C-ranked) occurrence of a globally imperiled (G2Q/S1) silver beard grass grassland community, *Bothriochloa laguroides* ssp. *torreyana*, a fair (C-ranked) occurrence of a globally vulnerable (G1G2Q/S1S2) forest community, *Populus deltoides / Sporobolus cryptandrus*, an excellent (A-ranked) and a good (B-ranked) occurrence of a globally vulnerable (G3/S3) grassland community, *Hesperostipa neomexicana*, and a good (B-ranked) occurrence of a globally vulnerable (G3/SU) shortgrass prairie, *Bouteloua eriopoda - Pleuraphis jamesii*. There are also good (B-ranked) to fair (C-ranked) occurrences of state rare communities. Plants of concern include an excellent (A-ranked) occurrence of the state imperiled (G5T4?/S1) lace hedgehog cactus (*Echinocereus reichenbachii* var. *perbellus*), and one good (B-ranked) and one fair (C-ranked) occurrence of the state rare (G4/S2) long-hood milkweed (*Asclepias macrotis*). This site also contains extensive high quality areas of cryptogamic soils.

Natural Heritage element occurrences at the Purgatoire Mesas PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Populus deltoides / Sporobolus cryptandrus Forest	Plains Cottonwood / Sand Dropseed	G1G2Q	S1S2				C	1998-10-02
Natural Communities	Cercocarpus montanus / Hesperostipa comata Shrubland	Mixed Foothill Shrublands	G2	S2				BC	2007-05-11
Natural Communities	Cercocarpus montanus / Hesperostipa neomexicana Shrubland	Foothills Shrubland	G2G3	S2S3				C	1997-06-01
Natural Communities	Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G2G4	S3				BC	1994-07-10
Natural Communities	Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G2G4	S3				C	1994-07-10
Natural Communities	Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G2G4	S3				C	1997-06-23
Natural Communities	Bothriochloa laguroides ssp. torreyana Herbaceous Vegetation	Silver Beard Grass	G2Q	S1				C	1998-10-02
Natural Communities	Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G3	SU				B	1994-08-17
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				A	1994-07-10

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				B	1994-07-10
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				B	1985-08-29
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				B	1994-08-17
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				C	1992-09-15
Natural Communities	Juniperus monosperma / Bouteloua gracilis Woodland	Foothills Pinyon - Juniper Woodlands	G5	S3S4				B	1994-07-09
Natural Communities	Stipa comata - Bouteloua gracilis Herbaceous Vegetation	Montane Grasslands	G5	S2S3				C	1997-05-31
Natural Communities	Juniperus monosperma / Bouteloua eriopoda Woodland	Juniper Woodland	GNR	S2S3				A	1997-06-23
Natural Communities	Juniperus monosperma / Bouteloua eriopoda Woodland	Juniper Woodland	GNR	S2S3				AB	1997-06-23
Natural Communities	Juniperus monosperma / Bouteloua eriopoda Woodland	Juniper Woodland	GNR	S2S3				B	1997-06-01
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2				B	2007-06-14
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2				C	2007-08-01

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Echinocereus reichenbachii var. perbellus	lace hedgehog cactus	G5T4?	S1				A	2007-06-14

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

Boundary Justification: The boundary encompasses the tops of several mesas, the Rourke Plateau, side slopes and rim rock areas, the mouths of several other smaller side canyons, and the valley bottom. It is intended to protect the occurrences from direct physical disturbance and to provide sufficient area within which natural fire and herbivory regimes can be simulated in attempt to maintain the structure and composition of the mosaic of native plant communities.

Protection Urgency Rank Comments (P4): Approximately half of this site is owned by the USFS as a part of the Picket Wire Canyonlands but without any special designation. The portion in the vicinity of Rourke Canyon and plateau are owned by the USFS and leased to a private landowner for grazing. A slightly smaller portion is owned by the State Land Board with the grazing leases held by the USFS. A very small section is owned by the Department of the Army as part of the Pinon Canyon Maneuver Site. The remaining areas are in private ownership. Some portions of this site have effective protection while the remaining areas do not. The OV Mesa area is owned by the State Land Board and managed by The Nature Conservancy under a long-term lease. Small portions of the privately owned parcels are protected by conservation easements. Protection of the elements could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

Protection Comments: Small portions of the site are protected through special lease and management agreements or designations. These include The Nature Conservancy's management of State Land Board parcels on OV Mesa, special designation of some parcels on the Comanche National Grassland, and conservation easements on portions of private lands. Collaboration among the various public and private land owners may be necessary to establish effective protection for the remainder of this site.

Management Urgency Rank Comments (M3): Some locations, particularly the valley bottoms have been invaded by non-native weedy species such as saltcedar, cheatgrass, and kochia. These species have the potential to reduce the quality and viability of the grassland and forest communities that occur on the valley floor. Cheatgrass is also present on some of the plateau and mesa tops and represents a significant threat to the viability and quality of the elements that occur on the side slopes and tops. Following recent drought periods, broom snakeweed has invaded and become dominant on several of the larger plateaus in the north portion of the site.

Management Needs: There is a current and long-term need to eliminate exotic plants (saltcedar, cheatgrass, kochia, salsola, etc). This will likely require collaboration among several public and private land owners over many years of successive effort to be effective. The more isolated communities on the mesa tops and steep side slopes are relatively less impacted by the invasion of exotic species than those areas on the valley floor and floodplains. Management to prevent the spread of exotic species into these areas while simulating natural regimes of fire and herbivory are needed to ensure these areas maintain viability and quality over the long-term. Cryptogamic soils are known to be especially sensitive to trampling and often take unusually long periods of time to recover following disturbance. Maintaining these soil communities in good condition will require minimizing disturbance to the soil by carefully designing and maintaining trails, grazing regimes, and other activities with the potential to disturb the soil. Further investigations into the natural dynamics of fire in these communities may indicate the need for fire-related management. Removal or thinning of juniper woodlands should only be conducted when clear indications exist that the density and extent of the woodlands are well outside the normal range of variation for that community type. When and if undertaken, such actions should be conducted to minimize soil disturbance, propagation of non-native exotics, fragmentation or direct destruction of the community of concern, and alteration of understory composition. Research and efforts to manage the density of broom snakeweed on plateaus is needed to maintain the viability and quality of the grassland and woodland communities in those areas. Such efforts might include simulating more natural grazing and fire regimes through the use of prescribed burning and altered grazing rotations.

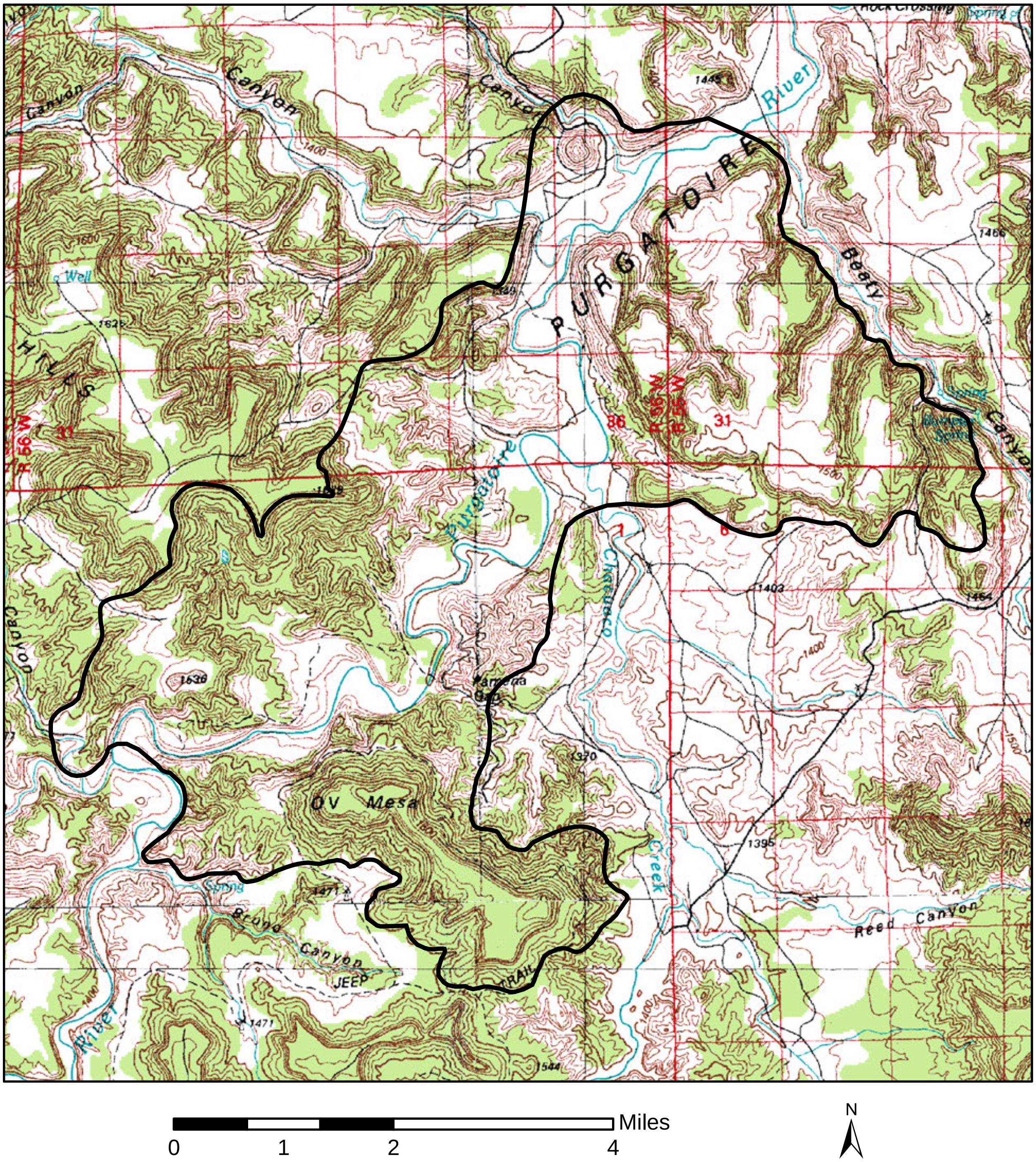
Land Use Comments: The ranch lands were settled in the mid to late 1800s and have been more or less continuously grazed by sheep, and to a greater extent cattle, since that time. Alterations associated with that land use include construction of artificial stock ponds, corrals, and other minor facilities.

Exotic Species Comments: Exotic grasses, especially *Bromus japonicus* and *Bromus tectorum*, dominate disturbed areas on the canyon floor and a few areas on top of mesas. Saltcedar is prevalent on the floor of the valley near the channel of the Purgatoire and Chacuaco rivers. A single saltcedar tree was found on top of a mesa near a former stockpond, but the area is now abandoned and probably too dry for it to spread or survive. Kochia and other herbaceous weeds are found near the canyon mouth.

Information Needs: More information is warranted regarding the ecological dynamics and effects of fire suppression and historical grazing on *Juniperus monosperma* woodlands, *Cercocarpus montanus* shrublands, and the various grassland communities.

Version Author: Stevens, J.E.

Version Date: 04/22/2008



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Map Date: 05/01/2008

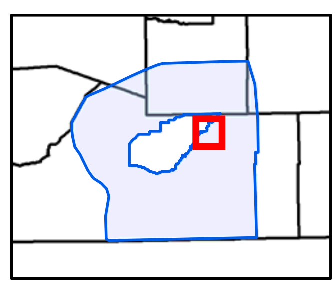
Legend

PCA Boundary

Kim, 37103-A1
La Junta, 37103-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 13. Purgatoire Mesas Potential Conservation Area, B3: High Biodiversity Significance

Purgatoire River and Tributaries

Biodiversity Rank - B3: High Biodiversity Significance

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

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

U.S.G.S. 7.5-minute quadrangles: Beaty Canyon, Box Ranch, Doss Canyon North, Doss Canyon South, Humbar Spring, Johnson Canyon, Lambing Spring, Miners Peak, O V Mesa, Packers Gap, Painted Canyon, Patterson Crossing, Plum Canyon, Riley Canyon, Rock Crossing, Sheep Canyon, Stage Canyon, Tobe, Trementina Canyon, Trinchera, Trinchera Cave, Villegreen

Size: 101,766 acres (41,183 ha) **Elevation:** 4,345 - 6,380 ft. (1,324 - 1,945 m)

General Description: The Purgatoire River and Tributaries site includes the Purgatoire Canyon and the side canyons of its tributaries. The canyon system is extensive and the views into the network of red sandstone canyons are often magnificent. Rising from the canyon floor to the top of the surrounding plateaus are river terraces of various size and steep rocky canyon walls and cliff faces. Within this setting are a series of mesas and inter-fluvial plateaus ranging from small to large. Numerous narrow side canyons dissect the mesas and plateaus and extend out away from the main canyons. While the main valley of the Purgatoire and Chacuaco rivers have long been used for human habitation, and now contain a number of non-native species, the deep side canyons are more inaccessible and typically contain communities of mostly native vegetation. The bottoms of the smaller side canyons often consist of exposed sandstone bedrock that support seasonally flooded pools which house numerous populations of the plains leopard frog. Surrounding the pools are open juniper woodlands with an abundance of bedrock and bare ground, cactus, yucca, and various native grasses. The exposed bedrock on the canyon floor, steep canyon sides, and cliffs provides extensive habitat for the rare ferns. The site contains numerous populations, both documented and un documented, of the state-rare ferns, plains leopard frogs, flathead chub, suckermouth minnow, and black-necked gartersnake.

Key Environmental Factors: The natural structure of the exposed bedrock and boulder fields, and the relative lack of non-native species within the smaller side canyons are the key environmental factors sustaining the populations of rare ferns. Although some non-native weedy species can be found in the side canyons, they are not widespread or prevalent. The dry rocky habitat and narrow recessed canyons create extensive habitat for the multiple fern species. The main environmental factor sustaining the plains leopard frog and fish populations is the natural flows of surface and ground waters. These flows are fairly intact, although there are some developed cattle ponds at the head of some canyons within the area and there are, scattered throughout the area, cattle tanks that are pumping ground water for livestock use. However, the canyon pools are still receiving substantial amounts of water, but during periods of drought water use might influence viability of the plains leopards frogs at this location.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ^{o}F, and summer average maximum temperatures in July and August are near or above 90 ^{o}F (HPRCC 2008).

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of the Purgatoire Canyon is believed to have been inhabited by people for as long as 5,000 years, and many native tribes lived in or visited the area. The first people of European descent to enter the area were with the Coronado expedition of 1540. Although considered part of Spain, the area remained sparsely populated by Euro-Americans until about 1821 when Mexico received independence from Spain and trade began between Santa Fe and Missouri. Soon thereafter, Spanish émigrés began to colonize the larger canyons. They built small settlements and ranches and raised herds of goats and sheep. The Purgatoire Canyon itself became an alternate trade route, and European settlement increased to a peak of about 400 people in the canyon by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dry-land-farming homesteaders fenced the land. In the 1920s and 1930s, the Purgatoire Canyon area was affected by the Dust Bowl and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continued on most private lands. The creation of the Department of the Army's Pinon Canyon Maneuver Site in the 1980s removed grazing from that site, however, cattle grazing continues as the primary land use on adjacent private lands.

Cultural Features: There are numerous archaeological and paleontological sites.

Biodiversity Significance Rank Comments (B3): The biodiversity rank is based on a good (B-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*). Multiple occurrences of state rare plants also inhabit the site. These include excellent (A-ranked), good (B-ranked) and fair (C-ranked) occurrences of the state rare (G5/S1) ebony spleenwort (*Asplenium platyneuron*), good (B-ranked) occurrences of the state rare (G5/S1) black-stemmed spleenwort (*Asplenium resiliens*), excellent (A-ranked) and good (B-ranked) occurrences of the state rare (G5?/S2) Eaton's lip fern (*Cheilanthes eatonii*), good (B-ranked) and fair (C-ranked) occurrences of the state rare (G5/S2S3) purple cliff-brake (*Pellaea atropurpurea*), a good (B-ranked) occurrence of the state rare (G5/S2) southern maiden-hair (*Adiantum capillus-veneris*), a fair (C-ranked) occurrence of the state rare (G4/S1)

Standley's cloak fern (*Cheilanthes standleyi*) and a fair (C-ranked) occurrence of the state rare (G5T4?/S2) smooth cliff-brake (*Pellaea suksdorfiana*). In addition, the site supports occurrences of aquatic dependent animals. These include multiple good (B-ranked) to fair (C-ranked) occurrences of the state vulnerable (G5/S3) plains leopard frog (*Rana blairi*), an occurrence of the state rare (G5/S2) suckermouth minnow (*Phenacobius mirabilis*) and occurrences of the state rare (G5/S3) flathead chub (*Platygobio gracilis*) which is a species of concern in Colorado.

Natural Heritage element occurrences at the Purgatoire River and Tributaries PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	B	2007-07-13
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	BC	2007-06-20
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	BC	2007-07-29
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	C	2007-06-06
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	C	2007-06-27
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	C	2007-07-13
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	CD	2007-07-14
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	2007-07-28
Fish	Hybopsis gracilis	Flathead Chub	G5	S3		SC	BLM/ USFS	E	2007-10-20
Fish	Hybopsis gracilis	Flathead Chub	G5	S3		SC	BLM/ USFS	E	2007-10-99
Fish	Hybopsis gracilis	Flathead Chub	G5	S3		SC	BLM/ USFS	E	2007-11-18
Fish	Phenacobius mirabilis	Suckermouth Minnow	G5	S2		SE		E	2007-10-20
Fish	Phenacobius mirabilis	Suckermouth Minnow	G5	S2		SE		E	2007-10-99
Vascular Plants	Argyrochosma fendleri	Fendler cloak - fern	G3	S3				B	2007-09-07
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1				H	1985-06-13
Vascular Plants	Adiantum capillus - veneris	southern maiden - hair	G5	S2				B	2007-09-07
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				A	2007-05-20
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				B	1994-06-12
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				B	2007-06-04
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				B	2007-09-05

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				B	2007-09-07
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				C	1994-06-12
Vascular Plants	Asplenium platyneuron	ebony spleenwort	G5	S1				H	1985-06-13
Vascular Plants	Asplenium resiliens	black - stemmed spleenwort	G5	S1				B	2007-09-07
Vascular Plants	Asplenium resiliens	black - stemmed spleenwort	G5	S1				B	2007-09-09
Vascular Plants	Pellaea atropurpurea	purple cliff - brake	G5	S2S3				B	2007-09-05
Vascular Plants	Pellaea atropurpurea	purple cliff - brake	G5	S2S3				C	2007-08-02
Vascular Plants	Pellaea atropurpurea	purple cliff - brake	G5	S2S3				H	1985-06-13
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S2				A	2007-05-20
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S2				A	2007-06-12
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S2				A	2007-09-07
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S2				A	2007-09-09
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S2				B	2007-09-11
Vascular Plants	Pellaea suksdorfiana	smooth cliff - brake	G5T4?	S2				H	1985-06-13

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

Boundary Justification: The site was designed to contain the canyons of the Purgatoire and Chacuaco Rivers and the canyons of their tributaries. It uses a buffer of 300m on each side of the canyon to ensure inclusion of the channel, the canyon bottoms, and the canyon walls. The buffer is intended to protect the physical structure of the canyons that the population of rare ferns depend on, as well as the surface and groundwater flows that the population of plains leopard frogs are dependent upon. Protection of the rivers and their flows is necessary for sustaining the state rare fishes.

Protection Urgency Rank Comments (P3): The site is a mixture of private land, State land, USFS land (Comanche National Grasslands) and Department of Army land (PCMS). The publicly owned parcels are ostensibly protected. Protection on private parcels could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

Protection Comments: The area has multiple land owners, including U.S. Forest Service lands in the Comanche National Grassland, Department of Defense lands in Pinon Canyon Maneuver Site and an abundance of large, privately owned ranches. The existing land use is largely compatible with the rare amphibians and ferns. Due to the multiplicity of public and private owners, a large scale multi-party collaborative approach will likely be necessary to establish effective protection over the entire expanse of this site.

Management Urgency Rank Comments (M4): Current land use is dominated primarily by livestock grazing and appears compatible with continued viability of the biological resources. Maintaining the current hydrologic regime to ensure long-term viability of the fish and amphibian population is the most important management need. It will also be important to avoid the introduction of exotic species (e.g., fishes, bullfrogs), to protect the population of native fish and amphibians from unnatural levels of predation and competition.

Management Needs: The introduction of exotic species (e.g., fishes, bullfrogs) should be prohibited and ground and surface water flows should be maintained at current levels. Avoiding additional water diversions and impoundments, and maintaining water quality and avoiding pollution of the water resource, is important.

Land Use Comments: The area was historically grazed, especially by cattle, but some sheep grazing also occurred. Some of the side canyons are inaccessible to cattle grazing and disturbance, as seen in the quality of the natural communities in these areas.

Natural Hazard Comments: The juniper uplands include steep slopes and cliffs and safety should be considered when hiking within these areas.

Information Needs: There is a need to understand the historical hydrological regime. The long term effects of water regulation and diversion directly pertain to the viability of the plains leopard frogs.

Version Author: Sovell, J.R. and J.E. Stevens
Version Date: 02/08/2008

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Map Date: 04/18/2008

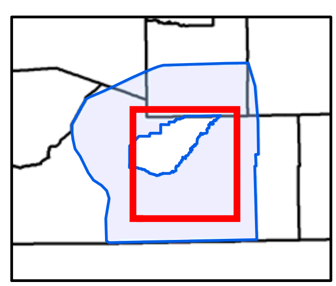
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 14. Purgatoire River and Tributaries Potential Conservation Area, B3: High Biodiversity Significance

Round Top Hill

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 4,301 acres (1,741 ha) **Elevation:** 4,300 - 4,493 ft. (1,311 - 1,369 m)

General Description: The site is a mix of short and mid grass prairie located on a patchwork of fee simple parcels and Comanche National Grassland parcels leased by the Edgar Ranch. It is generally bordered on the east and west by dirt surface county roads. It is centered on the rise known as Round Top Hill and includes the Dry Creek channel on the western edge.

Key Environmental Factors: Surficial geology is a combination of calcareous shales and limestones of the Niobrara formation, and older gravels and alluviums (Tweto 1979). Soil type is limited to the Manzanola series, which are described as very deep, well drained soils that formed in alluvial materials derived from sedimentary rock (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The Edgar Ranch continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B3): The site supports a good (B-ranked) occurrence of a globally imperiled (G3G4T2/S2) plant subspecies, rayless goldenweed (*Oonopsis foliosa* var. *monocephala*).

Natural Heritage element occurrences at the Round Top Hill PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2007-06-25

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

Boundary Justification: The boundary is drawn to contain the rare plants found on the gravelly shale bearing soils of the Niobrara formation, as well as other potential habitat found on the older quaternary gravels and alluviums. Although the geology thought to be important to this subspecies also occurs outside of the site, the boundary as drawn covers the minimum extent needed to maintain this occurrence.

Protection Urgency Rank Comments (P4): Protection of the rare plant could be improved by taking measures to increase the intent and tenure of legal protection. Because this site is partly on private land and partly on the Comanche National Grassland, conservation protection would require a collaborative effort between both landowners, but could be relatively simple. Possible mechanisms include special agency designations, perpetual conservation easements, natural area designations, and habitat conservation plans.

Management Urgency Rank Comments (M4): The current dominant land use of livestock grazing appears compatible with continued viability of the biological resources.

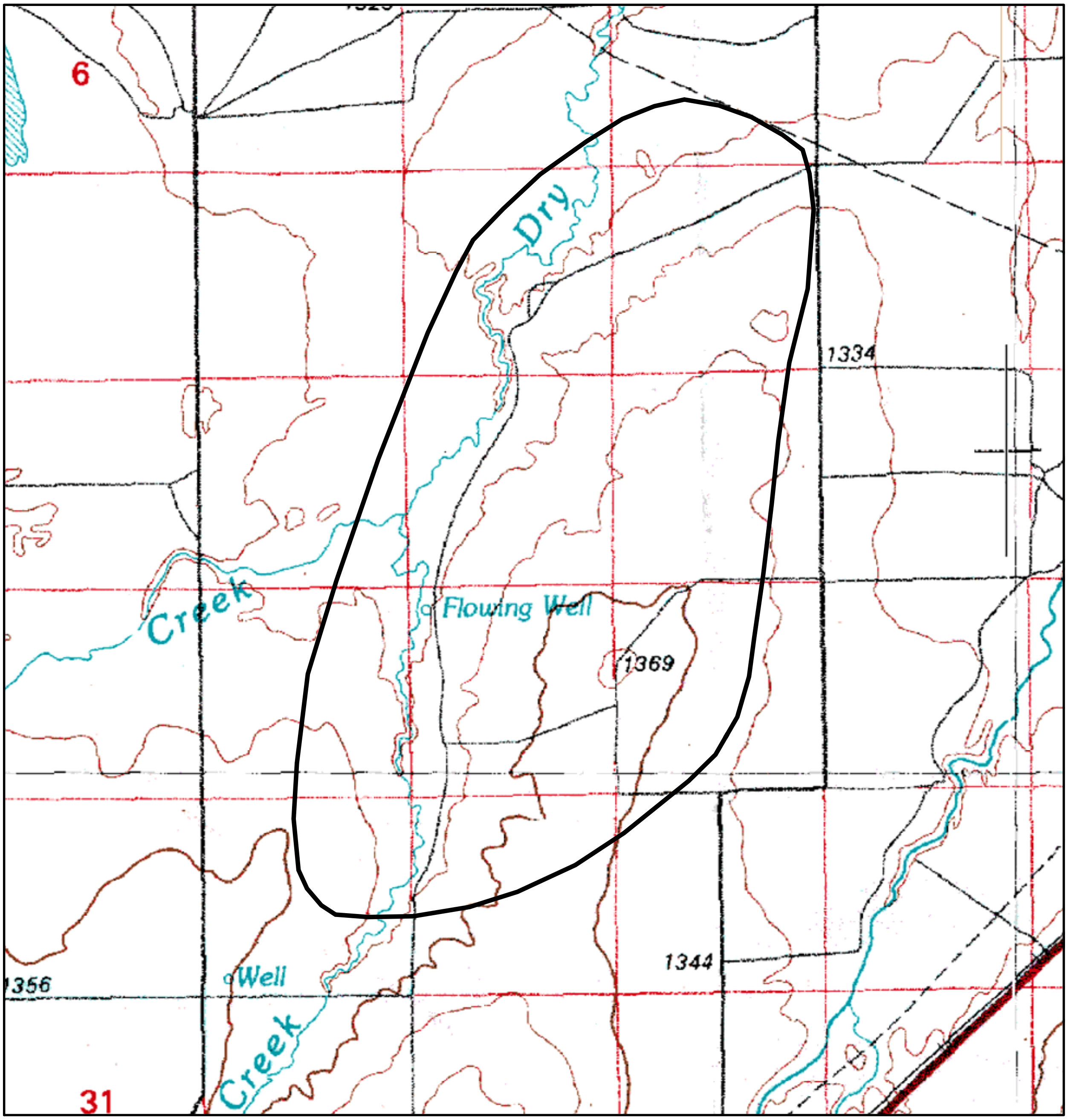
Management Needs: Manage the site to prevent direct physical destruction of the habitat. Mining or other excavation of the soils and rock should be avoided. However, maintaining rates of erosion and surface disturbance within the natural range of variation will prevent degradation of the characteristics that support continued viability of the element.

Land Use Comments: The current livestock grazing regimes appear compatible with the continued viability of the biological resources. Appropriate timing and intensity of grazing may be a valuable and necessary management tool.

Information Needs: Significant communities occur throughout the area beyond the site boundary. Further inventory could locate occurrences nearby. Very little is known about the role of fire in these types. Additional research into the role and effects of fire is needed.

Version Author: Stevens, J.E.

Version Date: 04/28/2008



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Map Date: 05/01/2008

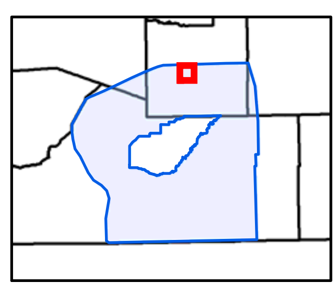
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 15. Round Top Hill Potential Conservation Area, B3: High Biodiversity Significance

Southern Purgatoire

Biodiversity Rank - B3: High Biodiversity Significance

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

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

U.S.G.S. 7.5-minute quadrangles: Abeyta, Alps Mesa, Box Ranch, Branson, Branson SE, Doss Canyon North, Doss Canyon South, Emery Peak, Humbar Spring, Johnson Canyon, Miners Peak, Painted Canyon, Patterson Crossing, Pine Canyon, Trementina Canyon, Trinchera, Trinchera Cave, Trinchera Pass

Size: 248,108 acres (100,406 ha) **Elevation:** 5,120 - 6,400 ft. (1,561 - 1,951 m)

General Description: Southern Purgatoire includes the escarpment that lies between two major canyons, the Chacuaco Canyon and the Purgatoire Canyon. Shortgrass prairie dominates the area. Vegetation consists of approximately 56% grassland or mixed grasses/forbs/cacti and 41% mixed shrubland. The remainder of the site includes trace amounts of pinon - juniper, greasewood, water, bare land and agricultural land. Multiple grassland birds inhabit the site. mountain plover, ferruginous hawk, swift fox, long-billed curlew, burrowing owl, and Texas horned lizards have all been documented. Black-tailed prairie dogs, an important food source for ferruginous hawks, have also been observed.

Key Environmental Factors: The rich diversity of species and plant communities is mostly attributable to the presence of an unfragmented native shortgrass prairie that has experienced minimal disturbance.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ºF, and summer average maximum temperatures in July and August are near or above 90 ºF (HPRCC 2008).

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of the Purgatoire Canyon is believed to have been inhabited by people for as long as 5,000 years, and many native tribes lived in or visited the area. The first people of European descent to enter the area were with the Coronado expedition of 1540. Although considered part of Spain, the area remained sparsely populated by Euro-Americans until about 1821 when Mexico received independence from Spain and trade began between Santa Fe and Missouri. Soon thereafter, Spanish émigrés began to colonize the larger canyons. They built small settlements and ranches and raised herds of goats and sheep. The Purgatoire

Canyon itself became an alternate trade route, and European settlement increased to a peak of about 400 people in the canyon by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dry-land-farming homesteaders fenced the land. In the 1920s and 1930s, the Purgatoire Canyon area was affected by the Dust Bowl and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continued on most private lands. The creation of the Department of the Army's Pinon Canyon Maneuver Site in the 1980s removed grazing from that site, however, cattle grazing continues as the primary land use on adjacent private lands.

Biodiversity Significance Rank Comments (B3): This site supports extant occurrences of the globally imperiled (G2/S2B) mountain plover (*Charadrius montanus*), an extant occurrence of the globally vulnerable (G3/S3) swift fox (*Vulpes velox*), a fair (C-ranked) occurrence of the state rare (G4/S3) black-tailed prairie dog (*Cynomys ludovicianus*), and good (B-ranked) and fair (C-ranked) occurrences of the state rare (G5/S2B) long-billed curlew (*Numenius americanus*).

Natural Heritage element occurrences at the Southern Purgatoire PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Charadrius montanus	Mountain Plover	G2	S2B		SC	BLM/ USFS	E	1997-06-99
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	B	2007-06-27
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	C	2003-06-04
Birds	Numenius americanus	Long - billed Curlew	G5	S2B		SC	BLM/ USFS	E	2007-06-20
Mammals	Vulpes velox	Swift Fox	G3	S3		SC	USFS	E	1997-06-14
Mammals	Cynomys ludovicianus	Black - tailed Prairie Dog	G4	S3		SC	USFS	C	2003-06-04

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

Boundary Justification: The site was drawn primarily for grassland species, especially mountain plover and swift fox, and includes a mosaic of mixed grassland and mixed shrubland. Pinon - juniper woodland to the west, north and east were excluded as well as irrigated agriculture to the south. The eastern boundary ends at Chacuaco Canyon and Mesa de Maya which act as sufficient barriers to the dispersal of swift fox. There is an area of open landscape between the canyon and mesa along Highway 160 that may allow for some movement of swift fox between this site and the Comanche Grassland site, which adjoins this site to the east. Movement of fox between these two sites, however, is probably infrequent. The western boundary is defined by the Purgatoire Canyon, which acts as an effective barrier to swift fox dispersal. Boundary was drawn using Landsat ETM+ satellite imagery and 25m Colorado Vegetation Classification data (CDOW).

Protection Urgency Rank Comments (P3): A conservation plan for this site has the potential to preserve an intact landscape dominated by native shortgrass prairie in an area that is rich in its diversity of animals, plants, and plant communities. The site is a mixture of private land, State land, USFS land (Comanche National Grassland) and Department of Army land (PCMS). The publicly owned parcels are ostensibly protected. Protection on private parcel could be improved by taking measures to increase the intent and tenure of legal protection (e.g. easements).

Management Urgency Rank Comments (M4): Large portions of the site are grazed by livestock, a use that is compatible with continued viability of the biological resources. Conservation of mountain plover requires grasslands where the vegetation is short in height as is maintained through grazing by wildlife, livestock, or prairie dogs or by fires. The removal of grazing with subsequent increases in vegetation height results in habitat that is unsuitable for plover.

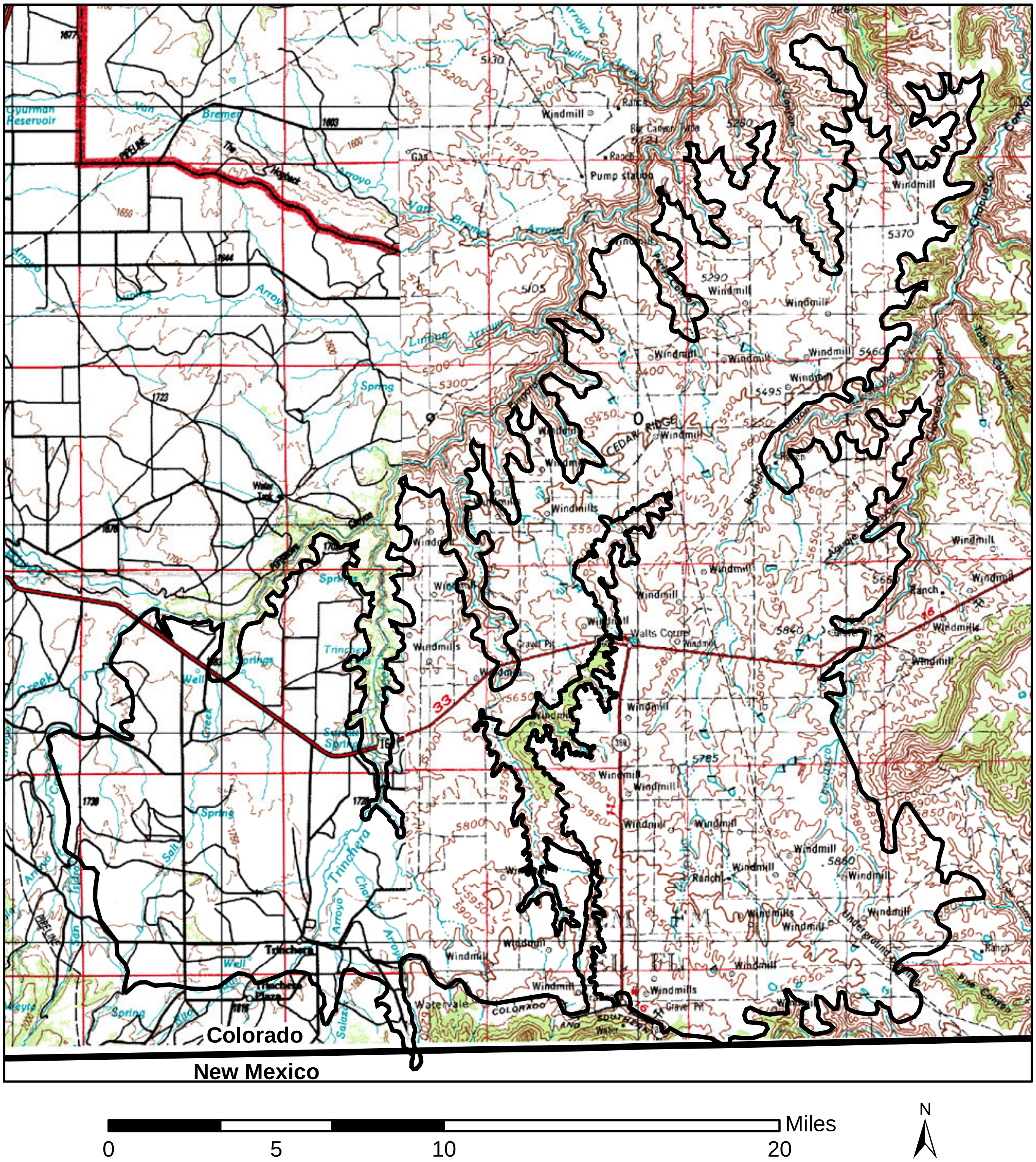
Management Needs: As is the case in many other areas, the driving conservation issues in the shortgrass prairie are habitat loss and habitat alteration. Ferruginous hawk and swift fox are very sensitive to disturbance and need big, unfragmented landscapes (CSP Bird Working Group 2004). Consequently, conversion of the remaining shortgrass prairie to other land uses should be prevented as should fragmentation of the existing large acreages of shortgrass prairie. Management should replicate the timing, intensity, and landscape distribution of the natural disturbances that shaped the shortgrass prairie including grazing and fire. In practice, however, modern agriculture tends to spread out grazing intensity evenly, producing a comparatively homogeneous landscape and fire has been nearly eliminated from the landscape. For the purposes of bird conservation, some grassland parcels should be grazed heavily and others not at all, to replicate the heterogeneous landscape historically created by climate and native species grazing. Currently, fire suppression and certain grazing patterns in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale (CSP Bird Working Group 2004).

Land Use Comments: Currently and historically the site was grazed, especially by cattle.

Information Needs: Ferruginous hawk may be nesting within the site. More information is needed to verify breeding and develop element occurrences.

Version Author: Sovell, J.R.

Version Date: 04/17/2008



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Map Date: 04/18/2008

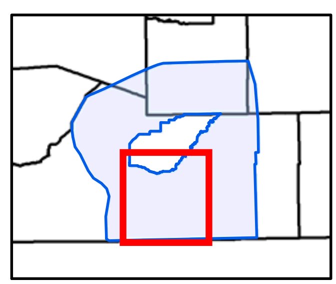
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 16. Southern Purgatoire Potential Conservation Area, B3: High Biodiversity Significance

Upper Bachicha Creek

Biodiversity Rank - B3: High Biodiversity Significance
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Box Ranch

Size: 1,000 acres (405 ha) **Elevation:** 5,700 - 5,800 ft. (1,737 - 1,768 m)

General Description: Upper Bachicha Creek is on a highway right-of-way in rolling short grass prairie.

Key Environmental Factors: Surficial geology is a combination of calcareous shales and limestones and heavily influences soil characteristics and hence vegetation (Tweto 1979). Soil type is limited to the Richfield Series, which is described as very deep, well drained soils that formed in calcareous loess (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ^{o}F occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use on surrounding landscape has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The private ranches in the area continue cattle ranching as the sole land use. Highway right-of-way is ungrazed but may be mowed once or twice in a year.

Biodiversity Significance Rank Comments (B3): The site supports a fair (C-ranked) occurrence of the globally imperiled (G2G3/S2S3) Arkansas Valley evening primrose (*Oenothera harringtonii*).

Natural Heritage element occurrences at the Upper Bachicha Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G2G3	S2S3			USFS	C	2007-06-06

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

Boundary Justification: The boundary was drawn to include the rare plant occurrence and a buffer onto the adjacent private lands which appear to contain suitable habitat.

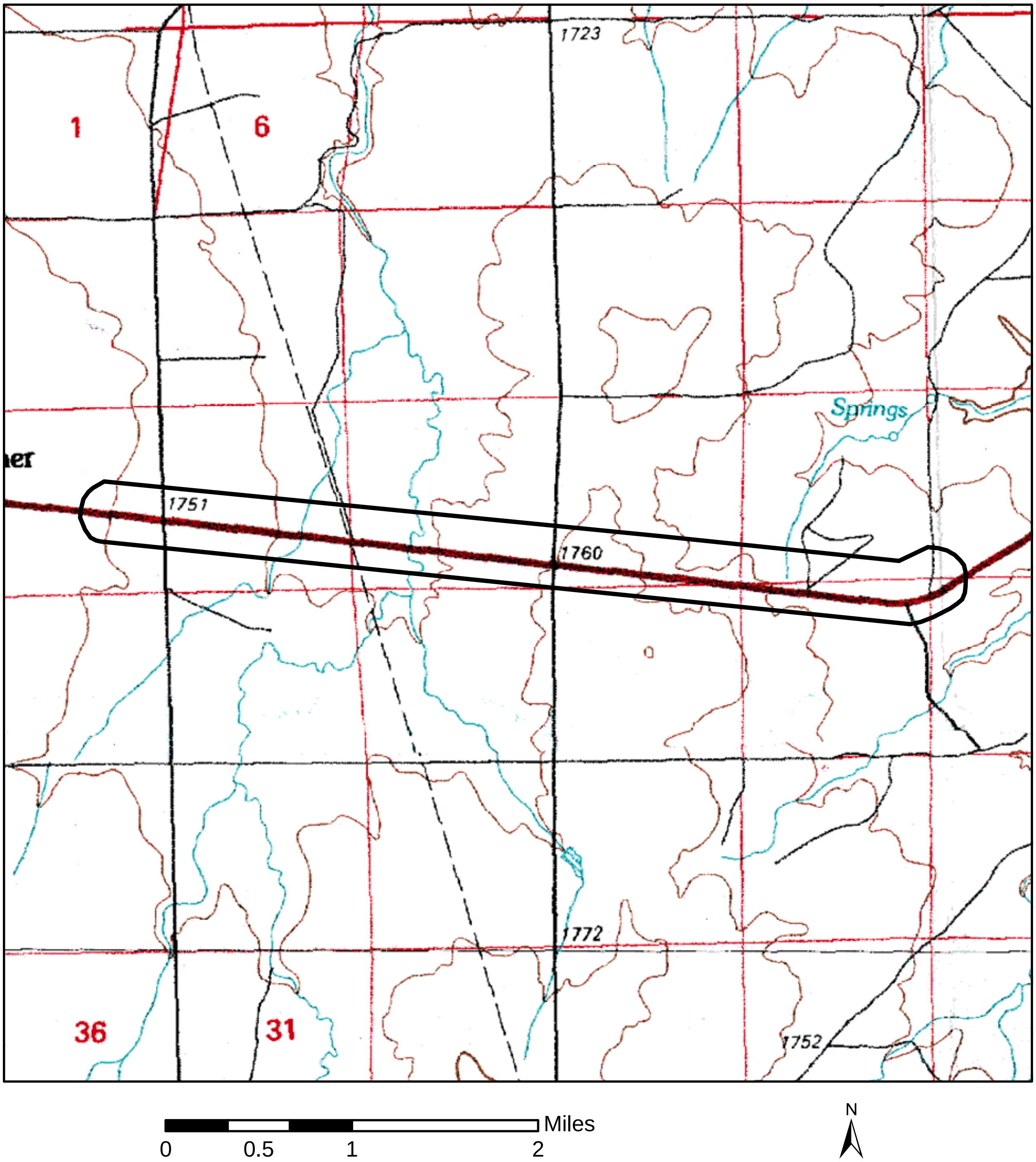
Protection Urgency Rank Comments (P4): The site is within the highway right-of-way and is currently not protected. Protection of the elements could be improved by taking measures to increase the intent and tenure of legal protection. Such measures may include having CDOT document this site under the shortgrass prairie initiative agreement with USFWS. Maps for that agreement should be updated to reflect this new location.

Management Urgency Rank Comments (M4): Mowing in the highway right-of-way, if conducted, should be timed to not impact growth of the plants or its reproduction. Highway maintenance operations need to be conducted to minimize threats to the element.

Management Needs: Alter maintenance and mowing operations to minimize impacts to the rare plant. Adjacent private lands may contain suitable habitat for individuals to establish over time given appropriate grazing regimes.

Land Use Comments: Maintenance operations in the highway right-of-way have the potential to impact the element occurrence.

Version Author: Stevens, J.E.
Version Date: 04/04/2008



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Map Date: 04/03/2008

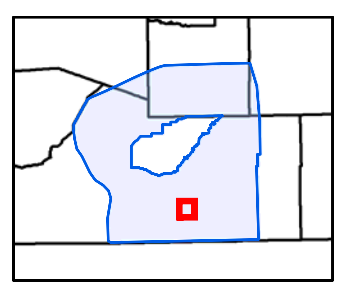
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 17. Upper Bachicha Creek Potential Conservation Area, B3: High Biodiversity Significance

Perly Uplands

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Doss Canyon South

Size: 6,317 acres (2,557 ha) **Elevation:** 5,200 - 5,520 ft. (1,585 - 1,683 m)

General Description: Perly Uplands occupies the rolling hills and prairie land on the west side of Perly Canyon, near the top of its watershed. It is dissected by several un-named tributaries of Perly Creek and bounded on two sides by two track ranch roads. It is drawn to conserve the mixed grass prairie and the watershed area up the drainage from the community.

Key Environmental Factors: Surficial geology is a combination of Dakota sandstone and Purgatoire formation consisting of sandstone and shales (Tweto 1979). Soil type consists of the Wiley and Richfield series, which are described as very deep, well drained soils that formed in calcareous loess (SCS 1994).

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). This ranch, owned by the Colorado State Land Board, continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B4): The site supports a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) Great Plains mixed grass prairie community, *Hesperostipa neomexicana*.

Natural Heritage element occurrences at the Perly Uplands PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				C	2007-06-11

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

Boundary Justification: The boundary contains the rolling hills and plains of deep soil that support the rare plant community. It is based on distribution of soils and drainage patterns. Although the soils, hydrologic, and topographic factors thought to be important to this element extend beyond the boundary, this area as drawn covers the minimum extent needed to maintain the known occurrence.

Protection Urgency Rank Comments (P4): The site is on Colorado State Land Board land and maintained as a working cattle ranch. Current livestock grazing regimes appear compatible with the continued viability of the rare community. Protection of the element could be improved by increasing the intent and tenure of legal protection. Applying a special agency designation such as State Trust Lands, would be a relatively simple method to effectively increase protection.

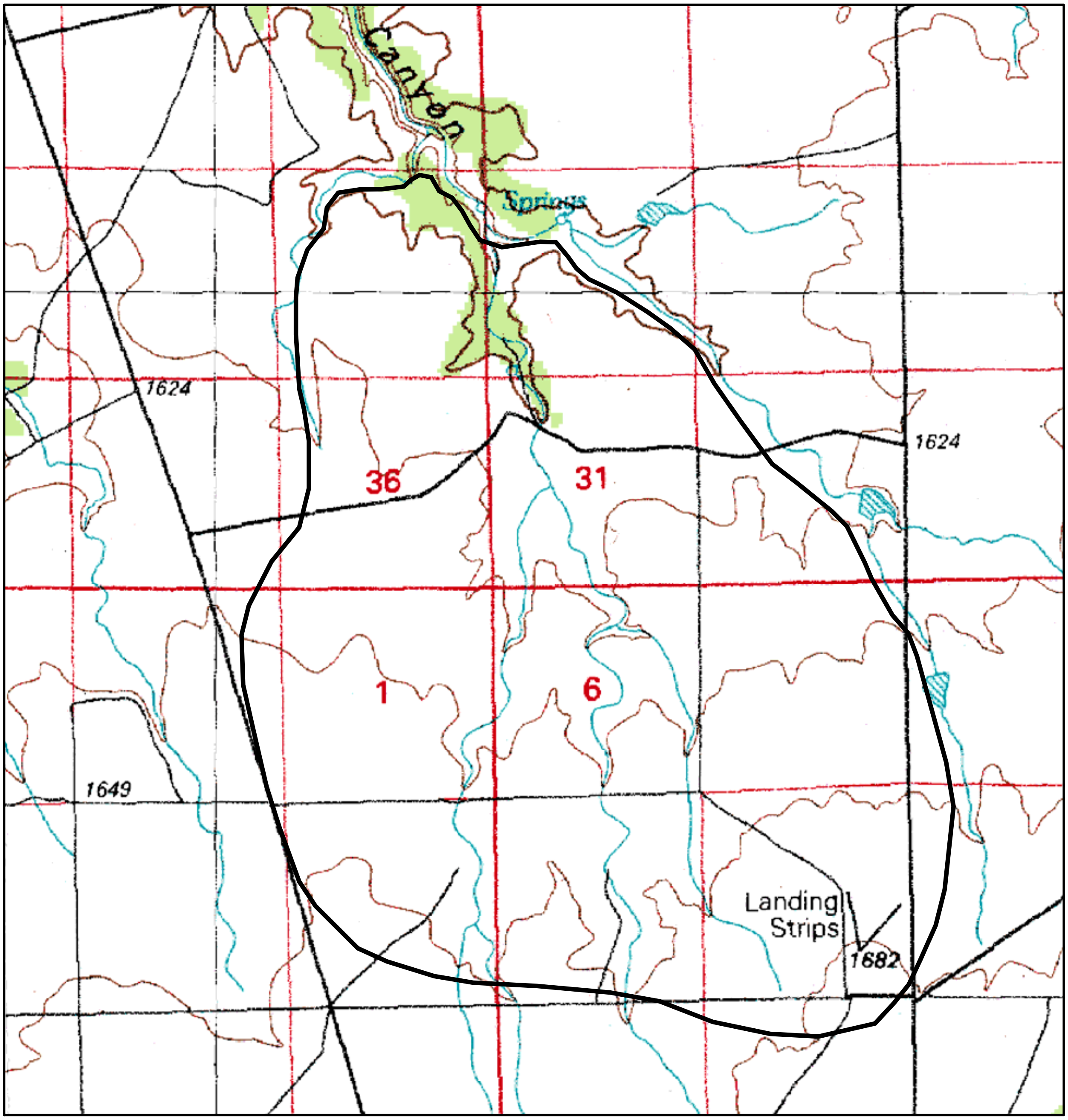
Management Urgency Rank Comments (M4): The dominant land use of livestock grazing appears compatible with continued viability of the biological resources. Encroachment of juniper on grasslands in the absence of fire can diminish the quality of the community. Removal or thinning of juniper woodlands should only be conducted when clear indications exist that the density and extent of the woodlands are well outside the normal range of variation for that community type. When and if undertaken, such actions should be conducted to minimize soil disturbance, propagation of non-native exotics, fragmentation, or direct destruction of the element of concern. Periodic use of prescribed fire may be appropriate.

Land Use Comments: Continue appropriate grazing regimes or incorporate periodic burning to stimulate regeneration and maintain species composition. Appropriate timing, intensity of grazing and periodic prescribed burning may be valuable and necessary management tools.

Information Needs: Additional occurrences may exist in the unsurveyed areas of similar soils, topography, and hydrology that extend beyond the site boundaries. Further field surveys are warranted.

Version Author: Stevens, J.E.

Version Date: 04/04/2008



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Map Date: 04/03/2008

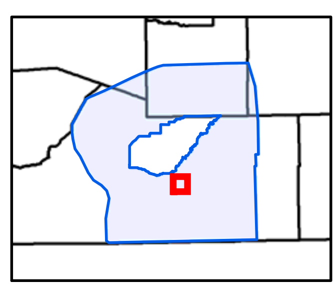
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 18. Perly Uplands Potential Conservation Area, B4: Moderate Biodiversity Significance

Flathead Canyon

Biodiversity Rank - B5: General Biodiversity Interest
Protection Urgency Rank - P4: No Threat or Special Opportunity
Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

U.S.G.S. 7.5-minute quadrangles: Jesus Canyon

Size: 690 acres (279 ha) **Elevation:** 5,200 - 5,760 ft. (1,585 - 1,756 m)

General Description: Flathead Canyon is a deep walled canyon with striking cliffs that in some places are 300 feet high. The views from the cliffs are spectacular. The canyon is characterized by rocky boulder-strewn steep slopes with a canyon floor of perennial and annual grasses that are subject to seasonal spring flooding and flooding from summer rains. Soils are of shallow eolian sediments and material weathered from sandstone. The canyon slopes are vegetated with shrublands or woodlands in most areas, but with benches where there is a mosaic of grasslands and woodlands. The dominate vegetation is juniper woodland and some of the steeper canyon slopes are covered with shrubs, generally mountain mahogany (*Cercocarpus montanus*), although Gambel's oak (*Quercus gambelii*) is also common. Two state rare amphibians populate the pools and springs of the canyon bottom; the canyon tree frog (*Hyla arenicolor*) and the plains leopard frog (*Rana blairi*).

Key Environmental Factors: Maintaining the integrity of the hydrology in the canyon, both the surface and groundwater flows, to assure natural recharge of the intermittent pools of the canyon bottom is important to the viability of the rare amphibian populations. Any changes in the hydrologic regime causing a decline in surface waters, like water diversions or pumping of surface and groundwater, would be detrimental to the continued viability of the amphibian population.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ^{o}F, and summer average maximum temperatures in July and August are near or above 90 ^{o}F (HPRCC 2008).

Land Use History: The area has been inhabited by people for as long as 5,000 years, particularly areas further east within the Purgatoire Canyon. Apparently many native tribes lived in or visited the area. The site is within the vicinity of the Santa Fe Trail and by the early 1840s traders and Spanish emigres colonized the canyons and brought ranching to the area. Ranching was the dominant force until 1909 when dry-land-farming homesteaders fenced the land. The 1920s and 1930s brought the "Dust Bowl" and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was discontinued in the 1950s, livestock continued to dominate. The creation of the Pinon Canyon Maneuver Site in the 1980s meant the end of grazing over a large portion of the area, while private lands continue to be grazed (Friedman 1985).

Biodiversity Significance Rank Comments (B5): The site supports an extant occurrence of the state rare (G5/S2) canyon treefrog (*Hyla arenicolor*) and the state rare (G5/S3) plains leopard frog (*Rana blairi*).

Natural Heritage element occurrences at the Flathead Canyon PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Hyla arenicolor	Canyon Treefrog	G5	S2			BLM	E	2007-06-28
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	2007-06-28

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

Boundary Justification: The boundary was drawn for the canyon tree frog and plains leopard frog. It extends for approximately 2 miles down canyon into areas that have not been surveyed, but that contain suitable habitat. The canyon slopes and parts of the escarpment are also included to help protect the uplands from disturbance and erosion. Although this site incorporates the element occurrences and additional suitable habitat, management at the watershed scale is important to protect a greater proportion of the groundwater recharge area believed necessary to maintain the surface flows, seeps, and springs that supply water to the pools, which support the amphibian population.

Protection Urgency Rank Comments (P4): This site is located entirely on private ranchland and is inaccessible to the general public. It is under the ownership of one owner making it relatively simple to develop a conservation plan that would preserve the entire site. Protection could be increased by raising the tenure and intent of legal protection of the site.

Management Urgency Rank Comments (M4): There are no evident threats nor is there any human disturbance within the canyon where the amphibian populations reside. Maintenance of the current hydrology to ensure long-term viability of the amphibian population is the most important management need. Management needs to also consider the impacts that fluctuations to water sources and the introduction of non-native bullfrogs, which out-compete native amphibians, will have on the viability of the amphibian population.

Management Needs: Efforts to prevent introduction of bullfrogs into the drainage should be implemented. The non-native bullfrog will out compete plains leopard frogs.

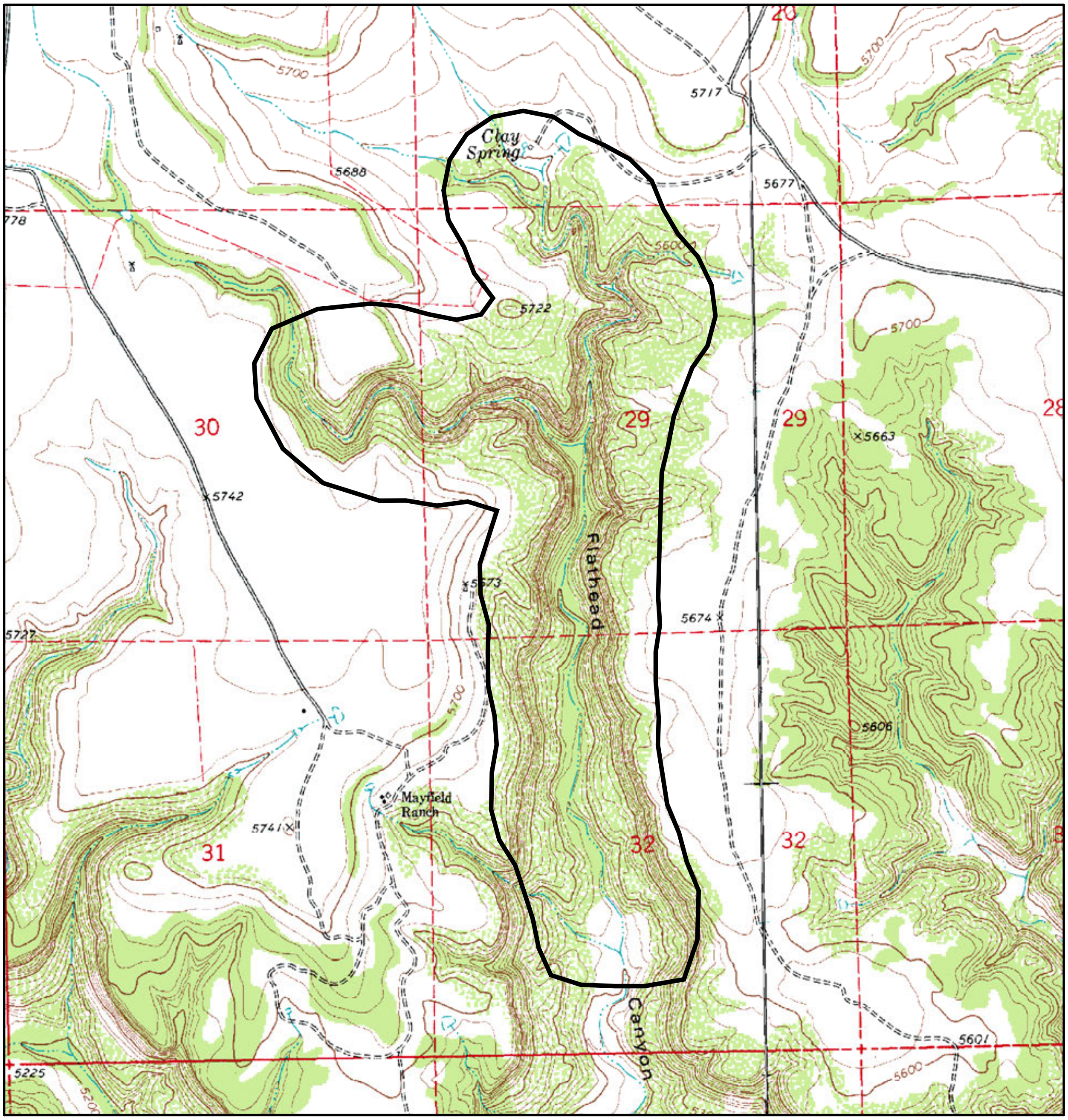
Land Use Comments: Ranching is the current use of the land and cattle grazing currently occurs on adjacent land. The site itself is inaccessible to cattle and is ungrazed.

Natural Hazard Comments: The juniper uplands include steep slopes and cliffs and safety should be considered when hiking within these areas.

Information Needs: Additional information on the size and extent of the amphibian population would assist with management of the population. Inventory the remaining area of the canyon to determine the population sizes of the two amphibians.

Version Author: Sovell, J.R.

Version Date: 04/04/2008



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Map Date: 04/03/2008

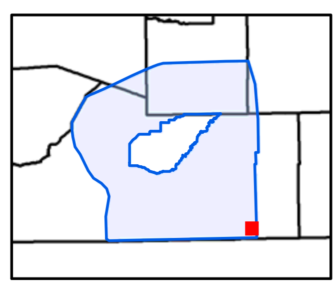
Legend

PCA Boundary

Jesus Canyon, 37103-A4

7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey

Location in Project Area



Map 19. Flathead Canyon Potential Conservation Area, B5: General Biodiversity Interest

Stormy Point

Biodiversity Rank - B5: General Biodiversity Interest

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: La Junta SW, Timpas

Size: 3,224 acres (1,305 ha) **Elevation:** 4,210 - 4,810 ft. (1,283 - 1,466 m)

General Description: The Stormy Point site contains an open, mesic draw dominated by needle and thread grass (*Hesperostipa comata*), three-awn (*Aristida purpurea*), tansy mustard (*Descurainia pinnata*), western wheatgrass (*Agropyron smithii*) and blue grama (*Bouteloua gracilis*). Two unnamed drainages, one of which contains Browning and Reese Reservoir No. 1, support populations of green toads (*Bufo debilis*) and Couch's spadefoot (*Scaphiopus couchii*). At the bottom of the drainage there is an area of a few acres that floods and holds water after seasonal summer rain storms. Additional populations of green toads and Couch's spadefoot were recorded from this ephemeral wetland.

Key Environmental Factors: Couch's spadefoot and green toad depend on the seasonally flooded wetlands found within the drainage of the site for successful reproduction. Any changes to the hydrology causing a decline in surface waters, like water diversions or pumping of surface and groundwater, would be detrimental to the continued viability of the amphibian population.

Climate Description: The climate is semi-arid with precipitation averaging about 14 inches per year. About half of the yearly precipitation is received during the months of May through August. Winter average minimum temperatures are in the range of 16-20 ºF, and summer average maximum temperatures in July and August are near or above 90 ºF (HPRCC 2008).

Land Use History: The area has been inhabited by people for as long as 5,000 years, particularly areas further east within the Purgatoire Canyon. Apparently many native tribes lived in or visited the area. The site is within the vicinity of the Santa Fe Trail and by the early 1840s traders and Spanish emigres colonized the canyons and brought ranching to the area. Ranching was the dominant force until 1909 when dry-land-farming homesteaders fenced the land. The 1920s and 1930s brought the "Dust Bowl" and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was discontinued in the 1950s, livestock continued to dominate. The creation of the Pinon Canyon Maneuver Site in the 1980s meant the end of grazing over a large portion of the area, while private lands continue to be grazed (Friedman 1985).

Biodiversity Significance Rank Comments (B5): The site supports an extant occurrence of the state rare (G5/S2) green toad (*Bufo debilis*) and the state imperiled (G5/S1) Couch's spadefoot (*Scaphiopus couchii*). Both species are known from very few locations in Colorado, however they are two of the most poorly understood amphibians in the state. Populations of both species are difficult to find except for after major rainfall events when individuals become active and mate, so timing and luck are important to successfully record these amphibians during field surveys. It is likely that more populations exist than are currently known.

Natural Heritage element occurrences at the Stormy Point PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo debilis	Green Toad	G5	S2				E	2007-06-29
Amphibians	Scaphiopus couchii	Couch's Spadefoot	G5	S1		SC		E	2007-06-29

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

Boundary Justification: The boundary was drawn to include two populations of green toads and one Couch's spadefoot population. It contains the two drainages, in their entirety, within which three populations of amphibians reside. It also includes some of the uplands that are necessary to maintain hydrological functions, which are responsible for the viability of the resident amphibian populations.

Protection Urgency Rank Comments (P4): The area is within the Comanche National Grassland boundary and is given no special designation.

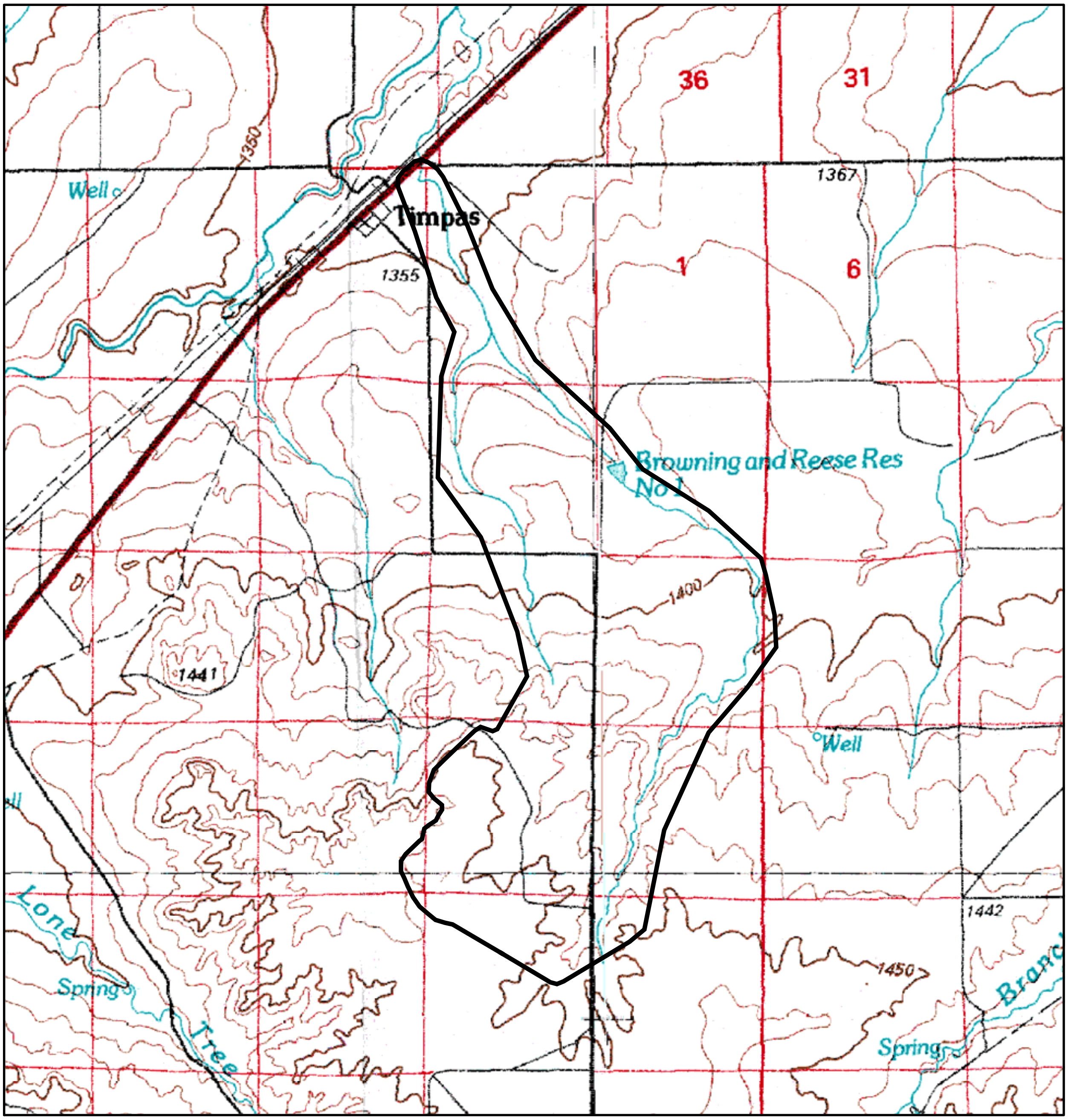
Protection Comments: Stormy Point is within the Comanche National Grassland and the site and surrounding land is managed for livestock grazing.

Management Urgency Rank Comments (M4): There are no direct threats of major significance to these two amphibian species as long as moderate cattle grazing remains the major land use.

Management Needs: Future management should consider the impacts of incompatible grazing, use of pesticides, introduction of non-native bullfrogs and fluctuations to water sources on the reproductive success of the amphibian population. The development of cattle ponds within native grasslands has the potential to increase the habitat available to these two amphibian species.

Version Author: Sovell, J.R.

Version Date: 03/25/2008



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Map Date: 04/01/2008

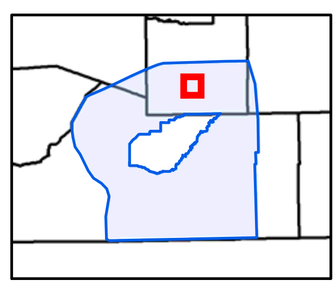
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster
Graphic produced by the
U.S. Geological Survey

Location in Project Area



Map 20. Stormy Point Potential Conservation Area, B5: General Biodiversity Interest

Tobe Headwaters

Biodiversity Rank - B5: General Biodiversity Interest

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

U.S.G.S. 7.5-minute quadrangles: Miners Peak, Tobe

Size: 192 acres (78 ha) **Elevation:** 6,400 - 6,600 ft. (1,951 - 2,012 m)

General Description: Site is located in the upper headwaters canyon of Tobe Creek and consists of an open woodland of juniper and cottonwood with a graminoid understory. It includes the canyon bottom and a small buffer up the side slopes.

Key Environmental Factors: Intermittent stream course with existing native vegetation supports the rare plant.

Climate Description: The climate is semiarid and is typical of the high plains of southeastern Colorado where approximately 13 inches of precipitation is received annually. Most precipitation occurs between April and September, with May typically being the wettest month. Annually, climate of the area is characterized by cold winters and hot summers with winter temperatures as low as zero on at least several days and temperatures of over 100 ºF occurring on many days in July and August (HPRCC 2008).

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The private ranch owner continues cattle ranching as the sole land use.

Biodiversity Significance Rank Comments (B5): The site supports an excellent (A-ranked) occurrence of a state rare (G5/S2) plant, prairie violet (*Viola pedatifida*).

Natural Heritage element occurrences at the Tobe Headwaters PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Viola pedatifida	prairie violet	G5	S2				A	2007-05-16

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

Boundary Justification: The site is drawn to maintain the canyon bottom where the rare violet is found and a buffer up the side slopes to protect these areas from activities that could induce erosion and result in sedimentation of the valley floor.

Protection Urgency Rank Comments (P4): Site has no formal protection, however, current land use is compatible with the rare violet.

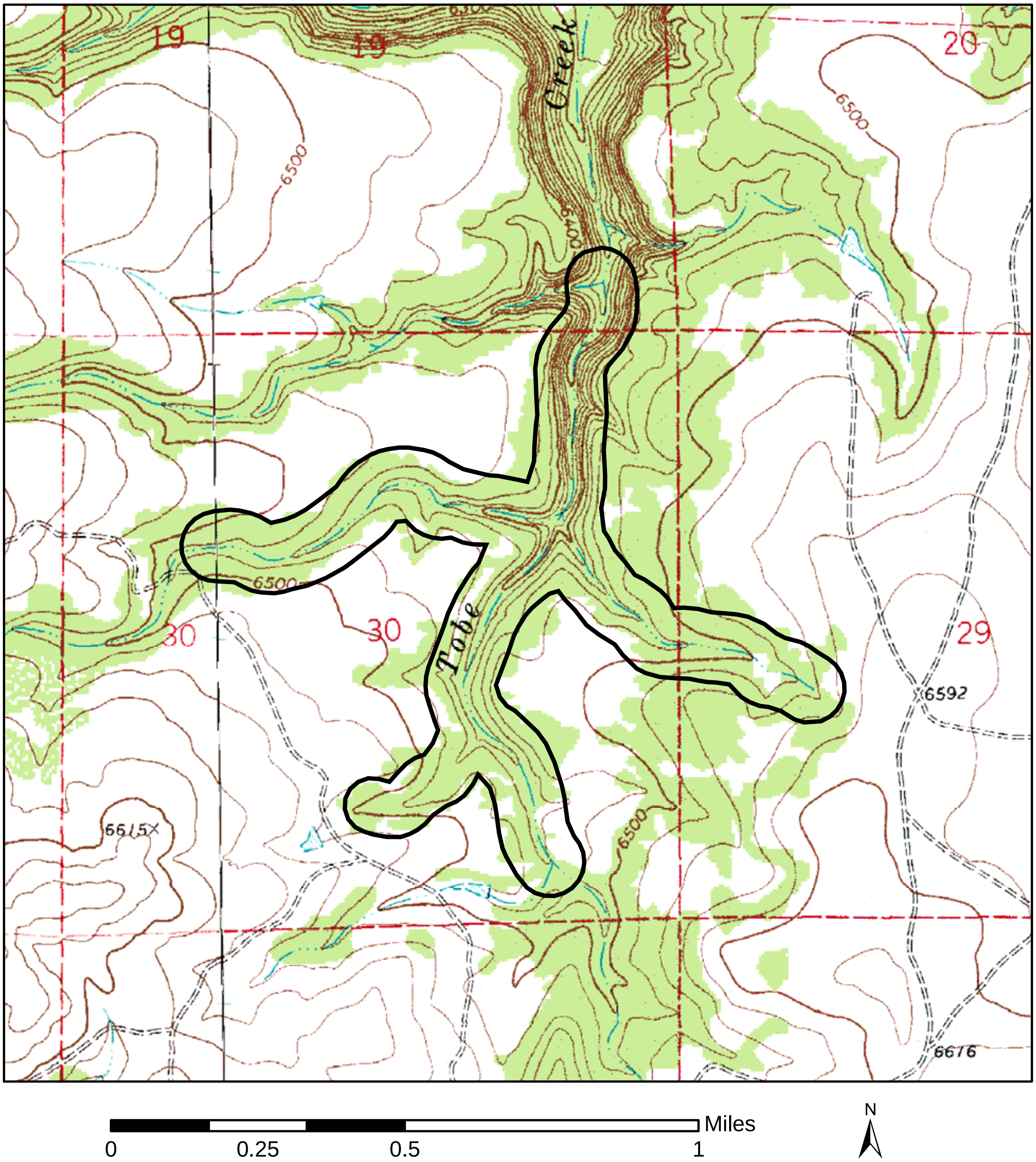
Management Urgency Rank Comments (M3): Control nearby infestations of hound's tongue and any other exotics so they do not invade the site.

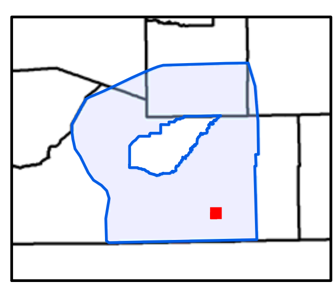
Management Needs: Control offsite infestations of hound's tongue and any other exotics to prevent colonization within the site.

Land Use Comments: Dominant land use is livestock grazing that appears to be compatible with the element.

Exotic Species Comments: No exotic species were observed on site; however, hound's tongue (*Cynoglossum* sp.) was seen along the access road on approach.

Version Author: Stevens, J.E.
Version Date: 04/18/2008



Colorado Natural Heritage Program Colorado State University 254 General Services Building 8002 Campus Delivery Fort Collins, CO 80523-8002 Ph (970) 491-1309 Fax (970) 491-3349 www.cnhp.colostate.edu Map Date: 04/03/2008	**Legend** PCA Boundary Tobe, 37103-B5 Miners Peak, 37103-B6 7.5 Minute Digital Raster Graphic produced by the U.S. Geological Survey	Location in Project Area 

Map 21. Tobe Headwaters Potential Conservation Area, B5: General Biodiversity Interest

CONSERVATION ASSESSMENT

The 15 ecological systems of the study area can generally be categorized into three groups: canyon communities and their associated aquatic systems, woodland communities, and grassland/shrubland communities. The primary ecological processes that influence how these communities are distributed on the landscape are fire, grazing, soils and drought. There is constant interplay among these systems and processes, though some systems are more closely tied to particular processes than others. Fire is an especially important process affecting the distribution of juniper woodlands in the study area, while grazing exerts a stronger influence over grasslands and shrublands. Soils and drought have a significant influence over all of the ecological systems within the study area.

This conservation assessment considers the general condition of canyon, woodland, and grassland/shrubland communities within the study area as it relates to current land use and management. These comments are based on observations by biologists conducting field surveys for this project during the summer of 2007. A thorough analysis of conservation issues at a regional scale was not conducted as part of this project, so this assessment should be considered preliminary.

Overall, the condition of the biological resources in the study area is excellent, and current management is compatible with biological diversity in most places. This area harbors the largest intact working landscape remaining not only on Colorado's eastern plains, but also in the entire Central Shortgrass Prairie ecoregion. The Shortgrass Prairie Partnership (Neely et al. 2006) has identified this area as having high landscape integrity and very high conservation value – a testament to the quality of management by the landowners in this area. The following comments summarize our best professional judgment of areas where there are opportunities to improve alignment of management strategies with maintaining or improving quality of biological resources.

Canyon Communities

Canyon communities include elements from Southern Rocky Mountains Juniper Woodland and Savanna, Southern Rocky Mountains Lower Montane-Foothills Shrubland, Western Great Plains Cliff and Outcrop, Western Great Plains Riparian Woodland and Shrubland, Western Great Plains Shortgrass Prairie, and other shrublands. These communities support those conservation targets that are closely tied to hydrology, including fish, amphibians, garter snakes, and ferns. These areas are also rich in archaeological artifacts and cultural sites.

The canyon communities are unique in the CSP ecoregion, and are in excellent condition compared to similar canyon systems elsewhere in Colorado. They are generally intact in terms of condition and function, based on the presence of indicators such as the plains leopard frog. The canyon complex in this study area is thought to support the densest population of this species in Colorado. All of the fish found during the 2007 survey were native species, with the exception of the largemouth bass, which is present in Perly Canyon and the Carrizo Creek drainage. All of the native fish expected to occur in the area were recorded in the 2007 samples.

Though many of the canyon communities are in excellent condition, there are some areas where altering the management approach could alleviate adverse impacts from current or past land use. Some streams have bullfrogs that compete with, and predate on, native amphibians. If left uncontrolled, this situation could pose a serious threat to the continued persistence of some native species. Also, watering tanks have been installed at the top of most side-drainages. These tanks capture water that would otherwise flow into the tributaries, thereby reducing water flow into the habitats downstream. Weed invasions are associated with these locations, and tend to migrate downstream. Potential for hydrological alteration and spread of weeds related to these tanks is probably the most significant management concern observed in the canyons. One potential benefit of these tanks is that they attract amphibians, and therefore may be providing additional habitat at the tops of canyons, and also downstream where the canyons hold ponds. However, the natural habitat would be improved by removing tanks that are no longer working. Re-grading and re-seeding with native seeds would help reduce or eliminate the existing weed seedbank, and improve conditions for native amphibians overall.

Many of the canyons get very little, if any, grazing during growing season, and only light grazing in the winter. Some of the smaller side-tributaries do not get grazed at all due to the difficulty of access for cattle. Side canyons that are not grazed are in very pristine condition. However, side canyons that are used periodically for grazing have some weed infestations, especially cheatgrass. Ideally, these side canyons would not be grazed. Although there is tamarisk in a few of the side canyons, the shrub component is generally comprised of native species. Chacuaco Canyon, which has a very wide river bottom similar to the Purgatoire River, is in need of restoration. This area has the highest degree of weed invasion (particularly tamarisk and cheatgrass) of the canyons visited during the survey, as well as nitrification in some pools (i.e., increased algae growth due to increased levels of nitrogen from cattle droppings) and some erosion of streambanks associated with cattle use. In general, side slopes in the canyons are in excellent condition, due largely to the fact cattle tend to stay in the bottoms of the canyons, and do not go upslope.

Woodland Communities

Woodlands in the study area are primarily juniper. These woodlands occur on rimrock, where old growth junipers tend to occur in narrow strips of 100 meters or less, mostly on the tops of the canyons. As soil becomes deeper further away from the rocky edges of the canyons, younger age classes of juniper begin to appear in juniper savannas, where seedlings can become established more easily. This system supports a suite of birds unique to the CSP ecoregion (but more common elsewhere), including gray vireo, loggerhead shrike, and curve-billed thrasher. The juniper woodlands in the study area are the only large juniper woodlands in the CSP ecoregion, and are unique compared to other juniper woodlands in Colorado. Most juniper woodlands in Colorado occur on the West Slope, where they are usually found in combination with pinyon pine and a different suite of understory species. The uniqueness of these juniper woodlands is further demonstrated by presence of the triploid Colorado checkered whiptail. The whiptail is endemic to the juniper woodlands of southeastern Colorado, and is not known to occur in any other place in the world.

In general, fire is a dominant ecological process in most juniper systems, acting in concert with climatic conditions to influence distribution and density. In areas where surfaces are very rocky, such as the rimrock found in the study area, fires do not carry well, and are not usually a source of mortality for trees. However, in juniper savannas where soil and vegetation litter buildup are greater, fire can kill the trees. Fire suppression in modern times has potentially allowed junipers to increase to a density above what may occur if fires were allowed to burn. Native Americans may have historically set fires that kept junipers from invading into grasslands (Vale 2002). Under favorable climatic conditions, and in the absence of human-modified fire patterns, it is possible that juniper density would have increased even above levels seen today.

In areas where the predominant land use is cattle grazing, juniper zones are often intensely managed to increase forage production. Within the study area, chaining, bulldozing, herbicides, and burning have been used to reduce juniper density and improve conditions for cattle. The soil disturbance that results from chaining allows for proliferation of weeds such as cheatgrass, whose seeds germinate earlier and have a competitive advantage over native species. Even so, much of the remaining juniper woodland and savanna systems appear to be in good condition in most areas. In places where control of junipers is unavoidable or desirable (e.g., where junipers are encroaching into adjacent grasslands), controlled burns that mimic the natural fire regime are preferable to use of herbicides or the destructive methods of chaining or bulldozing.

Some juniper savannas have experienced an increase in density of snakeweed (*Gutierrezia sarothrae*). This is a native species that is not palatable to cattle, and therefore may increase in density under some grazing regimes (Campbell and Bomberger 1934, Ralphs et al. 2007). Drought can also result in increased snakeweed, and intense grazing may contribute to increased levels of snakeweed after a drought (Harrington and Pieper 1993). The OV Mesa, owned by Colorado State Land Board and leased by The Nature Conservancy, has not been grazed since at least the early 1990’s, and is not thought to have experienced intense prior grazing due to lack of water resources. This site has the same soil type as the surrounding area but considerably less snakeweed. Of the properties surveyed in the study area, those that experienced intense grazing during the recent drought appear to have significantly more snakeweed present than those that did not. Fire kills snakeweed, and may be a useful management tool for areas where density of snakeweed is too high (McDaniel et al. 1997, Valone et al. 2002, Parmenter 2008). Grazing in winter or deferred rotation would help keep abundance of snakeweed down and support blue grama.

Grassland/Shrubland Communities

Shortgrass prairie is the dominant ecological system outside the canyon/juniper zone. Patches of midgrass prairie, sandsage, saltbush, and winterfat communities are scattered throughout prairie communities where soil conditions are suitable. The grassland and shrubland communities in the study area support many conservation targets, including a suite of declining prairie birds, swift fox, black-tailed prairie dog, spadefoot toads that inhabit small pools and basins, massasauga rattlesnake, and Texas horned lizard. Though shortgrass prairie is the dominant grassland system, the landscape also supports exemplary patches of midgrass prairie species such as New Mexico feathergrass (*Hesperostipa neomexicana*). One of the factors that makes this area so phenomenal, and so unique in Colorado, is the fact that the landscape still supports a mosaic of ecological systems, with large, very high quality patches of rare communities such as the New Mexico feathergrass occurring where conditions are suitable.

The most significant ecological processes in the grassland/shrubland systems are grazing and climate (especially drought). The condition and species composition of grasslands and shrublands is highly variable across the study site. Differences are likely due to variations in soils and grazing management. Areas that have previously been tilled are still showing altered species composition. Many of these areas have significantly reduced cover of blue grama. This grass can be thought of as a relictual old-growth species, probably becoming widespread under significantly different climatic conditions of the past (i.e., sufficient moisture present at the right time in the growing season). In order to germinate from seed, this species requires temperatures to remain in the 50's and topsoil to remain moist for at least 10 days. These conditions are now very rare, and successful establishment of blue grama through seeding is therefore difficult (Briske and Wilson 1977, 1978). Being a bunch grass, this species does not spread by rhizomes, but rather each plant expands from its base. Thus, soil disturbances that pull plants out of the ground, such as tilling, can permanently remove blue grama from the local community. As the only native grass occurring in this area that has high nutritional value during winter[1], this species is very important to retain on grazing lands. Fortunately, blue grama is very resilient to grazing, and co-exists quite well with cattle under compatible grazing regimes. Because this ecological system evolved under grazing by native herbivores, lack of grazing could be considered a "disturbance" in this system. Grasslands that are not grazed may experience a buildup in litter and an increase in weeds compared to similar areas that are grazed (Milchunas et al. 1990, 1992).

It is also important to maintain prairie dog complexes. They are an integral component of a healthy shortgrass prairie ecosystem. Prairie dogs have been proposed as keystone species in North American grasslands (Miller et al. 1994). They impact grassland ecosystems by increasing habitat heterogeneity, modifying ecosystem processes, and enhancing regional biodiversity (Ceballos et al. 1999). Consequently, the protection of prairie dogs is necessary to maintain the proper functioning of native shortgrass prairies.

On the whole, grasslands and shrublands within the study area are relatively free of weeds. Roads are a primary vector for weeds, and the road density is quite low in this area.

Shale barrens are small patch systems that occur within grasslands and shrublands in areas where substrates are exposed. These areas are significant for the rare plants that are often found there. These areas are characterized by lack of fire (which doesn't carry well over rocky surfaces), very low biomass, and relatively weed-free (due to lack of soil for weed establishment). These areas are not preferred by livestock, so they do not tend to be grazed. Shale barrens are easily damaged by roads. Roads in these areas can have a disproportionately large impact in terms of direct

[1] Buffalograss (*Buchloe dactyloides*) is another native grass of the Colorado prairie that has high nutritional value in winter, but occurs only sparsely – if at all – in the study area.

destruction, especially given that these patches occur in such limited numbers over a small range. Once damaged, shale barrens do not recover easily.

Potential Impacts

Overall, the condition of the natural communities in the study area is excellent. Most current management is compatible with conservation of biological values, and there are few significant threats. Even with activities of humans making a living off the land, the biodiversity value is very high. This landscape still supports almost the full suite of native species, with the exceptions of only black-footed ferrets, wolves, and grizzly bears.

Hydrological Modifications

As discussed under canyon communities, the only hydrological modification observed within the study area is related to watering tanks on top of the side canyons. These tanks are diverting water, and thereby altering the natural quantity and timing of in-stream flow in these tributaries. However, the pools found within the canyons are still receiving enough water to sustain widely distributed subpopulations of plains leopard frogs. During periods of drought, water use may influence the viability of some subpopulations of the frogs, but the fact that plains leopard frogs still remain in most of the area's canyons seems to indicate that the metapopulation dynamics are still functioning. If local populations are dying off during drought, recolonization may be occurring once precipitation returns to normal levels.

There are no large-scale hydrological modifications within the study area. However, the Purgatoire River has been dammed upstream at the Trinidad Reservoir. The water in this drainage is now managed primarily to comply with the Arkansas River compact, which requires that the water be sent downstream to Kansas. Though water is not diverted in the study area, the natural hydrograph (timing and quantity of peak flows) is altered. The dam has some moderating influence on timing and quantity of flows, but input from below the dam (e.g., runoff during summer storms) is not affected, and the area still experiences flash-flood events. We do not know what effect this change in hydrology has had on native flora and fauna in the study area.

Development and Recreation

Urban development is not a pressure that is currently impacting the study area. In fact, some communities are losing population rather than growing. The study area is far enough away from existing urban growth areas that residential development is not considered a significant threat in the near future. However, the rimrock/canyon country is especially beautiful, and may have significant aesthetic appeal as potential sites for subdivision into second home development.

The study area also has potential for recreation development, including motorized recreation similar to that featured at Moab, Utah. High intensity motorized recreation, if it were to occur, would presumably have adverse impacts on biological resources in the area. Hunting is currently the most common recreational activity in the study area. Conducted properly, this is generally a low-impact activity in terms of overall biological diversity.

Extractive Industries

The only mining activity observed in the study area was hand picking of sandstone and mossrock for the landscape industry. These activities are small in scale, and are not having a significant, observable impact on the natural landscapes. There has not been oil and gas or wind energy development in this area, and the study area is not included in maps showing high potential for future development by these industries. Due to lack of forests and a limited amount of woodlands in the study area, there is no logging to speak of. Overall, extractive uses of the land are not expected to have a significant impact on biological resources in the study area in the foreseeable future.

Renewable Resources

The Governor's Task Force on Renewable Resource Generation Development Areas has considered the potential of the lands within the project area for development of wind and solar renewable energy resources. The area is not considered a high potential for development of wind energy. The area is, however, targeted as a potential area for development of solar energy resources (Renewable Resource Generation Development Areas Task Force 2007)

Grazing Management

Livestock grazing is a very significant activity in the study area, not only as a principal ecological process, but also as the primary economic activity supporting the local human communities. In shortgrass prairie, grazing maintains native plant composition and structure within the ecological system, as well as habitat for prairie fauna. In this system, the cessation of grazing can have as significant of an adverse impact on the biodiversity as excessive grazing. It is important, however, to manage grazing such that a heterogeneous mosaic of taller structure, shorter structure, and the full suite of native species is maintained across the landscape. A change in grazing practices and restoration may be needed in areas where structure is homogenous, increasers (plants not palatable to cattle) are dominant, weeds are proliferating, and/or blue grama is declining. In woodland systems, the most common source of adverse impact from grazing management is related to intentional reduction in natural juniper cover to promote forage. In areas where juniper are invading grasslands due to loss of natural ecological processes such as fire, reducing juniper cover would not be considered an adverse impact from an ecological system standpoint, unless methods used are unduly destructive (e.g., chaining, bulldozing). In canyon and riparian areas, grazing that is not carefully managed may result in altered species composition and weed infestations, as well as reduced water quality (i.e., nitrification) and streambank erosion.

Proposed Expansion of Pinyon Canyon Maneuver Site

The proposed expansion of the U.S. Army's Pinyon Canyon Maneuver Site (PCMS) is a very emotional and politically charged issue. Because the proposed expansion was the catalyst that initiated this survey project, we offer these comments as our suppositions on the **potential** impacts to biological resources from this change in ownership, should it ultimately occur. These comments are restricted to field observations of biological resources, and do not address the many cultural, political, and economic considerations related to the proposed expansion. It is necessary to state unequivocally that CNHP is neither in support of, nor opposed to, the expansion of PCMS.

Biological and ecological systems are very complex, and may respond to changes in management in unanticipated ways. Changes from altering land use could be either positive or negative, depending on a wide variety of factors, including type of use, as well as timing, frequency, duration, and/or intensity of use. Military training could result in a variety of potential impacts, including soil compaction and erosion from mechanized maneuvers, weeds, and altered species composition, as well as impacts to animal behavior from noise (from both ground training and any flight training that may occur) and presence of humans in large numbers. However, detailed information on timing, frequency, and intensity of training is not available. In the absence of detailed information on how lands would be managed under expanded PCMS tenure, it is impossible to make definitive statements as to whether the condition of ecological systems would be expected to remain stable, improve, or deteriorate. The following comments are based on the assumption that the U.S. Army would manage newly acquired lands in the same way that the existing PCMS is currently being managed. A thorough, multi-year study of all ecological systems has not been conducted for PCMS or for the private lands in this project's study area. Therefore, these comments are based on observations made in the field by CNHP biologists conducting surveys on both private lands and on PCMS. These surveys have been conducted over several years at a variety of scales and for a variety of purposes. Though they do not represent a direct comparison between PMCS and surrounding private lands, they offer the best information currently available for us to draw on as we begin to think about potential changes in the biological resources of this landscape as they relate to land ownership.

Canyon Communities

The canyon communities, including riparian systems, are in excellent condition on PCMS. This is primarily due to the fact that the topography in these areas is not conducive to mechanized training, and therefore the canyons receive little use. The canyons on private lands within the study area are also generally in excellent condition, but some areas have been adversely impacted by conditions associated with livestock grazing (e.g., weeds, water tanks). Assuming that livestock grazing will not be a component of U.S. Army management, there is potential for conditions in some riparian areas to improve after PCMS expansion. Riparian communities tend to be very resilient, and can exhibit dramatic improvement over relatively short timeframes with restoration. Under compatible management regimes, it should be possible to maintain equally healthy canyon communities on privately-owned ranchland and military lands.

Woodland Communities

To our knowledge, woodland communities on PCMS primarily occur adjacent to canyons, where training is limited to dismounted activity (i.e., troops on foot, but no tracked or wheeled vehicles, or live fire training). To the extent that trail systems and bivouac sites are re-used frequently, there is potential for local impact (e.g., weeds, trampling), but these areas are not likely to experience intense disturbances such as those typical of mechanized maneuver.[2] If these assumptions are correct, then impacts to woodland systems from military training are likely to be mild compared to potential impacts on private lands where woodlands are being chained or bulldozed, or otherwise managed to maximize forage production. On some private lands, junipers are beginning to invade adjacent grasslands, probably as a result of fire suppression. In these areas, management of juniper is good for grasslands, but not necessarily good for the woodland. We do not know the status of juniper/grassland invasion on PCMS. This may not be as much of an issue on PCMS, especially in areas where fires occur as a result of live-fire training. In private-land woodlands where ranchers are using compatible grazing practices and not altering natural community structure, the quality of woodland communities would be expected to be similar between private ranchlands and military land. It should be noted that responses of these communities are under-studied, so much remains unknown about how these trees respond to different disturbances. Junipers are long-lived species; thus, it may take a long time to see impacts from disturbance.

Grassland Communities

Of all the ecological systems in the study area, grassland communities currently exhibit the greatest difference in quality between private land and military land. The quality of private grasslands is generally better from a biodiversity conservation perspective, with the exception of private lands where snakeweed abundance and density is high. The greatest conservation concern in grasslands is currently bird communities. Maintaining the full suite of native grassland birds requires a mosaic of habitats, ranging from very short structure and high percentage of bare ground, to taller grasses with a shrub component. Livestock grazing at varying intensities (light to heavy) can mimic the mosaic-creating effects of native herbivores in this system, and may play a major role in maintaining suitable landscapes for many grassland species (Milchunas et al. 1998). Grasslands at PCMS have not been grazed. Given the assumption that livestock grazing will continue to be absent from U.S. Army land, it is possible that conditions on newly acquired grasslands would deteriorate. Habitat for birds who require very short structure would potentially become unsuitable after PCMS expansion. Also, heavy mechanized traffic (e.g., tanks) could be very destructive to blue grama (the dominant grass in this area), which can be very difficult to restore. Once lost from an area, blue grama is extremely slow to recolonize (Riegel 1941, Hyder et al. 1971), especially over large areas, where blue grama may remain absent from the vegetation community for many decades (Coffin and Lauenroth 1990). This is true whether loss of blue grama results from mechanized traffic, incompatible grazing, or other disturbance. Mechanized traffic would also be very destructive to shale barrens, which is the most fragile community in the study area. Shale barrens within the existing PCMS boundary have been utilized, but tank traffic is now restricted from these areas. The silty soils commonly found on toe slopes that provide habitat for *Oonopsis* and *Oenothera* are better able to tolerate disturbance

[2] A study of the impacts of military training on PCMS found slight but statistically insignificant decline in juniper density with disturbance from training over a 10-year period (Milchunas et al. 1999).

such as periodic mechanized traffic. Finally, it is possible that weeds could increase in areas used frequently and at high intensities for military training (e.g., mechanized maneuvers, bivouac).

Need for Additional Study

A direct comparison between biological communities on PCMS and neighboring private ranchlands has not been conducted. In order to make more definitive statements about the relative compatibility between these disparate land uses and health of the biological communities, a concurrent comparison (i.e., same year, same time of year) study is needed. Focusing on the bird community, in conjunction with limited vegetation sampling, could be accomplished for a reasonable investment (i.e., time, funding) and would yield at least some answers relatively quickly. Birds are comparatively easy to sample, and there are well-tested study methods already available. Transects designed to detect differences in bird communities between PCMS and neighboring private ranchlands could offer a statistically valid analysis of the relative health of adjacent habitats.

CONSERVATION STRATEGIES

There are many ways to think about conservation of biological diversity. Conservation strategies can include legal land protection (e.g., easements, long-term leases, fee simple acquisition, purchase of specific land use rights) and compatible land management, as well as public education and research. Any or all of these strategies may be employed to protect habitat and to alleviate threats, and may be focused on conserving specific local populations or on making large-scale, strategic contributions to species recovery overall. A comprehensive approach to biodiversity conservation would employ all of these approaches.

This study area is unique in that it is one of the least fragmented landscapes within Colorado, and also within the CSP ecoregion – comprised mainly of relatively few large to very large parcels under control of relatively few managers. What this means for managers working in this landscape is – in part – that conservation strategies that might otherwise require collaborative approaches can be implemented on single-owner properties with at least some expectation of local success. That being said, there is a very unique opportunity here for collaborative management across boundaries, setting the stage for an unprecedented contribution to landscape-scale conservation of at-risk prairie species.

The first step in facilitating conservation of biological resources is to identify the significant elements of biodiversity and their locations within the study area. This report provides the information necessary for this first step. The next step is to use this information to conserve these elements and the areas that support them. The PCA descriptions within this report provide protection and management suggestions for most areas identified during the inventory. In addition, some general recommendations for conservation of biological diversity in Southeast Colorado are given here. The strategies suggested below are offered as a suite of potential conservation actions that could be implemented by single landowners, or by groups of landowners working in coordination, as the needs and desires of each landowner allow.

1). Using the information in this report, develop and implement a plan for conserving biological resources in conjunction with maintaining thriving economic enterprises. The PCAs in this report provide a basic framework for implementing a comprehensive conservation program. The B1, B2 and B3 sites, because they have global biological significance, warrant priority attention. Conservation plans may focus on compatible management strategies, or may also include plans for term or perpetual legal land protection, if appropriate and desirable. Conservation tools that may be useful include incentive-based cost-share and funding programs such as those offered through the Farm Bill and the Colorado Division of Wildlife, to support compatible management practices and habitat restoration where needed. Land trusts are available to assist in purchase or donation of conservation easements, as well as term easements, leases, and management agreements for protection of biological diversity.

2). Recognize the importance of larger, contiguous natural communities. The most desirable scenario from a biodiversity conservation perspective would be to maintain large, unfragmented landscapes that allow grazers to move freely through grasslands in a sustainable way, creating the mosaic of habitats that is needed to sustain the full suite of native prairie plants and animals. Ideally, bison would be re-introduced into landscapes where large enough tracts of suitable habitat exist. This landscape offers an excellent opportunity to re-introduce bison into the suite of native fauna. Domestic cattle function to some extent as a surrogate for bison, but not completely. There are some properties within the study area that are of sufficient size and habitat suitability to accommodate a bison herd (e.g., over 100,000 acres of primarily grassland habitat, without many fences). Maintaining concurrent bison and cattle operations would require keeping the species separate to avoid hybridizing and disease transmission. However, introduction of bison could be economically feasible from a variety of perspectives, including hunting, sale of bison meat, and ecotourism.

Whether grazing bison or domestic cattle, maintaining larger pastures with less fencing would be preferable for retaining native grass species as well as wildlife. Smaller ranches require higher stocking rates to keep the operation economically sustainable, which means more, smaller pastures, more fencing, and more intensive management. For smaller ranches under appropriate management (e.g., rotations, deferments), quality and composition of plant communities need not, in theory, be different or worse than plant communities on large ranches. In reality, given stochastic events and other complexities in ecological systems (e.g., drought, weather fluctuations, soil differences), combined with differences in palatability of different grasses, it may be very hard to manage smaller pastures to achieve grassland quality comparable to that which exists in large unfragmented landscapes that are grazed appropriately.

3). Promote a collaborative management approach with neighboring landowners to maintain a landscape scale mosaic of ecological systems and meet the habitat needs of the full suite of prairie species. It may be possible for group of landowners to enter into a cooperative venture that is organized into a special district focused on biodiversity conservation (e.g., similar to special districts that have been created for other purposes such as water provision, fire protection, etc.). Such an endeavor could constitute a value-added component to traditional ranching products (e.g., eco-friendly beef) and help ranchers tap into new markets. If desired, related opportunities could be pursued to diversify existing economic enterprises, such as ecotourism. A comparable approach has been used successfully in Africa to promote local ecotourism and improve economic sustainability of the ranching community.[3] Ranchers in Africa are dealing with surprisingly similar challenges to those now facing many American producers, and they have developed a successful model of collaborative management that strengthens individual ranches as well as the local ecosystem. Whether or not this level of collaboration is currently possible in the American West – where a higher premium is placed on individualism – is uncertain. However, if there was a group of producers interested in regional, collaborative management, a similar effort here could include a diversity of management efforts and business enterprises, such as ranching, hunting, watchable wildlife, bird-watching, dude ranching and other forms of ecotourism. Diversifying business approaches could, in some cases, broaden managers' perspectives on qualities of different habitat types, and thereby improve management. For example, properties with significant juniper habitats might approach juniper management with ecotourism ventures such as bird-watching in mind. Certainly, landowners

[3] See www.laikipia.org for an example of how creative collaborative management at an ecosystem scale has been used to improve the livelihoods of local people.

could benefit from collaborative marketing of both traditional and non-traditional business ventures in ranching country.

The Shortgrass Prairie Partnership is working to promote collaborative conservation and to develop incentive-based tools for biodiversity conservation in the CSP ecoregion. This Partnership, comprised of private organizations, public agencies, and agricultural producers, could offer additional information, expertise, and support to landowners wishing to pursue individual or collaborative conservation activities.

4). **Manage lands to support healthy populations of native wildlife**. Maintain prairie dog communities to support the suite of associated species, including Burrowing Owl, Mountain Plover, and Ferruginous Hawk. Continue to take a proactive approach to weed and exotic species control, recognizing that weeds adversely affect both agricultural production and native plant communities. Be vigilant about early detection of weed infestations. If it is necessary to spray weeds, be mindful of potential adverse impacts, especially on wetlands, aquatic invertebrates, and amphibians, as well as any rare plants and their pollinators. Avoid accidental or purposeful introduction of non-native species, including exotic fish and bullfrogs.

5). **Continue inventories and monitoring where necessary, including inventories for species that cannot be surveyed adequately in one field season and continue inventories on lands that CNHP could not access in 2007.** Not all targeted inventory areas can be surveyed in one field season due to several factors, including lack of access, phenology of species, or time constraints. Because some species are ephemeral or migratory, completing an inventory in one field season is often difficult. Despite the best efforts during one field season, it is likely that some elements were not documented during the survey. Thus, it is recommended that this report and the data included within it serve as a guide for subsequent surveys of Southeast Colorado.

6). **Promote public education**. A significant step in the process of conserving biodiversity in southeast Colorado could include educating citizens and other stakeholders on the value that this area offers. As described in this report, Southeast Colorado is rich in animal and plant diversity. Conveying the value and function of these habitats and the species that inhabit them to the public can generate greater interest in conserving these lands.

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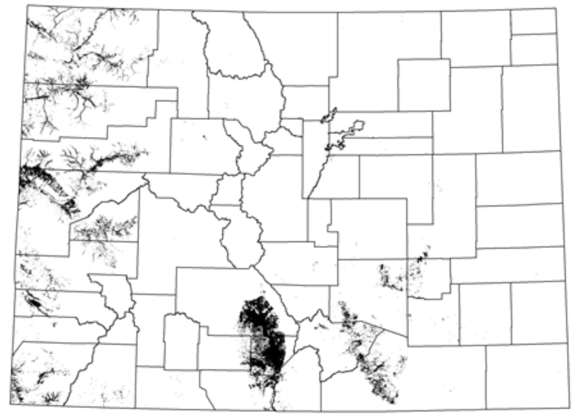
ECOLOGICAL SYSTEM PROFILES

INTER-MOUNTAIN BASINS GREASEWOOD FLAT

S. Spackman



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DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
- *Distichlis spicata - (Scirpus nevadensis)* Herbaceous Vegetation
- *Distichlis spicata* Herbaceous Vegetation

ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE
- *Eleocharis palustris* Herbaceous Vegetation

LEYMUS CINEREUS HERBACEOUS ALLIANCE
- *Leymus cinereus* Herbaceous Vegetation

PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
- *Puccinellia nuttalliana* Herbaceous Vegetation

SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE
- *Salicornia rubra* Herbaceous Vegetation

SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE
- *Sarcobatus vermiculatus - Artemisia tridentata* Shrubland
- *Sarcobatus vermiculatus / Distichlis spicata* Shrubland
- *Sarcobatus vermiculatus / Suaeda moquinii* Shrubland
- *Sarcobatus vermiculatus* Shrubland

SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SPARSELY VEGETATED ALLIANCE
- *Sarcobatus vermiculatus / Juncus balticus* Sparse Vegetation
- *Sarcobatus vermiculatus / Sporobolus airoides* Sparse Vegetation

SARCOBATUS VERMICULATUS SHRUBLAND ALLIANCE
- *Sarcobatus vermiculatus / Bouteloua gracilis* Shrubland

SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE
- *Sporobolus airoides* Southern Plains Herbaceous Vegetation

SPOROBOLUS AIROIDES INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
- *Sporobolus airoides - Distichlis spicata* Herbaceous Vegetation

Overview: The Greasewood Flats ecological system occurs throughout much of the western U.S. in intermountain basins and extends onto the western Great Plains. In eastern Colorado, occurrences are primarily in the southwestern portion of plains. Large occurrences are also found in the lower elevations of Colorado's western valleys and throughout much of the San Luis Valley. Greasewood flats are large patch systems confined to specific environments defined by hydrologic regime, soil salinity and soil texture.

Characteristic species: This ecological system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus. Atriplex canescens, Atriplex confertifolia, Chrysothamnus nauseosus, Cylindropuntia candelabra,* or *Krascheninnikovia lanata* may be present to codominant. The herbaceous layer, if present, is usually dominated by graminoids such as *Sporobolus arioides*, *Distichlis spicata*, and *Bouteloua gracilis*. Small patches of *Sporobolus airoides, Distichlis spicata* (where water remains ponded the longest), or *Eleocharis palustris* herbaceous types may be found within the shrubland system.

Environment: Greasewood flats are typically found near drainages on stream terraces and flats, on alluvial fans along streams or arroyos, or they may form rings around playas. Sites usually have saline soils, a shallow water table and flood intermittently, but remain dry for most of the growing season.

Dynamics: Because greasewood flats are tightly associated with saline soils and groundwater that is near the surface, the primary ecological process that maintains greasewood flats is groundwater recharge, rather than surface water. *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Groundwater flows and depth are one of the most important driving factors in maintaining this system. *Sarcobatus vermiculatus*, like many facultative halophytes, is tolerant of alkaline and saline soil conditions that allow the species to occur in sites with less interspecific competition (Ungar et al. 1969, Bransen et al. 1976). The shrub also occurs on extremely arid non-saline sites.

Although most studies indicate that *Sarcobatus vermiculatus* is relatively unharmed by fire, the degree of damage may vary according to season of burn, fuel loading, and intensity of fire. Fire will top kill *S. vermiculatus*, but the shrub will promptly resprout from the root crown (Daubenmire 1970).

Sarcobatus vermiculatus is not ordinarily browsed, but Daubenmire (1970) found that under heavy stocking rates, the shrubs will develop a compact canopy.

R. Rondeau

Variation: This system occurs as a mosaic of communities with open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. Greasewood dominated vegetation can occur as a narrow band along a channel, or in a mosaic of communities where composition and density of the shrub and understory species vary with depth to water table, salinity and alkalinity, soil texture, and past land use or disturbance. Occurrences may be surrounded by grasslands, stabilized sand dunes, wet meadow systems, mixed salt desert scrub, sandsage, or shortgrass prairie. Hanson (1929) described stands in south-central Colorado and found that pure stands of *S. vermiculatus* and *Distichlis spicata* are more common on strongly saline/alkaline sites with fine-textured soil and shallow water tables, whereas stands with mixed shrubs such as *Chrysothamnus* or *Artemisia* are more common on drier, coarser textured, low-alkaline sites. *Sporobolus airoides* is found on dry, strongly alkaline sites, and *Pascopyrum smithii* is most common on less alkaline, moist, sites in low lying areas.

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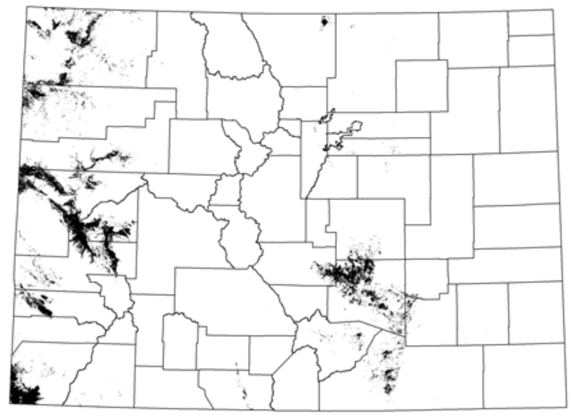
Rank:	A	B	C	D
① CONDITION				
Natural hydrologic regime (Note that the hydrologic regime for this system can potentially be affected by off-site factors many miles away)	Natural hydrologic regime intact. No or little evidence of alteration due to drainage, flood control, irrigation canals, livestock grazing, digging, burming, vehicle use, etc.	Natural hydrologic regime intact or slightly altered (within 60-140% of historic means for timing and magnitude). Alteration is easily restorable by ceasing such activities.	Natural hydrologic regime altered by local drainage, diking, filling, digging, or dredging. Alteration is extensive but potentially restorable over several decades.	Natural hydrologic regime or disturbance to site not restorable. System remains fundamentally compromised despite restoration of some processes.
Invasive exotics with major potential to alter structure and composition (e.g., whitetop, leafy spurge, Russian knapweed, diffuse knapweed, spotted knapweed, yellow toadflax)	Absent to minimal (<1% cover), with no potential for expansion.	Few (1-3% cover), with little potential for expansion if restoration occurs.	May be widespread (3-7% of the occurrence with some patches larger than 1 acre) but potentially manageable with restoration of most natural processes.	May be dominant over significant portions of the area, with little potential for control.
Native increaser spp.	Not abnormally predominant.	May form dense stands over <10% of the occurrence, but do not appear to be expanding.	>10% cover, may be dominant in some areas.	
Disturbance	Livestock grazing, if present, appears to mimic native herbivory levels and patterns.	Livestock grazing appears to be compatible and in general mimics native herbivory levels and patterns.	Vehicle use or grazing disturbance is extensive and significant enough to have notable impact on species composition.	
② SIZE				
Acres A rank: Wide range of plant associations showing a range of variation in hydrology, salinity, and soil texture. Large enough to buffer most of occurrence from edge effects and small hydrologic alterations.	>1,000	100-1,000	50-100	< 50
③ LANDSCAPE CONTEXT				
Surrounding land	Wet meadows and grasslands within 1 mile of the occurrence are unaltered by urban or agricultural uses (> 90% natural).	Grasslands, shrublands and wet meadows within ½ mile of the occurrence may have moderate urban or agricultural alteration (60-90% natural).	Adjacent grasslands, shrublands, and wet meadows are fragmented by alteration (20-60% natural). Landscape restorable over years or decades.	Adjacent lands mostly converted to agricultural or urban uses. Landscapes missing fundamental system components that render restoration unfeasible.
Landscape hydrology	No evidence of human-caused alteration of hydrology.	Limited or minor human-caused alteration of hydrology, especially groundwater pumping and canals.	Local or moderate human-caused alteration of hydrology.	Major human-caused alteration of hydrology.
Timing and depth of high and low groundwater	Little affected by groundwater pumping. Remains from 90-110% of historic patterns.	Little affected by groundwater pumping, remains from 75-90% of historic patterns.		Groundwater pumping is affecting greater than 20% of the area.
Invasive species (e.g. *Cardaria*)	None present on adjacent lands.	No or very few invasive species present on adjacent lands, and if present, easily controlled.	May be abundant on adjacent wet meadows, altering species composition.	
Connectivity Extent to which patches of natural and semi-natural vegetation allow movement of water and species across the landscape.	Connectivity allows natural ecological processes (e.g., flooding and species migration) to occur. No barriers present.	Substantial connectivity among patches of natural and semi-natural vegetation remains. Few barriers present.	Limited connectivity. Some barriers present restrictng movement across system boundaries.	Connectivity is severely hampered.

INTER-MOUNTAIN BASINS MIXED SALT DESERT SCRUB

R. Rondeau



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ATRIPLEX CANESCENS SHRUBLAND ALLIANCE
- *Atriplex canescens - Artemisia tridentata* Shrubland
- *Atriplex canescens / Bouteloua gracilis* Shrubland
- *Atriplex canescens / Pleuraphis jamesii* Shrubland
- *Atriplex canescens / Sporobolus airoides* Shrubland
- *Atriplex canescens* Shrubland

ATRIPLEX CONFERTIFOLIA SHRUBLAND ALLIANCE
- *Atriplex confertifolia - Sarcobatus vermiculatus* Shrubland
- *Atriplex confertifolia / Achnatherum hymenoides* Shrubland
- *Atriplex confertifolia / Leymus salinus* Shrubland
- *Atriplex confertifolia / Pleuraphis jamesii* Shrubland
- *Atriplex confertifolia / Pseudoroegneria spicata* Shrubland
- *Atriplex confertifolia* Wyoming Basins Shrubland

KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE
- *Krascheninnikovia lanata / Achnatherum hymenoides* Dwarf-shrubland
- *Krascheninnikovia lanata / Hesperostipa comata* Dwarf-shrubland

Overview: This extensive ecological system includes open-canopied shrublands of typically saline desert basins, alluvial slopes and plains across the intermountain western U.S. Considered a matrix forming system to the west of Colorado, this type also extends in limited distribution into the southern Great Plains, where it is a large patch system. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species.

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

Environment: This system is comprised of arid to semi-arid shrublands on lowland and upland sites usually at elevations between 4,980 and 7,220 ft (1,520-2,200 m). Sites can be found on all aspects and include valley bottoms, alluvial and alkaline flats, mesas and plateaus, playas, drainage terraces, washes and interdune basins, bluffs, and gentle to moderately steep sandy or rocky slopes. Slopes are typically gentle to moderately steep, but are sometimes unstable and prone to surface movement. Many areas within this system are degraded due to erosion and may resemble “badlands.” Soil surface is often very barren in occurrences of this system. The interspaces between the characteristic plant clusters are commonly covered by a microphytic crust (West 1982).

This is typically a system of extreme climatic conditions, with warm to hot summers and freezing winters. Annual precipitation ranges from approximately 5-13 in (13-33 cm). In much of the ecological system, the period of greatest moisture will be mid- to late summer, although in the more northern areas a moist period is to be expected in the cold part of the year. However, seasonality of occurrence is probably of less importance on this desert system than in other ecosystems because desert precipitation comes with an extreme irregularity that does not appear in graphs of long-term seasonal or monthly averages (Blaisdell and Holmgren 1984). Soils are shallow to moderately deep, poorly developed, and a product of an arid climate and little precipitation. Soils are often alkaline or saline.

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

The winter months within this system are a good time for soil moisture accumulation and storage. There is generally at least one good snow storm per season that will provide sufficient moisture to the vegetation. The winter moisture accumulation amounts will affect spring plant growth. Plants may grow as little as a few inches to 3 ft. Unless more rains come in the spring, the soil moisture will be depleted in a few weeks, growth will slow and ultimately cease, and the perennial plants will assume their various forms of dormancy (Blaisdell and Holmgren 1984). If effective rain comes later in the warm season, some of the species will renew their growth from the stage at which it had stopped. Others, having died back, will start over as if emerging from winter dormancy (Blaisdell and Holmgren 1984). Other communities are maintained by intra- or inter-annual cycles of flooding followed by extended drought, which favor accumulation of transported salts. The moisture supporting these intermittently flooded wetlands is usually derived off-site, and they are dependent upon natural watershed function for persistence (Reid et al. 1999).

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

Variation: Occurrences of this ecological system vary from almost pure occurrences of single species to fairly complex mixtures. The characteristic mix of low shrubs and grasses is sparse, with large open spaces between the plants (Blaisdell and Holmgren 1984). The species present depend on the geographic range of the grasses, alkalinity/salinity and past land use.

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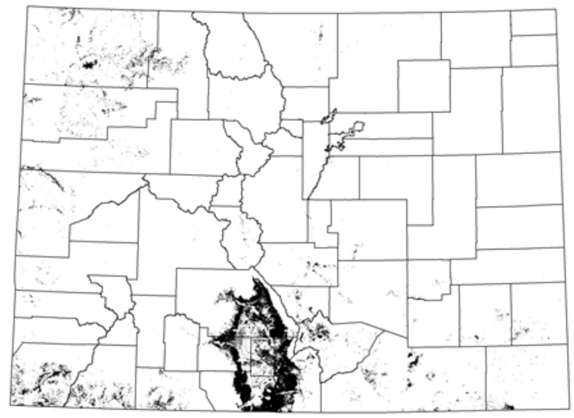
West, N.E. 1982. Approaches to synecological characterization of wildlands in the Intermountain West. Pages 633-643 in In-place Resource Inventories: Principles & Practices. A national workshop, Univ. of Maine, Orono. Soc. of Amer. Foresters, McClean, Va. August 9-14, 1981.

Rank:	A	B	C	D
① SIZE				
Acres (on eastern plains)	>30,000 >1,000 Sufficient internal variability to capture characteristic biophysical gradients and retain natural geomorphic disturbance. Buffered from edge effects.	10,000-30,000 100-1,000	5,000-10,000 30-100	< 5,000 <30 Too small to remain viable with altered natural geomorphic processes and contain insufficient area to maintain a diversity of plant associations. Susceptible to invasive exotics.
② CONDITION				
Community structure	A variety of structural stages are present that could provide habitat for shrubland and grassland birds.	Heterogenity of structure is present throughout the majority of the occurrence or easily re-established through management practices.	Much of the occurrence is dominated by a single structural stage, and may be lacking in vegetative species diversity.	Vegetation within the occurrence has little or no structural diversity and is likely to have low native species diversity. May be invaded by native woody species.
Native perennial increaser spp.	< 5% cover.	Community dominated by natives, native perennial increasers may be present and even dominant in spots, but not throughout the occurrence.		Dominant.
Invasive exotics with major potential to alter structure and composition (e.g., leafy spurge, Russian knapweed, diffuse knapweed, spotted knapweed, yellow toadflax)	Absent or < 1% cover.	1 to 3% of the occurrence, with no patches larger than 1 acre.	3-7% of the occurrence with some patches larger than 1 acre. May be having an impact on the stability of the system, but could be controlled with a sustained effort.	Present and widespread.
Other non-native annual spp. (e.g. *Halogeton glomeratus, Bromus tectorum, Salsola kali, S. paulsenii, Bassia hyssopifolia*)	Absent or incidental.	May be present in disturbed areas only, and are not found throughout the occurrence.	Can be present and quite abundant in small patches.	Present and abundant.
Disturbance	No surficial disturbance is evident or if present than in only small, isolated areas (e.g. ranch activities and buildings; off-road vehicle use). There are few or no roads within the occurrence.	Surficial disturbances are limited to less than 20% of the occurrence area (e.g. mines or ranch activities and buildings; off-road vehicle use). There are only a few roads found within the occurrence.	Surficial disturbances occur on more than 20% of the area (e.g. mines or ranch activities and buildings; off-road vehicle use). There are more than a few roads found within the occurrence.	Surficial disturbances occur on more than 50% of the area (e.g. mines or ranch activities and buildings; off-road vehicle use). Many roads are found within the occurrence.

Ground cover	Microbiotic crusts are intact. Natural microrelief is undisturbed. Soil erosion is not accelerated by anthropogenic activities.	Microbiotic crusts are intact in at least 80% of the occurrence. Soil erosion may be accelerated in small patches, or lightly so throughout the occurrence.	Microbiotic crusts are removed from more than 25% of the area, or are in various stages of degradation throughout the occurrence.	Microbiotic crusts are >75% removed, occurring only in small pockets naturally protected from livestock and off-road vehicle use.
③ LANDSCAPE CONTEXT				
Connectivity	Occurrence is highly connected to the surrounding landscape, which has been little altered by agriculture or development (>90% natural).	Occurrence is moderately connected to the surrounding landscape, which has been somewhat altered by agriculture or development (70-90% natural).	The occurrence is moderately fragmented and isolated, and the surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation.	The occurrence is highly fragmented and isolated.
Surrounding land	The occurrence captures the characteristic ecological gradients (including nested patch communities, e.g. washes, saltbush scrub flats) and geomorphic processes, and is largely surrounded by other high quality communities.	The occurrence captures the characteristic ecological gradients (including nested patch communities, e.g. washes, saltbush scrub flats) and geomorphic processes, and the occurrence is surrounded by other natural and semi-natural communities of at least moderate quality, such as areas that may have been used extensively for heavy livestock grazing or military training currently or in the past.	The surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation. Adjacent systems surrounding occurrence are fragmented by alteration (20-70% natural), with limited connectivity to other characteristic natural communities.	The area around the occurrence is entirely, or almost entirely, converted to agricultural or urban land use; occurrence is at best buffered on one side by natural communities. The surrounding landscape is primarily intensive agriculture or urban development.

INTER-MOUNTAIN BASINS SEMI-DESERT SHRUB-STEPPE

R. Rondeau



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ERICAMERIA NAUSEOSA SHRUB SHORT HERBACEOUS ALLIANCE
- *Ericameria nauseosa / Muhlenbergia pungens - Achnatherum hymenoides* Shrub Herbaceous Vegetation

ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE
- *Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland

KRASCHENINNIKOVIA LANATA DWARF-SHRUB HERBACEOUS ALLIANCE
- *Krascheninnikovia lanata / Bouteloua gracilis* Dwarf-shrub Herbaceous Vegetation
- *Krascheninnikovia lanata / Pascopyrum smithii - Bouteloua gracilis* Dwarf-shrub Herbaceous Vegetation

KRASCHENINNIKOVIA LANATA DWARF-SHRUBLAND ALLIANCE
- *Krascheninnikovia lanata / Pleuraphis jamesii* Dwarf-shrubland
- *Krascheninnikovia lanata / Poa secunda* Dwarf-shrubland

Overview: This ecological system occurs throughout the intermountain western U.S., typically at lower elevations on alluvial fans and flats with moderate to deep soils. In Colorado, this system is generally a large-patch type, except in the San Luis Valley, where it is matrix forming. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer. Pinyon-juniper woodlands and sagebrush shrublands commonly are adjacent to this system at the upper elevations

Characteristic species: This semi-arid shrub-steppe is typically dominated by graminoids (>25% cover) with an open shrub layer. Characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Hesperostipa comata, Pleuraphis jamesii, Poa secunda*, and *Sporobolus airoides*. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include *Atriplex canescens, Artemisia tridentata, Chrysothamnus greenei, Chrysothamnus viscidiflorus, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Annual grasses, especially the exotics *Bromus japonicus* and *Bromus tectorum*, may be present to abundant. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some occurrences. Mosses and lichens may be important ground cover. Forbs are common on disturbed weedy sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Halogeton glomeratus, Lactuca serriola*, and *Lepidium perfoliatum*.

Environment: In Colorado, semi-desert shrub steppe occurs between 7,500-9,500 ft (2,280-2,900 m) in elevation, on windswept mesas, valley floors, gentle slopes, or shoulders of ridges. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 3 ft (1 m) depth (West 1983). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium; or deep, fine to medium-textured alluvial soils with some source of sub-irrigation during the summer season. Soils may be alkaline and typically moderately saline (West 1983). Some occurrences occur on deep, sandy soils, or soils that are highly calcareous (Hironaka et al. 1983). Temperatures are continental with large annual and diurnal variation. Summers are hot and winters cold, with low annual precipitation, ranging from 7-16 in (18-40 cm) and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic.

Dynamics: This ecological system is maintained by large-scale natural ecological processes such as fire and grazing by large mammals. Anthropogenic changes including fire suppression and historic heavy livestock grazing have altered most occurrences of this shrub-steppe type. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some occurrences.

Variation: Historically, *Krascheninnikovia lanata* was typically dominant in this dwarf-shrub system. This shrub, together with the grasses *Hesperostipa comata*, and *Oryzopsis hymenoides* are considered decreasers under grazing. As a consequence of anthropogenically induced changes in grazing, *Chrysothamnus greenei* is now the dominant shrub in the San Luis Valley, although the wetter areas still have significant amounts of *Krascheninnikovia lanata*. Other shrubs that have increased from historic heavy livestock grazing include *Chrysothamnus parryi*, *C. viscidiflorus*, and *Gutierrezia sarothrae* (Johnston 1997).

Hironaka, M., M. A. Fosberg, and A. H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Forestry, Wildlife, and Range Experiment Station Bulletin No. 15, University of Idaho, Moscow. 44 pp.

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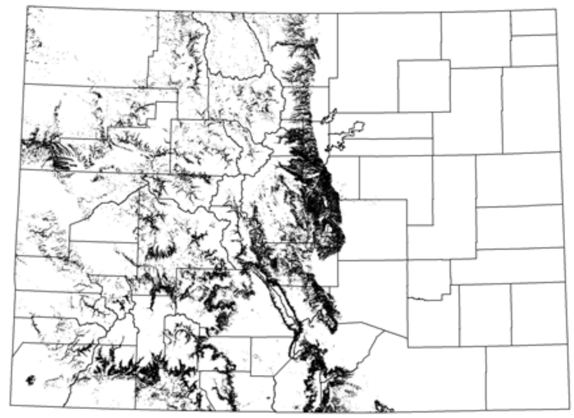
Rank:	A	B	C	D
① SIZE				
Acres (in San Luis Valley)	>5000 >90,000	2000-5000 50,000-90,000	1000-2000 30,000-50,000	<1000 < 30,000
② CONDITION				
Community structure	*Krascheninnikovia lanata* is dominant at least in large patches. If trees or rabbitbrush are present, these are widely scattered and mature. Species richness is often high and includes several native grasses as well as a diverse forb component. Plant vigor is high.	*Krascheninnikovia lanata* is dominant in large patches. If trees or rabbitbrush are present, these are scattered and mature. Species richness is often high, and native bunchgrasses are dominant. Non-native species may be present but in small amounts (< 5% total canopy cover).	*Krascheninnikovia lanata* is limited to small patches or scanty cover throughout occurrence. Non-native species are present and may dominate small patches, although native species still dominate. Total canopy cover is at least 20% grasses. Seedlings, juveniles, or saplings of trees and shrubs may be present.	Non-native species are dominant, native species have less than 10% canopy cover and 20% relative cover. Alteration is extensive and restoration potential is low.
Invasive exotics with major potential to alter structure and composition	Absent.	May be present, but <1% cover.	May be present although still manageable if attended to within the next few years.	Present.
Native increaser spp. (e.g. *Koeleria macrantha, Artemisia frigida*)	< 3% cover.	<5% cover.	May be co-dominant or dominant.	May be dominant.
Disturbance (Off-road vehicle use, livestock grazing)	Minimal or non-existent.	Vehicle use, if present, occupies less than 1% of the occurrence. Livestock grazing is well managed with less than 3% of the occurrence showing	Vehicle use, if present, occupies less than 5% of the occurrence. Livestock grazing is well managed with less than 10% of the occurrence showing	Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition, soil

		signs of a C condition.	signs of a D condition.	compaction and stability.
Ground cover & soils	Soils have a distinct A-horizon and are very stable (low erosion rate). Soils are not compacted Drainages are natural stable channels with no signs of unnatural erosion. Fairly uniform distribution of litter is present. Surface soil is stabilized by organic matter decomposition products and/ or a biological crust. The soil surface should show slight to no evidence of rills, wind scoured areas, or pedestaled plants. Plant cover is adequate to protect from excess soil erosion.	Soils may be slightly modified but still have a distinct A-horizon. Soil compaction moderately widespread. Water flow pattern nearly matches what is expected for the site; erosion is minor. Soil surface loss or degradation is moderate in plant interspaces with some degradation beneath plant canopies. Slight active pedestalling. Bare areas are of moderate size and sporadically connected. Litter buildup may be present in some areas. Soil structure is degraded and soil organic matter content is significantly reduced.	Deposition and cut areas common; occasionally connected. Soil surface resistance to erosion significantly reduced in most plant canopy interspaces and moderately reduced beneath plant canopies. Moderately active pedestalling. Bare ground is moderate to much higher than expected for the site. Bare areas are large and often connected. Soil surface loss or degradation may be severe throughout the site Soil compaction may be widespread.	Water flow patterns unstable with active erosion. Soil surface resistance to erosion may be extemely reduced throughout the site. Abundant active pedestalling and numerous terracettes. Bare ground is much higher than expected for the site. Bare areas are large and generally connected. Soil compaction is extensive throughout the occurrence.
Natural processes	Fires are still part of this system.	Major natural ecological processes are still able to function or be simulated.	Fire frequency may have been altered, although easily restored. Some ecological processes have been altered and are no longer able to function or be fully restored.	Fire frequency may be greatly altered and difficult to restore. System remains fundamentally compromised despite restoration of some processes.
③ LANDSCAPE CONTEXT				
Connectivity	Connectivity of adjacent systems allows natural ecological processes (e.g., fire), and species migrations to occur. No unnatural barriers present.	Limited or minor human-caused alteration of landscape. Adjacent systems surrounding occurrence retain much connectivity. Few non-natural barriers present.	Adjacent systems surrounding occurrence are fragmented by alteration with limited connectivity. Some non-natural barriers are present.	Connectivity is severely hampered
Surrounding land	Occurrence surrounded by a native and unaltered landscape with very little to no urban development or agriculture (>90% natural).	Surrounding landscape composed of at least 75% natural or semi-natural vegetation, with little urban development within or adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation. Adjacent systems surrounding occurrence are fragmented by alteration (20-60% natural). Significant disturbance, but easily restorable.	Major human-caused alteration of surrounding landscape. Adjacent systems surrounding occurrence are mostly converted to agricultural or urban uses.

Rocky Mountain Dry-Mesic and Mesic Montane Mixed Conifer Forest and Woodland

R. Rondeau



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ABIES CONCOLOR FOREST ALLIANCE
- *Abies concolor - Pseudotsuga menziesii / Acer glabrum* Forest
- *Abies concolor - Pseudotsuga menziesii / Erigeron eximius* Forest
- *Abies concolor - Pseudotsuga menziesii / Vaccinium myrtillus* Forest
- *Abies concolor / Arctostaphylos uva-ursi* Forest
- *Abies concolor / Mahonia repens* Forest
- *Abies concolor / Quercus gambelii* Forest
- *Abies concolor / Symphoricarpos oreophilus* Forest

ABIES CONCOLOR WOODLAND ALLIANCE
- *Abies concolor / Festuca arizonica* Woodland
- *Abies concolor / Galium triflorum* Woodland
- *Abies concolor / Holodiscus dumosus* Scree Woodland

PICEA PUNGENS FOREST ALLIANCE
- *Picea pungens / Arctostaphylos uva-ursi* Forest
- *Picea pungens / Arnica cordifolia* Forest
- *Picea pungens / Carex siccata* Forest
- *Picea pungens / Erigeron eximius* Forest
- *Picea pungens / Juniperus communis* Forest
- *Picea pungens / Linnaea borealis* Forest
- *Picea pungens / Lonicera involucrata* Forest

PICEA PUNGENS WOODLAND ALLIANCE
- *Picea pungens / Festuca arizonica* Woodland

PSEUDOTSUGA MENZIESII FOREST ALLIANCE
- *Pseudotsuga menziesii / Acer glabrum* Forest
- *Pseudotsuga menziesii / Arctostaphylos uva-ursi* Forest
- *Pseudotsuga menziesii / Carex geyeri* Forest
- *Pseudotsuga menziesii / Carex rossi*i Forest
- *Pseudotsuga menziesii / Festuca arizonica* Forest
- *Pseudotsuga menziesii / Jamesia americana* Forest
- *Pseudotsuga menziesii / Juniperus communis* Forest
- *Pseudotsuga menziesii / Mahonia repens* Forest
- *Pseudotsuga menziesii / Muhlenbergia montana* Forest
- *Pseudotsuga menziesii / Paxistima myrsinites* Forest
- *Pseudotsuga menziesii / Physocarpus monogynus* Forest
- *Pseudotsuga menziesii / Quercus gambelii* Forest
- *Pseudotsuga menziesii / Symphoricarpos oreophilus* Forest

PSEUDOTSUGA MENZIESII WOODLAND ALLIANCE
- *Pseudotsuga menziesii / Holodiscus dumosus* Scree Woodland
- *Pseudotsuga menziesii / Leucopoa kingii* Woodland

PSEUDOTSUGA MENZIESII TEMPORARILY FLOODED WOODLAND ALLIANCE
- *Pseudotsuga menziesii / Betula occidentalis* Woodland
- *Pseudotsuga menziesii / Cornus sericea* Woodland

Overview: These are mixed-conifer forests occurring on all aspects at elevations ranging from 4,000 to 10,800 ft (1,200-3,300 m). The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence. *Pseudotsuga* *menziesii* and *Abies concolor* are most common canopy dominants, but *Picea engelmannii, Picea pungens*, or *Pinus ponderosa* may be present to codominant. This system was undoubtedly characterized by a mixed severity fire regime in its "natural condition," with a high degree of variability in lethality and return interval. More mesic types are found predominantly in cool ravines and on north-facing slopes, including lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions and north- and east-facing slopes which burn somewhat infrequently. Mesic types also include mixed conifer/*Populus tremuloides* stands.

Characteristic species: *Pseudotsuga menziesii* and *Abies concolor* are the most common canopy dominants, but *Picea engelmannii, Picea pungens*, or *Pinus ponderosa* may be present to codominant. *Populus tremuloides* is often present as intermingled individuals in remnant aspen clones, or in adjacent patches. A number of cold-deciduous shrub and graminoid species are found in many occurrences (e.g., *Arctostaphylos uva-ursi, Mahonia repens, Paxistima myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii,* and *Festuca arizonica*). Other important species include *Acer glabrum, Acer grandidentatum, Amelanchier alnifolia, Arctostaphylos patula, Holodiscus dumosus, Jamesia americana, Juniperus communis, Physocarpus monogynus, Quercus X pauciloba, Robinia neomexicana, Rubus parviflorus*, and *Vaccinium myrtillus.* Where soil moisture is favorable, the herbaceous layer may be quite diverse, including graminoids such as *Bromus ciliatus (= Bromus canadensis), Calamagrostis rubescens, Carex geyeri, Carex rossii, Carex siccata (= Carex foenea), Festuca occidentalis, Koeleria macrantha, Luzula parviflora Muhlenbergia montana, Muhlenbergia virescens, Poa fendleriana, Pseudoroegneria spicata*, and forbs such as *Achillea millefolium, Arnica cordifolia, Erigeron eximius, Fragaria virginiana, Linnaea borealis, Osmorhiza berteroi, Packera cardamine (= Senecio cardamine), Thalictrum occidentale, Thalictrum fendleri, Thermopsis rhombifolia, Viola adunca*, and species of many other genera, including *Lathyrus, Penstemon, Lupinus, Vicia, Arenaria, Galium*.

Environment: *Pseudotsuga menziesii* forests occupy drier sites, and *Pinus ponderosa* is a common codominant. *Abies concolor* dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and north- and east-facing slopes which burn somewhat infrequently. *Picea pungens* is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations.

Dynamics: Forests in this ecological system represent the gamut of fire tolerance. In the most mesic types, naturally occurring fires are of variable return intervals, and mostly light, erratic, and infrequent due to the cool, moist conditions. In general, fire suppression has lead to the encroachment of more shade-tolerant, less fire-tolerant species (e.g., climax) into occurrences and an attendant increase in landscape homogeneity and connectivity (from a fuels perspective). This has increased the lethality and potential size of fires.

Pseudotsuga menziesii forests are the only true ‘fire-tolerant' occurrences in this ecological system. *Pseudotsuga menziesii* forests were probably subject to a moderate-severity fire regime in presettlement times, with fire-return intervals of 30-100 years (Crane 1982). Many of the important tree species in these forests (*Populus tremuloides, Pinus ponderosa, Pinus contorta*) are fire-adapted (Pfister 1977), and fire-induced reproduction of *Pinus ponderosa* can result in its continued codominance in *Pseudotsuga menziesii* forests (Steele et al. 1981). Successional relationships in this system are complex. *Pseudotsuga menziesii* is less shade-tolerant than many northern or montane trees such as *Tsuga heterophylla, Abies concolor,* and *Picea engelmannii*, and seedlings compete poorly in deep shade. At drier locales, seedlings may be favored by moderate shading, such as by a canopy of *Pinus ponderosa*, which helps to minimize drought stress. In some locations, much of these forests have been logged or burned during European settlement, and present-day occurrences are second-growth forests dating from fire, logging, or other occurrence-replacing disturbances (Mauk and Henderson 1984, Chappell et al. 1997).

Variation: The alliances in this system are found on slightly different, but intermingled, biophysical environments: *Abies concolor* dominates at higher, colder locations; *Picea pungens* represents mesic conditions; *Pseudotsuga menziesii* dominates intermediate zones. As many as seven conifers can be found growing in the same occurrences, with the successful reproduction of the diagnostic species determining the association type. Common conifers include *Pinus ponderosa*, *Pinus flexilis*, *Abies lasiocarpa* var. *lasiocarpa*, *Abies lasiocarpa* var. *arizonica*, *Juniperus scopulorum*, and *Picea engelmannii*. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence (DeVelice et al. 1986, Muldavin et al. 1996).

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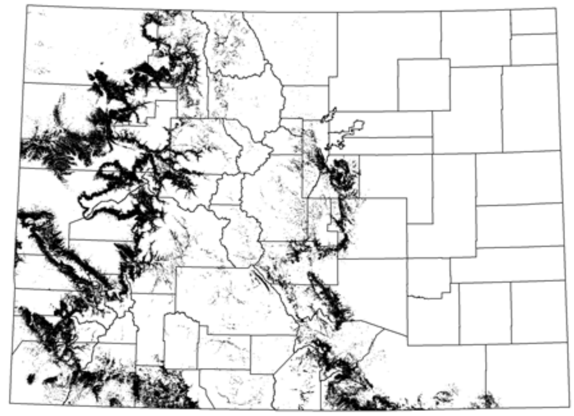
Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. USDA Forest Service General Technical Report INT-114. Intermountain Forest and Range Experiment Station, Ogden, UT. 138 pp.

Rank:	A	B	C	D
① **CONDITION**				
Community structure	A mature stand of mixed conifer that consists of 10 trees per acre at least 150 years old. Usually this is a multi-aged stand with some dead standing trees as well as some fallen mature trees. Where the site is dry, the stand would be more open compared to a cooler, more moist site such as a north-facing slope or drainage bottom. Some of the overstory trees would have large and open branched, flattened or dead tops and contain some rot.	Little to no evidence of past logging disturbance over a major proportion of the occurrence and majority of stand is > 100 years old, may show evidence of selective logging that has altered their structure.	Stands regenerated naturally after logging or young to mature stands with significant history of selective logging disturbance that altered composition or structure.	Immature, "dog-hair" stand of conifers, especially white fir with very low species diversity.
Non-native species	Few to no invasive species are present.	May be present with low to moderate frequency in the understory, but have low percent cover.	May be uncommon to frequent but do not dominate or co-dominate understory (<10-20% cover).	
② **SIZE**				
Acres	>5,000	2,000-5,000	1,000-2,000	< 1,000
③ **LANDSCAPE CONTEXT**				
Surrounding land	Occurrence surrounded by a large area (>2000 ac/800 ha) of natural vegetation.	Landscape composed of at least 80% natural or semi-natural vegetation; or landscape has very little development or agriculture but has major components of non-native vegetation in at least one physiognomic layer or is composed primarily of young tree plantations.	Landscape is a mosaic of agricultural or semi-developed areas and natural or semi-natural vegetation, the latter composing 25-80% of the landscape, or landscape is dominated by very young tree plantations (cut within last 20 years).	Occurrence surrounded primarily by urban or agricultural landscape, with <25% landscape cover of natural or semi-natural vegetation.
Connectivity	Connectivity of adjacent systems allows natural ecological processes, e.g., fire and species migrations to occur. No unnatural barriers present. Few small roads in the surrounding landscape.	Adjacent systems surrounding occurrence retain much connectivity. Few non-natural barriers present.	Adjacent systems surrounding occurrence are fragmented by alteration with limited connectivity.	Connectivity is severely hampered.

Rocky Mountain Gambel Oak - Mixed Montane Shrubland

S. Kettler



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AMELANCHIER ALNIFOLIA SHRUBLAND ALLIANCE
Amelanchier alnifolia / Artemisia tridentata / Festuca idahoensis Shrubland
Amelanchier alnifolia / Pseudoroegneria spicata Shrubland

AMELANCHIER UTAHENSIS SHRUBLAND ALLIANCE
Amelanchier utahensis - Cercocarpus montanus Shrubland
Amelanchier utahensis / Carex geyeri Shrubland
Amelanchier utahensis / Pseudoroegneria spicata Shrubland
Amelanchier utahensis Shrubland

ARCTOSTAPHYLOS PATULA SHRUBLAND ALLIANCE
Arctostaphylos patula - Quercus gambelii - (Amelanchier utahensis) Shrubland

JUNIPERUS SCOPULORUM WOODLAND ALLIANCE
Juniperus scopulorum - Quercus gambelii Woodland [Provisional]

QUERCUS GAMBELII SHRUBLAND ALLIANCE
Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland
Quercus gambelii / Amelanchier alnifolia Shrubland
Quercus gambelii / Amelanchier utahensis Shrubland
Quercus gambelii / Artemisia tridentata Shrubland
Quercus gambelii / Carex inops Shrubland
Quercus gambelii / Hesperostipa comata Shrubland [Provisional]
Quercus gambelii / Paxistima myrsinites Shrubland
Quercus gambelii / Symphoricarpos oreophilus Shrubland

Overview: This large patch ecological system occurs in the mountains, plateaus, and foothills in the southern Rocky Mountains and Colorado Plateau ecoregions. These shrublands are most commonly found along dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 6,500 to 9,500 ft (2,000-2,900 m) in elevation, and are often situated above pinyon-juniper woodlands. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a relatively minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics.

Characteristic species: The vegetation is typically dominated by *Quercus gambelii* alone or codominant with *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. Vegetation types in this system may occur as sparse to dense shrublands composed of moderate to tall shrubs. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. In many occurrences of this system, the canopy is dominated by the broad-leaved deciduous shrub *Quercus gambelii*, which occasionally reaches small tree size. Occurrences can range from dense thickets with little understory to relatively mesic mixed-shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between.

Scattered trees are occasionally present in stands and typically include species of *Pinus* or *Juniperus*. Characteristic shrubs that may co-occur, or be dominant in place of oak, include *Amelanchier alnifolia, Amelanchier utahensis, Arctostaphylos patula, Artemisia tridentata, Cercocarpus montanus, Ptelea trifoliata, Prunus virginiana, Purshia stansburiana, Robinia neomexicana, Rosa* spp., *Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is sparse to moderately dense, ranging from 1-40% cover. Perennial graminoids are the most abundant species, particularly *Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua gracilis, Aristida* spp., *Carex inops, Carex geyeri, Elymus arizonicus, Eragrostis* spp., *Festuca* spp., *Koeleria macrantha*, *Muhlenbergia* spp., and *Stipa* spp. Many forb and fern species can occur, but none have much cover. Commonly present forbs include *Achillea millefolium*, *Artemisia* spp., *Geranium* spp., *Maianthemum stellatum*, *Thalictrum fendleri*, and *Vicia americana*. Ferns include species of *Cheilanthes* and *Woodsia*. Annual grasses and forbs are seasonally present, and weedy annuals are often present, at least seasonally.

Environment: This ecological system typically occupies the lower slope positions of the foothill and lower montane zones where it may occur on level to steep slopes, cliffs, escarpments, rimrock slopes, rocky outcrops, and scree slopes. Climate is semi-arid and characterized by mostly hot-dry summers with mild to cold winters and annual precipitation of 10-27 in (25-70 cm). Precipitation mostly occurs as winter snows but may also consist of some late summer rains. Substrates are variable and include soil types ranging from calcareous, heavy, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. Soils are typically poorly developed, rocky to very rocky, and well-drained. Parent materials include alluvium, colluvium, and residuum derived from igneous, metamorphic, or sedimentary rocks such as granite, gneiss, limestone, quartz, monzonite, rhyolite, sandstone, schist, and shale.


S. Spackman

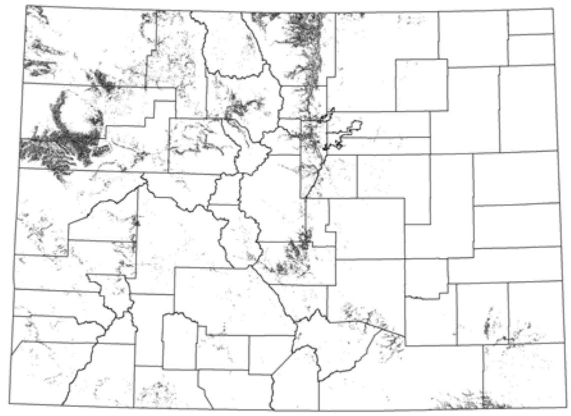
Dynamics: Fire typically plays an important role in this system, causing die-back of the dominant shrub species in some areas, promoting stump sprouting of the dominant shrubs in other areas, and controlling the invasion of trees into the shrubland system. Density and cover of *Quercus gambelii* and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

Variation: Although this is a shrub-dominated system, some trees may be present. In older occurrences, or occurrences on mesic sites, some of the shrubs may acquire tree-like sizes. Adjacent communities often include woodlands or forests of *Abies concolor, Pinus ponderosa, Pseudotsuga menziesii*, or *Populus tremuloides* at higher elevations, and *Pinus edulis* and *Juniperus osteosperma* on the lower and adjacent elevations. Shrublands of *Artemisia tridentata* or grasslands of *Festuca*, *Stipa*, or *Pseudoroegneria* may also be present at the lower elevations.

Rank:	A	B	C	D
① CONDITION				
Community structure	Native species dominant Species richness is often high, and native bunch grasses or sedges (non-increasers) are dominant. If trees are present, these are widely scattered and mature.	If trees are present, these are widely scattered and mature. Species richness is often high, and native grasses (non-increasers) are dominant	Herbaceous cover is codominated by native and non-native species. Alteration of vegetation is extensive but potentially restorable over several decades.	Non-native species are dominant. Alteration of vegetation is extensive and restoration potential is low.
Invasive exotics with major potential to alter structure and composition (e.g., leafy spurge, knapweed, non-native thistle, *Bromus inermis, Poa pratensis, Bromus tectorum)*	Absent or < 1% cover.	May be present, but <3% cover.		
Other non-native spp.	<1% total cover.	<3% total cover.	Co-dominant with native species.	Dominant.
Disturbance	Fragmentation is limited to less than 1% of the occurrence and the fire and grazing regimes are largely intact.	Fragmentation is limited to less than 5% of the occurrence and the fire and grazing regimes are relatively intact.	Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction. Fragmentation is limited to less than 15% of the occurrence; invasive woody species are present but still controllable. The fire and grazing regimes may need immediate management in order for the occurrence to not deteriorate.	Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction. System remains fundamentally compromised despite restoration of some processes. Soil compaction and continued disturbance is extensive throughout the occurrence.
②SIZE				
Acres	>5,000	2,000-5,000	1,000-2,000	< 1,000
③ LANDSCAPE CONTEXT				
Connectivity	Connectivity of adjacent systems allows natural ecological processes (e.g., fire), and species migrations to occur. No unnatural barriers present.	Adjacent systems surrounding occurrence retain much connectivity. Few non-natural barriers present.	Adjacent systems surrounding occurrence are fragmented by alteration with limited connectivity.	Connectivity is severely hampered.
Surrounding land	At least 90% native and unaltered landscape with very little to no urban development or agriculture, and little to no industrial forestry.	Surrounding landscape composed of at least 75% natural or semi-natural vegetation, with little urban development within or adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with >50% natural or semi-natural vegetation. Some non-natural barriers are present. Significant disturbance, but easily restorable.	Major human-caused alteration of surrounding landscape. Adjacent systems surrounding occurrence are mostly converted to agricultural or urban uses.

ROCKY MOUNTAIN LOWER MONTANE - FOOTHILL SHRUBLAND

R. Rondeau



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ARTEMISIA FRIGIDA SHRUBLAND ALLIANCE
- *Artemisia frigida / Bouteloua gracilis* Shrubland [Provisional]

ARTEMISIA NOVA SHRUB HERBACEOUS ALLIANCE
- *Artemisia nova / Leymus salinus* ssp. *salmonis S*hrub Herbaceous Vegetation

CERCOCARPUS MONTANUS SHRUB HERBACEOUS ALLIANCE
- *Cercocarpus montanus / Muhlenbergia emersleyi* Shrub Herbaceous Vegetation

CERCOCARPUS MONTANUS SHRUBLAND ALLIANCE
- *Cercocarpus montanus - Rhus trilobata / Andropogon gerardii* Shrubland
- *Cercocarpus montanus / Achnatherum scribneri* Shrubland
- *Cercocarpus montanus / Bouteloua curtipendula* Shrubland
- *Cercocarpus montanus / Elymus lanceolatus* ssp. *lanceolatus* Shrubland
- *Cercocarpus montanus / Hesperostipa comata* Shrubland
- *Cercocarpus montanus / Hesperostipa neomexicana* Shrubland
- *Cercocarpus montanus / Muhlenbergia montana* Shrubland
- *Cercocarpus montanus / Muhlenbergia pauciflora* Shrubland
- *Cercocarpus montanus / Pseudoroegneria spicata* Shrubland
- *Cercocarpus montanus / Rhus trilobata* var. *trilobata* Shrubland
- *Cercocarpus montanus* var. *paucidentatus / Petrophyton caespitosum* Shrubland

PRUNUS VIRGINIANA SHRUBLAND ALLIANCE
- *Prunus virginiana - (Prunus americana)* Shrubland

PURSHIA TRIDENTATA SHRUBLAND ALLIANCE
- *Purshia tridentata / Artemisia frigida / Hesperostipa comata* Shrubland
- *Purshia tridentata / Muhlenbergia montana* Shrubland
- *Purshia tridentata / Hesperostipa comata* Shrub Herbaceous Vegetation

RHUS TRILOBATA SHRUB HERBACEOUS ALLIANCE
- *Rhus trilobata / Festuca idahoensis* Shrub Herbaceous Vegetation
- *Rhus trilobata / Pseudoroegneria spicata* Shrub Herbaceous Vegetation
- *Rhus trilobata* Rocky Mountain Shrub Herbaceous Vegetation [Provisional]

RIBES CEREUM SHRUBLAND ALLIANCE
- *Ribes cereum / Leymus ambiguus* Shrubland

SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE
- *Symphoricarpos occidentalis* Shrubland

Overview: This large patch ecological system is found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and ranges from southern New Mexico extending north into Wyoming, and west into the Intermountain region. It is common where *Quercus gambelii* is absent such as the northern Colorado Front Range and in drier foothills and prairie hills. This system is generally drier than Rocky Mountain Gambel Oak-Mixed Montane Shrubland, but may include mesic montane shrublands where *Quercus gambelii* does not occur. It may occur as a mosaic of two or three plant associations often surrounded by grasslands or woodlands.

Characteristic species: Communities of this system are diverse, and species composition varies with elevation, aspect, soils, and disturbance history. Only a few of the component associations have a widespread distribution; many are restricted to a relatively small portion of the region. Communities range from xeric to mesic, and may be transitional to riparian woodland and shrublands. The dominant shrub species are generally well adapted to poor soils, dry sites, and disturbance by fire.

Association of this system are dominated by low to moderate hight shrubs averaging 1-2 m in height. The herbaceous stratum rarely exceeds 1m in height. Scattered trees or inclusions of grassland patches or steppe may be present, but the vegetation is typically dominated by a variety of shrubs including *Amelanchier utahensis, Cercocarpus montanus, Purshia tridentata, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus,* or *Yucca glauca*. Grasses present may include species of *Muhlenbergia, Bouteloua, Hesperostipa,* and *Pseudoroegneria spicata*.

Environment: These shrublands occur in the foothills, ridges, canyon slopes and lower mountains of the Rocky Mountains and on outcrops, mesas, and canyon slopes in the western Great Plains, at elevations between 1500-2900m (4900-9500 ft). In general, these are mixed shrublands of areas where oak is absent, although they may intergrade in places with oak/mixed mountain shrublands, such as at the northern extent of *Quercus gambelii* along the mountain front in Colorado (Vestal 1917, Whitfield 1933), or with other *Quercus* species on the Mesa de Maya (Rogers 1950). The component associations typically form a patchy mosiac of shrub communities that can change noticably across short geographic distances and are, as well, often transitional between plains systems and montane systems. These shrublands appear to be environmentally intermediate between grasslands and savanna/forest associations, being drier than the latter, and moister than the former (Vestal 1919).

Although this system is often associated with exposed sites, rocky substrates, and dry conditions which limit tree growth, the principle species characterizing these shrublands form associations that range from xeric to mesic. Many of the associations achieve their best growth under more mesic conditions, such as north facing slopes, narrow canyons, and relatively moist ravines and depressions (Ramaley 1931). Extensive stands of some types, however, may also be found on very dry, exceedingly shallow, rocky soils. Sites are generally moderate to steeply sloping (20-60%), but some stands may occur on in patches on rock ledges, scree and other steep slopes (50-100%). Aspects are variable. The distribution of these shrublands is determined by soil moisture availability and by a fire frequency and intensity that is balanced between elimination of shrubs and limitation of tree invasion.

Dynamics: Fire is a naturally occurring process in lower montane and foothill shrublands, but the system is not always fire-driven. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases sites are too xeric for much tree growth, even in the absence of fire. With the exception of *Purshia tridentata*, the dominant shrubs are generally able to survive fire and resprout vigorously after being top-killed. Variation in response to fire within and between species may gradually change the composition of a shrubland. Repeated fires may greatly decrease shrub abundance. Fire regimes in this type are probably naturally variable, depending on local site factors. Fire can greatly increase available soil nutrients in this system, although erosion potential also increases (Gucker 2006).

Dominant shrubs in this ecological system are generally palatable to browsing animals, and are tolerant of herbiverory at moderate levels. Herbivory affects energy and material flow in the system, but may also have differential impacts on life history stages of species. Turley et al. (2003) found that *Cercocarpus montanus* is able to compensate for annual growth lost to herbivory, at least under conditions of high resource availibility. However, unbrowsed shrubs produced many more flowers and seeds than browsed shrubs.

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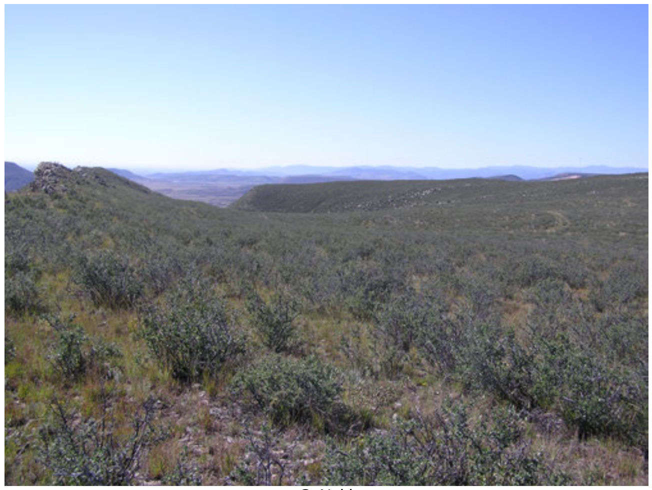
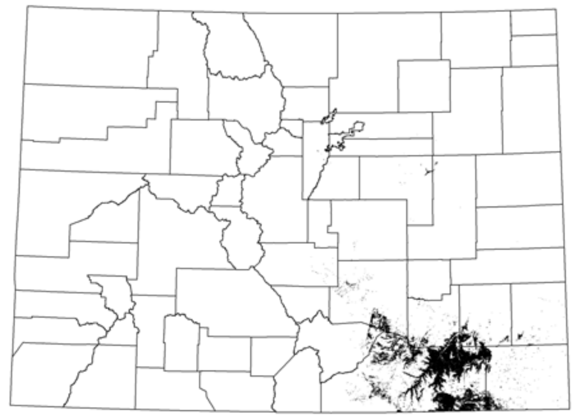


S. Neid

Rank:	A	B	C	D
① **CONDITION**				
Community structure	Native species dominant, non-native species may be present but in small amounts (< 1% total cover). If trees are present, these are widely scattered and mature. Species richness is often high, and native bunch grasses or sedges (non-increasers) are dominant.	Native species dominant, non-native species are present but in small amounts (< 3% total cover). If trees are present, these are widely scattered and mature. Species richness is often high, and native grasses (non-increasers) are dominant.	Herbaceous cover is co-dominated by native and non-native species. Alteration of vegetation is extensive but potentially restorable over several decades.	Non-native species are dominant. Alteration of vegetation is extensive and restoration potential is low.
Invasive exotics with major potential to alter structure and composition (e.g., leafy spurge, knapweeds, non-native thistle, *Bromus inermis, Poa pratensis, Bromus tectorum)*	Absent or < 1% cover.	May be present, but <3% cover.	Likely to be present.	Present, may have significant cover.
Native increaser spp. (e.g. *Yucca, Artemisia frigida*, and *Opuntia* spp.)	< 3% cover.	<5% cover.	>10% cover.	May be dominant.
Disturbance		Fire regime is largely intact, and grazing is not contributing to deterioration of the occurrence.	Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction. The fire and grazing regimes may need immediate management to prevent deterioration of the occurrence.	Vehicle use or livestock grazing disturbance, if present, is extensive and significant. System remains fundamentally compromised despite restoration of some processes. Soil compaction and continued disturbance is extensive throughout the occurrence.
Fragmentation		Fragmentation is limited to less than 5% of the occurrence.	Fragmentation is limited to less than 15% of the occurrence.	
② **SIZE**				
Acres	>5,000	2,000-5,000	1,000-2,000	< 1,000
③ **LANDSCAPE CONTEXT**				
Connectivity	Connectivity of adjacent systems allows natural ecological processes, e.g., fire and species migrations to occur. No unnatural barriers present.	Adjacent systems surrounding occurrence retain much connectivity. Few non-natural barriers present.	Adjacent systems surrounding occurrence are fragmented by alteration with limited connectivity.	Connectivity is severely hampered.
Surrounding land	At least 90% native and unaltered landscape with very little to no urban development or agriculture, and little to no industrial forestry.	Surrounding landscape composed of at least 75% natural or semi-natural vegetation, with little urban development within or adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with >50% natural or semi-natural vegetation. Some non-natural barriers are present. Significant disturbance, but easily restorable.	Major human-caused alteration of surrounding landscape. Adjacent systems surrounding occurrence are mostly converted to agricultural or urban uses.

SOUTHERN ROCKY MOUNTAIN JUNIPER WOODLAND AND SAVANNA

S. Kettler



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JUNIPERUS MONOSPERMA WOODLAND ALLIANCE

Juniperus monosperma / Andropogon hallii Woodland
Juniperus monosperma / Bouteloua curtipendula Woodland
Juniperus monosperma / Bouteloua eriopoda Woodland
Juniperus monosperma / Bouteloua gracilis Woodland
Juniperus monosperma / Cercocarpus montanus - Ribes cereum Woodland
Juniperus monosperma / Cercocarpus montanus Woodland
Juniperus monosperma / Hesperostipa neomexicana Woodland

Juniperus monosperma / Krascheninnikovia lanata Woodland
Juniperus monosperma - Rhus trilobata / Schizachyrium scoparium Woodland

JUNIPERUS SCOPULORUM WOODLAND ALLIANCE

Juniperus scopulorum / Schizachyrium scoparium Woodland

Overview: The Juniper Woodland and Savanna ecological system occupies lower and warmer elevations, primarily along the eastern and southern edge of the southern Rockies and Arizona-New Mexico mountains. Juniper woodlands and savannas are usually found just below the lower elevational range of *Pinus ponderosa* and often intermingle with grasslands and shrublands. In the canyons and tablelands of the southern Great Plains this system forms extensive cover at some distance from the mountain front. In the Colorado, this system is largely confined to the southeastern plains where it forms an extensive matrix with the Southwestern Great Plains Canyon ecological system.

Characteristic species: This system is best described as a savanna that has widely spaced mature (>150 years old) juniper trees with only occasional *Pinus edulis*. *Juniperus monosperma* and *Juniperus scopulorum* are the dominant tall shrubs or scattered short trees, though there may be inclusions of more dense juniper woodlands. Graminoid species are similar to those found in Western Great Plains Shortgrass Prairie, with *Bouteloua gracilis* and *Pleuraphis jamesii* being most common. In addition, succulents such as species of *Yucca* and *Opuntia* are typically present.

Environment: Occupies the lower and warmer elevations, growing from about 4,260 to 6,000 feet (1,300-1,830 m) in a semi-arid climate.

Dynamics: Although juniper woodlands and savannas are expected to occur naturally on the landscape, the extent and quality of this system has been severely altered since the early 1900's. Numerous studies have shown that juniper has encroached on shrublands and grasslands (e.g., Blackburn and Tueller 1970, West 1999). Processes that influence the formation and persistence of juniper savannas include climate, grazing, fires, tree harvest, and insect-pathogen outbreaks (West 1999; Eager 1999). Alteration of fire intensity and frequency, historic heavy livestock grazing, and changes in climate has led to various densities of younger trees occurring on some sites that were once shrublands or grasslands (West 1999, Commons et al. 1999).

Variation: Within a given region, the density of trees, both historically and currently, is strongly related to topoedaphic gradients. Less steep sites, especially those with finer textured soils, are where savannas, grasslands, and shrub steppes have occurred in the past. Juniper stands on these gentler slopes may have been larger but more savanna-like, with very open upper canopy and high grass production.


R. Rondeau

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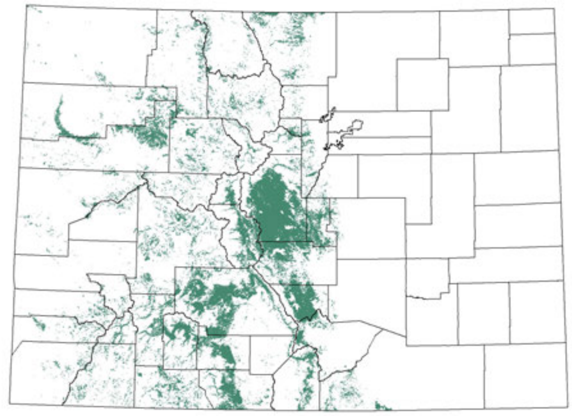
Rank:	A	B	C	D
① CONDITION				
Tree density	<30 per ha on favorable sites, but may range up to 200 trees per ha on rocky, less favorable sites.	<40 per ha on favorable sites, but not more than 600 trees per ha on rocky, less favorable sites.	>40 trees per ha on favorable sites, >600 per ha on rocky, less favorable sites.	Very high (>800 ha) on both favorable and poor sites.
Community structure	Herbaceous cover between trees is heavy enough to carry surface fires with some frequency, at least on the less steep, rocky sites.	System occurrence is dominated by natives, herbaceous undergrowth is present but may be declining.	The system occurrence is dominated by native species; however, herbaceous undergrowth is becoming sparse and is not sufficient to carry fire.	Herbaceous undergrowth is nearly absent.
Fire regime	Fire has occurred within the stand within the last 10 years for deep soil sites.	Fire has occurred within the stand within the last 20-50 years for deep soil sites.	Fire has not occurred within the stand for 50-100 years.	Fire has not occurred within the stand for >100 years.
Invasive exotics with major potential to alter structure and composition (e.g., leafy spurge, Russian knapweed, diffuse knapweed, spotted knapweed, or yellow toadflax)	Either not present or occupy less than 1 percent of the occurrence, with no patches larger than 1 acre.	No more than 1-3% of the occurrence with no patches larger than 1 acre.	3-7% of the occurrence, with some patches larger than 1 acre.	

Non-native annual grasses (e.g., *Bromus tectorum*)	Absent or incidental.	May be present only in disturbed areas but not found throughout the occurrence.		Present and abundant.
Native perennial increaser spp.	May be present on <5% of the area.	May be present and even dominant in spots, but not throughout the occurrence.	>10%	May be dominant.
Disturbance	No surficial disturbance is evident, the stand has never been "chained" and re-seeded. Some disturbance may be evident in small, isolated areas (e.g., mines or ranch activities and buildings; minor off-road vehicle use of <1%).	Little to no surficial disturbance is evident (<20% of the area). The stand has never been "chained" and re-seeded, or if such activities have occurred they have not resulted in removal of pre-settlement trees, soil compaction, or significant changes in understory species composition.	Surficial disturbances occur on no more than 30% of the area. Less than 50% of the stand may have been"chained" and/or re-seeded.	Surficial disturbances occur on >50% of the area. The stand may have been "chained" but not more than 50% of the occurrence.
Roads	Few or none.	None to only a few.	More than a few.	Many.
Soil erosion	Not significantly accelerated by anthropogenic activities	Soil erosion may be accelerated in small patches, or lightly so throughout the occurrence, but can be easily reversed by relatively simple, straightforward, and inexpensive changes in management.	Soil erosion and gullying may be observed in patches (up to 30%) within the stand.	May be severe in places.
② Landscape Context				
Surrounding land	Occurrence surrounded by at least 90% natural or semi-natural vegetation, with natural vegetation comprising the majority of the landscape.	Landscape composed of at least 80% natural or semi-natural vegetation. occurrence is surrounded by moderate- to low-quality prairie or other shrublands.	Landscape is a mosaic of agricultural or semi-developed areas and natural or semi-natural vegetation. Semi-natural vegetation may dominate the landscape.	Surrounded primarily by urban or agricultural landscape, with <25% landscape cover of natural or semi-natural vegetation.
Connectivity Does the surrounding landscape capture characteristic ecological gradients (including adjacent shortgrass prairie, canyons and shrublands) and geomorphic processes.	Highly connected.	Moderately connected.	Moderately fragmented and isolated.	Highly fragmented and isolated.
③ Size				
Acres	>5,000 Large enough to support a mosaic of stand conditions, ages, and disturbance patterns.	2,000-5,000	1,000-2,000	< 1,000 Subject to edge effects, with no opportunity for mosaic disturbance patterns.

Southern Rocky Mountain Montane-Subalpine Grassland

D. Culver



Extent exagerated for display

DANTHONIA INTERMEDIA HERBACEOUS ALLIANCE
Danthonia intermedia - Solidago multiradiata Herbaceous Vegetation
Danthonia intermedia Herbaceous Vegetation
DANTHONIA PARRYI HERBACEOUS ALLIANCE
Danthonia parryi Herbaceous Vegetation
DESCHAMPSIA CAESPITOSA SEASONALLY FLOODED HERBACEOUS ALLIANCE
Deschampsia caespitosa Herbaceous Vegetation
FESTUCA ARIZONICA HERBACEOUS ALLIANCE
Festuca arizonica - Muhlenbergia filiculmis Herbaceous Vegetation
Festuca arizonica - Muhlenbergia montana Herbaceous Vegetation
FESTUCA IDAHOENSIS HERBACEOUS ALLIANCE
Festuca idahoensis - Festuca thurberi Herbaceous Vegetation
Festuca idahoensis - Geranium viscosissimum Herbaceous Vegetation
FESTUCA THURBERI HERBACEOUS ALLIANCE
Festuca thurberi - Lathyrus lanszwertii var. *leucanthus* Herbaceous Vegetation
Festuca thurberi Subalpine Grassland Herbaceous Vegetation
LEYMUS CINEREUS HERBACEOUS ALLIANCE
Leymus cinereus Herbaceous Vegetation
MUHLENBERGIA FILICULMIS HERBACEOUS ALLIANCE
Muhlenbergia filiculmis Herbaceous Vegetation
MUHLENBERGIA MONTANA HERBACEOUS ALLIANCE
Muhlenbergia montana - Hesperostipa comata Herbaceous Vegetation
Muhlenbergia montana Herbaceous Vegetation
PASCOPYRUM SMITHII HERBACEOUS ALLIANCE
Pascopyrum smithii - Bouteloua gracilis Herbaceous Vegetation
POA FENDLERIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
Poa fendleriana Herbaceous Vegetation
PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE
Pseudoroegneria spicata - Poa fendleriana Herbaceous Vegetation
Pseudoroegneria spicata Herbaceous Vegetation

Overview: This ecological system typically occurs between 2200-3000 m (in the Colorado Rockies) on flat to rolling plains and parks or on lower sideslopes that are dry. These large patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole, ponderosa pine, and aspen forests. In limited circumstances (e.g., South Park in Colorado) they form the "matrix" of high-elevation plateaus. Although the largest occurrences are primarily within Colorado, examples are scattered throughout the region from Wyoming to New Mexico.

Characteristic species: These large patch grasslands are intermixed with forests of spruce-fir, lodgepole, ponderosa pine, mixed conifers, and aspen. Within the subalpine zone, forbs tend to be more prominent at higher elevations, and shrubs at lower elevations (Turner and Paulsen 1976). Associations are variable depending on site factors such as slope, aspect, precipitation, etc., but generally lower elevation montane grasslands are more xeric and dominated by *Muhlenbergia* spp., *Pseudoroegneria spicata*, *Festuca arizonica*, and *Festuca idahoensis*, while upper montane or subalpine grasslands are more mesic and may be dominated by *Festuca thurberi* or *Danthonia intermedia*. *Danthonia* *parryii* is found across most of the elevational range of this system. Montane grasslands in the Colorado Front Range are often dominated by *Leucopoa kingii* or *Muhlenbergia montana* (Peet 1981). In the San Juan Mountains of southwestern Colorado, these grasslands are dominated by *Festuca thurberi* and other large bunch grasses (Jamieson et al. 1996). Grasses of the foothills and piedmont, such as *Bouteloua gracilis, Bouteloua curtipendula, Hesperostipa comata, Koeleria macrantha, Pascopyrum smithii, Poa secunda,* and *Schizachyrium scoparium* may be included in lower elevation occurrences. Higher, more mesic locations may support additional graminoid species including *Agrostis* spp., *Carex* spp., *Festuca brachyphylla, Juncus drummondii, Phleum alpinum, Poa* spp., *or Trisetum spicatum.* Woody species are generally sparse or absent, but occasional individuals from the surrounding forest communities may occur. Scattered dwarf-shrubs may be found in some occurences; species vary with elevation and location. Forbs are more common at higher elevations.

Environment: These are typically grasslands of forest openings and park-like expanses in the montane and subalpine coniferous forests. Although smaller montane grasslands are scattered throughout the Southern Rocky Mountains ecoregion, the largest occurrence by far (over a million acres) is on the valley floor of South Park in central Colorado. This ecological system typically occurs between 2,200 and 3,000 m (7,200 and 10,000 feet) on gentle to steep slopes, parks, or on lower sideslopes that are dry, but it may extend up to 3,350 m (11,000 ft) on warm aspects.

The general climate in the range of this ecological system is typically montane to subalpine, characterized by cold winters and relatively cool summers, although temperatures are more moderate at lower elevations. Precipitation patterns differ between the east and west sides of the Continental Divide. In general, these grasslands experience long winters, deep snow, and short growing seasons. Average annual precipitation ranges between 20 to 40 inches, and the majority of this falls as snow (Turner and Paulsen 1976). Snowcover in some areas can last from October to May, and serves to insulate the plants beneath from periodic subzero temperatures. Other areas are kept free from snow by wind. Rapid spring snowmelt usually saturates the soil, and, when temperatures rise plant growth is rapid. Precipitation during the growing season is highly variable, but provides less moisture than snowmelt. Growing seasons are short, typically from June through August at intermediate locations, although frost can occur at almost any time.

The geology of the Southern Rocky Mountains is extremely complex. Not surprisingly, soils are also highly variable, depending on the parent materials from which they were derived and the conditions under which they developed. Podzolic soils have developed on most high mountain areas as a result of cool to cold temperatures, relatively abundant moisture, and the dominant coniferous forest vegetation. In the intermingled parks and open treeless slopes or ridges, grassland soils have developed. Soil texture is important in explaining the existence of montane-subalpine grasslands (Peet 2000). These grasslands often occupy the fine-textured alluvial of colluvial soils of valley bottoms, in contrast to the coarse, rocky material of adjacent forested slopes (Peet 2000). Soils are often similar to prairie soils, with a dark brown A-horizon that is rich in organic matter, well drained, and slightly acidic (Turner and Paulsen 1976). Other factors that may explain the absence of trees in this system are soil moisture (too much or too little), competition from established herbaceous species, cold air drainage and frost pockets, high snow accumulation, beaver activity, slow recovery from fire, and snow slides (Daubenmire 1943, Knight 1994, Peet 2000). Where grasslands occurr intermixed with forested areas, the less pronounced environmental differences mean that trees are more likely to invade (Turner and Paulsen 1976).

Dynamics: A variety of factors, including fire, wind, cold-air drainage, climatic variation, soil properties, competition, and grazing have been proposed as mechanisms that maintain open grasslands and parks in forest surroundings. Observations and repeat photography studies in sites throughout the southern Rocky Mountains indicate that trees do invade open areas, but that the mechanisms responsible for this trend may differ from site to site. Anderson and Baker (2005) discounted fire suppression as the cause of tree invasions in Wyoming's Medicine Bow Mountains, concluding that edaphic conditions were the most likely factor limiting tree establishment. In the San Juan Mountains of southeastern Colorado, Zier and Baker (2006) also found that the probability of tree invasion varied with forest type. Climatic variation, fire exclusion, and grazing appear to interact with edaphic factors to facilitate or hinder tree invasion in these grasslands (Zier and Baker 2006). In the Gunnison Basin, Schauer et al. (1998) identified seedling mortality as the primary factor preventing invasions of Engelmann spruce, but did not determine if this was due to competition from established grassland plants, or to edaphic conditions. The work of Coop and Givnish (2007) in the Jemez Mountains of northern New Mexico suggests that both changing disturbance regimes and climatic factors are linked to tree establishment in some montane grasslands. Pocket gophers (*Thomomys* spp.) are a widespread source of disturbance in montane-subalpine grasslands. The activities of these burrowing mammals result in increased aeration, mixing of soil, and infiltration of water, and are an important component of normal soil formation and erosion (Ellison 1946). In addition, Cantor and Whitham (1989) found that below-ground herbivory of pocket gophers restricted establishement of aspen to rocky areas in Arizona mountain meadows. The interaction of multiple factors indicates that management for the maintenance of these montane and subalpine grasslands may be complex.

Grazing by domestic livestock may act to override or mask whatever natural mechanism is responsible for maintaining a occurrence. Montane-subalpine grasslands were first grazed by domestic livestock beginning in the late 1800's (Turner and Paulsen 1976). After lower-elevation, more accessible rangelands were overstocked in the 1870's and 1880's, use of montane and subalpine grasslands increased dramatically. By the turn of the century nearly all grazable land was being utilized, and much was already overgrazed (Turner and Paulsen 1976). As National Forests were established following the Organic Administration Act of 1897, regulation of grazing on these high elevation grasslands was instituted. Use levels peaked near the end of the first World War, and current use levels are substantially lower than the highest previous level (Turner and Paulsen 1976).

Floristic composition in these grasslands is influenced by both environmental factors and grazing history. Grazing is generally believed to lead to the replacement of palatable species with less palatable ones more able to withstand grazing pressure (Smith 1967, Paulsen 1975, Brown 1994, but see Stohlgren et al. 1999). In general, palatable grasses are replaced by nonpalatable forbs or shrubs under cattle grazing (Smith 1967), while palatable forbs are characteristically absent from grasslands with a long history of sheep use (Turner and Paulsen 1976). Annual species are uncommon except on heavily disturbed areas.

Variation: Montane and subalpine grasslands are generally interspersed in forest communities as park-like openings that vary in size from a few to several thousand acres. A few exceptional occurrences are much larger, and should be considered separately from the majority of occurrences.

P. Lyon

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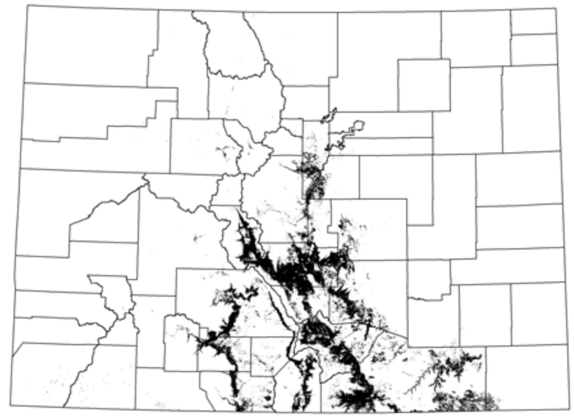
Rank:	A	B	C	D
① CONDITION				
Community structure	Native bunch grasses are dominant. If trees or shrubs are present, they are widely scattered and mature. Species richness is often high and includes several native grasses and a diverse forb component. Plant vigor is high.	Native bunch grasses are dominant. If trees or shrubs are present, they are widely scattered and mature. Species richness is often high and native bunchgrasses are dominant,	Native bunchgrasses present but may be nearly equal in canopy cover to non-native species. Trees and shrubs may have seedlings, juveniles, or saplings present. Alteration is extensive but potentially restorable over several decades.	Non-native species are dominant, native species have less than 10% canopy cover and 20% relative cover. Alteration is extensive and restoration potential is low.
Invasive exotics with major potential to alter structure and composition (e.g., non-native thistle, *Bromus inermis, Poa*	Absent	May be present, but <1% cover	May be prominent in small and discrete patches	Present

pratensis, Bromus tectorum)				
Other non-native spp.	<3% canopy cover	<10%, native species dominant	>20%	Dominant
Native increaser spp. *(Koelaria micrantha, Artemisia frigida)*	< 3%	<10%	Co-dominant or dominant	May be dominant
Disturbance	Fires are still part of this system. Livestock grazing, if present, is light and seasonally compatible.		Fire frequency may have been altered, although easily restored. Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition, soil compaction and stability.	Fire frequency may be greatly altered and difficult to restore. Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition, soil compaction and stability. System remains fundamentally compromised despite restoration of some processes.
Ground cover & soils	Drainages are natural stable channels with no signs of unnatural erosion. The soil surface should show slight to no evidence of rills, wind scoured areas, or pedestaled plants. Plant cover is adequate to protect from excess soil erosion. Soils have a distinct A-horizon and are very stable (low erosion rate). Soils are not compacted.	Water flow patterns nearly match what is expected for the site; erosion is minor. Soil surface loss or degradation is moderate in plant interspaces with some degradation beneath plant canopies. Slight active pedestalling. Bare areas are of moderate size and sporadically connected. Litter buildup may be present in some areas, Soil structure is degraded and soil organic matter content is significantly reduced. Soil compaction moderately widespread.	Deposition and cut areas common; occasionally connected. Soil surface resistance to erosion significantly reduced in most plant canopy interspaces and moderately reduced beneath plant canopies. Moderately active pedestalling. Bare ground is moderate to much higher than expected for the site. Bare areas are large and often connected. Soil surface loss or degradation may be severe throughout the site. Soil compaction may be widespread.	Water flow patterns unstable with active erosion. Soil surface resistance to erosion may be extremely reduced throughout the site. Abundant active pedestalling and numerous terracettes. Bare ground is much higher than expected for the site. Bare areas are large and generally connected. Soil compaction is extensive throughout the occurrence.
② Landscape Context				
Connectivity	No unnatural barriers present. Connectivity of adjacent systems allows natural ecological processes, e.g., fire to occur.	Few non-natural barriers present. development not directly adjacent to the occurrence. Limited or minor human-caused alteration of landscape. Adjacent systems surrounding occurrence have moderate urban or agricultural alteration (60-90% natural) but retaining much connectivity.	Adjacent systems surrounding occurrence are fragmented by alteration (20 – 60% natural), with limited connectivity. Some non-natural barriers are present.	Connectivity is severely hampered
Surrounding land	At least 90% native and unaltered landscape with very little to no urban development or agriculture, and little to no industrial forestry	Surrounding landscape composed of at least 75% natural or semi-natural vegetation, with any urban development not directly adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with >50% natural or semi-natural vegetation. Some non-natural barriers are present. Significant disturbance, but easily restorable.	Major human-caused alteration of surrounding landscape. Adjacent systems surrounding occurrence are mostly converted to agricultural or urban uses.
③Size				
Acres South Park	>500 >5000	50-500 2000-5000	25-50 1000-5000	< 25 < 1000

SOUTHERN ROCKY MOUNTAIN PINYON-JUNIPER WOODLAND

S. Neid



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JUNIPERUS MONOSPERMA WOODLAND ALLIANCE
- *Juniperus monosperma / Artemisia bigelovii* Woodland
- *Juniperus monosperma / Bouteloua curtipendula* Woodland
- *Juniperus monosperma / Bouteloua eriopoda* Woodland
- *Juniperus monosperma / Bouteloua gracilis* Woodland
- *Juniperus monosperma / Bouteloua hirsuta* Woodland
- *Juniperus monosperma / Cercocarpus montanus - Ribes cereum* Woodland
- *Juniperus monosperma / Hesperostipa neomexicana* Woodland

PINUS EDULIS - (JUNIPERUS SPP.) WOODLAND ALLIANCE
- *Pinus edulis - (Juniperus monosperma) / Bouteloua gracilis* Woodland
- *Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata* Woodland
- *Pinus edulis - Juniperus* spp. */ Artemisia tridentata* Woodland
- *Pinus edulis - Juniperus* spp. */ Cercocarpus montanus* Woodland
- *Pinus edulis - Juniperus* spp. */ Quercus gambelii* Woodland
- *Pinus edulis / Achnatherum scribneri* Woodland
- *Pinus edulis / Leymus ambiguus* Woodland
- *Pinus edulis / Poa fendleriana* Woodland
- *Pinus edulis / Pseudoroegneria spicata* Woodland
- *Pinus edulis / Purshia tridentata* Woodland
- *Pinus edulis / Quercus* X *pauciloba* Woodland

Overview: This southern Rocky Mountain ecological system occurs on dry mountains and foothills in southern Colorado, in mountains and plateaus of northern New Mexico and Arizona, and extends out onto breaks in the Great Plains. In Colorado, the southern Rocky Mountain pinyon-juniper woodlands are found in the south central part of the state, around the San Luis Valley, southern mountain front east to Mesa de Maya, and north to the Arkansas River Valley and Palmer Divide. In the canyons and tablelands to the east, *Pinus edulis* is absent, and this system is replaced by the Southern Rocky Mountain Juniper Woodland and Savanna system.

Characteristic species: *Pinus edulis* and/or *Juniperus monosperma* dominate the tree canopy. *Juniperus scopulorum* may codominate or replace *Juniperus monosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Artemisia tridentata, Cercocarpus montanus, Quercus gambelii, Achnatherum scribneri, Bouteloua gracilis, Festuca arizonica*, and *Pleuraphis jamesii*.

Environment: These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

Dynamics: Pinyon-juniper woodlands are influenced by climate, grazing, fires, tree harvest, and insect-pathogen outbreaks (West 1999; Eager 1999). From the late 1800s to the present, distribution and density of pinyon and juniper and accompanying native understory has been significantly altered (Stevens 1999). The effect of a fire on a stand is largely dependent on the tree height and density, fine fuel load on the ground, weather conditions, and season (Wright et al. 1979, Dwyer and Pieper 1967). Large trees generally survive unless the fire gets into the crown due to heavy fuel loads in the understory. In this system fire acts to open stands, increase diversity and productivity in understory species, and create a mosaic of stands of different sizes and ages across the landscape while maintaining the boundary between woodlands and adjacent shrubs or grasslands (Bradley et al. 1992). Altered fire regimes, overgrazing, and tree cutting can all affect stand quality and fire behavior. These factors can also disturb cryptogamic soils and lead to increased soil erosion and habitat/species loss.

Variation: Stands vary considerably in appearance and composition, both altitudinally and geographically. Juniper tends to be more abundant at the lower elevations, pinyon tends to be more abundant at the higher elevations, and the two species share dominance within a broad middle-elevation zone (Woodin and Lindsey 1954, Heil et al. 1993).

Site conditions influence the stand density. Sites with fewer trees typically have relatively deep soils and support a dense herbaceous level; those with more trees have shallow, rocky soils and often occur on steeper slopes. Stands may range from even aged to un-even aged stands. Some stands may have closed canopies with little or no understory, but many stands are open with widely scattered trees with a wide variety of understory vegetation (Rondeau 2001).

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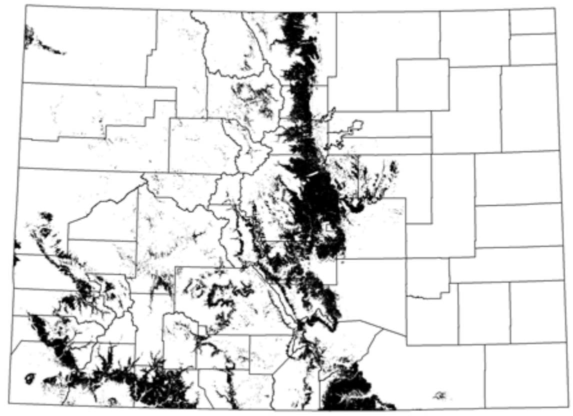
Rank:	A	B	C	D
① SIZE				
Acres	>90,000	50,000-90,000	30,000-50,000	< 30,000
② CONDITION				
Community structure	Tree density is <30 per ha on favorable sites, and up to 200 trees per ha on rocky, less favorable sites. Native dominated herbaceous cover between trees is heavy enough to carry regular fires. This is less important on steep, rocky sites.	Tree density is <40 ha on favorable sites, but not more than 600 trees per ha on rocky, less favorable sites. Community dominated by natives, herbaceous undergrowth is present but may be declining.	Tree density is >40 trees per ha on favorable sites, >600 per ha on rocky, less favorable sites. Community dominated by native species; herbaceous undergrowth is sparse and not sufficient to carry fire.	Tree density is very high (>800 ha) on both favorable and poor sites.
Non-native spp. (annual grasses, e.g. *Bromus tectorum*)	Absent or incidental.	May be present in disturbed areas only.	Can be abundant in both small and large patches.	Present and abundant.
Native increaser spp.	< 5% cover.	May be present and even dominant in spots, but not throughout the occurrence.		
Disturbance (e.g. ranch activities and buildings; energy development; off-road vehicle use)	No surficial disturbance is evident, the stand has never been "chained" and re-seeded. Some disturbance may be evident in small, isolated areas (e.g. mines or ranch activities and buildings; minor off-road vehicle use--<1%). Few to no roads.	No surficial disturbance is evident, the stand has never been "chained" and re-seeded. If some disturbance is evident it is limited to less than 20% of the occurrence area. There are no to only a few roads found within the occurrence.	Surficial disturbances occur on more than 20% of the area. Up to 50% of the stand may have been "chained" and re-seeded. There are more than a few roads found within the occurrence.	Surficial disturbances occur on more than 50% of the area (e.g. mines or ranch activities and buildings; off-road vehicle use). Up to 50% of the stand may have been "chained" and re-seeded.
Ground cover	Microbiotic crusts are intact. Natural microrelief is undisturbed. Soil erosion is not accelerated by anthropogenic activities. Accelerated soil erosion had not occurred, or if in the past, the herbaceous cover has increased sufficiently to check this problem.	Microbiotic crusts are intact in at least 80% of the occurrence. Soil erosion may be accelerated in small patches, or lightly so throughout the occurrence. Soil erosion can be easily reversed by relatively simple, straightforward, and inexpensive changes in management.	Microbiotic crusts are removed from more than 25% of the area, or are in various stages of degradation throughout the occurrence. Soil erosion and gullying may be observed in patches (up to 30%) within the stand.	Microbiotic crusts are >75% removed, occurring only in small pockets naturally protected from livestock and off-road vehicle use. Soil erosion may be severe in places.
③ LANDSCAPE CONTEXT				
Connectivity	Highly connected.	Moderately connected.	Moderately fragmented.	Highly fragmented.
Surrounding land	Area around the occurrence is largely intact natural vegetation, with species interactions and natural processes occurring across communities.	Area around the occurrence is moderately intact natural vegetation, with species interactions and natural processes occurring across many communities; landscape includes partially disturbed natural or semi-natural communities, some of it not high quality due to excessive grazing or recent logging.	Area around the occurrence is largely a combination of cultural and natural vegetation, with barriers between species interactions and natural processes across natural communities; occurrence is surrounded by a mix of intensive agriculture and adjacent forest lots (total area no smaller than ten times the minimum "C"-rated size).	Area around the occurrence is entirely, or almost entirely, surrounded by agricultural or urban land use; occurrence is at best buffered on one side by natural communities.

Southern Rocky Mountain Ponderosa Pine Woodland

S. Neid



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PINUS PONDEROSA FOREST ALLIANCE

Pinus ponderosa / Carex rossii Forest
Pinus ponderosa / Physocarpus monogynus Forest
Pinus ponderosa / Ribes cereum Forest

PINUS PONDEROSA WOODLAND ALLIANCE

Pinus ponderosa / Arctostaphylos patula Woodland
Pinus ponderosa / Arctostaphylos uva-ursi Woodland
Pinus ponderosa / Artemisia arbuscula Woodland
Pinus ponderosa / Artemisia tridentata - Purshia tridentata Woodland
Pinus ponderosa / Bouteloua gracilis Woodland
Pinus ponderosa / Bromus inermis Semi-natural Woodland
Pinus ponderosa / Carex geyeri Woodland
Pinus ponderosa / Carex inops ssp. *heliophila* Woodland
Pinus ponderosa / Festuca arizonica Woodland
Pinus ponderosa / Festuca idahoensis Woodland
Pinus ponderosa / Juniperus communis Woodland
Pinus ponderosa / Juniperus scopulorum Woodland
Pinus ponderosa / Leucopoa kingii Woodland
Pinus ponderosa / Muhlenbergia montana Woodland
Pinus ponderosa / Purshia stansburiana Woodland
Pinus ponderosa / Purshia tridentata Woodland
Pinus ponderosa / Quercus gambelii Woodland
Pinus ponderosa / Quercus X *pauciloba* Woodland
Pinus ponderosa / Rockland Woodland
Pinus ponderosa / Schizachyrium scoparium Woodland

Overview: This widespread ecological system is most common throughout the cordillera of the Rocky Mountains, but is also found in the Colorado Plateau region, west into scattered locations in the Great Basin, and north into southern British Columbia. These matrix-forming woodlands occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites.

Characteristic species: *Pinus ponderosa* is the predominant conifer; *Pseudotsuga menziesii, Pinus edulis*, and *Juniperus* spp. may be present in the tree canopy. The understory is usually shrubby, with *Artemisia nova, Artemisia tridentata, Arctostaphylos patula, Arctostaphylos uva-ursi, Cercocarpus montanus, Cercocarpus ledifolius, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Symphoricarpos oreophilus, Prunus virginiana, Amelanchier alnifolia,* and *Rosa* spp. being common species. *Pseudoroegneria spicata* and species of *Hesperostipa, Achnatherum, Festuca, Muhlenbergia*, and *Bouteloua* are some of the common grasses.

Grace's warbler, Pygmy nuthatch, and flammulated owl are indicators of a healthy ponderosa pine woodland.

Environment: This ecological system occurs at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites at elevations ranging from 6,500-9,200 ft (1,980-2,800 m). It can occur on all slopes and aspects, however, it commonly occurs on moderately steep to very steep slopes or ridgetops. This ecological system generally occurs on igneous, metamorphic, and sedimentary material derived soils, including basalt, basaltic, andesitic flows, intrusive granitoids and porphyrites, and tuffs (Youngblood and Mauk 1985). Characteristic soil features include good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, and periods of drought during the growing season. Surface textures are highly variable in this ecological system ranging from sand to loam and silt loam. Exposed rock and bare soil consistently occur to some degree in all the associations. Annual precipitation is 8-24 in (25-60 cm), mostly through winter storms and some monsoonal summer rains. Typically a seasonal drought period occurs throughout this system as well.

Dynamics: *Pinus ponderosa* is a drought-resistant, shade-intolerant conifer which usually occurs at lower treeline in the major ranges of the western United States. Historically, ground fires and drought were influential in maintaining open-canopy conditions in these woodlands. With settlement and subsequent fire suppression, occurrences have become denser. Presently, many occurrences contain understories of more shade-tolerant species, such as *Pseudotsuga menziesii* and/or *Abies* spp., as well as younger cohorts of *Pinus ponderosa*. These altered occurrence structures have affected fuel loads and alter fire regimes. Presettlement fire regimes were primarily frequent (5-15 year return intervals), low-intensity ground fires triggered by lightning strikes or deliberately set fires by Native Americans. With fire suppression and increased fuel loads, fire regimes are now less frequent and often become intense crown fires, which can kill mature *Pinus ponderosa* (Reid et al. 1999).

Variation: This system intergrades with Rocky Mountain Ponderosa Pine Savanna. The two are distinguished by the high frequency, surface-fire regime, less steep or rocky environmental setting, and more open grassy understory structure of the savanna system.

Reid, M. S., K. A. Schulz, P. J. Comer, M. H. Schindel, D. R. Culver, D. A. Sarr, and M. C. Damm. 1999. An alliance level classification of vegetation of the coterminous western United States. Unpublished final report to the University of Idaho Cooperative Fish and Wildlife Research Unit and National Gap Analysis Program, in fulfillment of Cooperative Agreement 1434-HQ-97-AG-01779. The Nature Conservancy, Western Conservation Science Department, Boulder, CO.

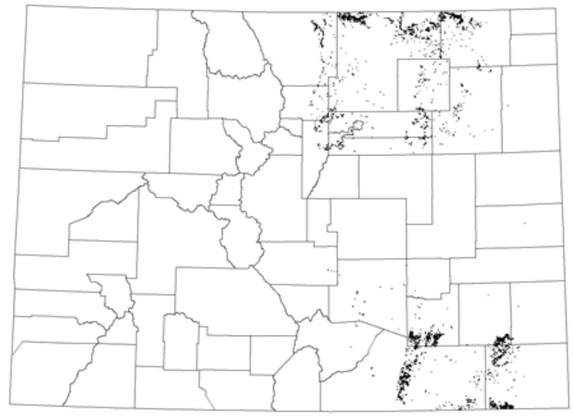
Youngblood, A. P., and R. L. Mauk. 1985. Coniferous forest habitat types of central and southern Utah. USDA Forest Service, Intermountain Research Station. General Technical Report INT-187. Ogden, UT. 89 pp.

S. Spackman

Rank:	A	B	C	D
① SIZE				
Acres	>90,000	50,000-90,000	30,000-50,000	< 30,000
② CONDITION				
Community structure **Note:** A variety of seral stages have been recognized in this system. Because the old-growth late seral stages are typically the most altered, ranking criteria are focused on these later seral stages as indicators of quality.	A mature stand of ponderosa pine consists of approximately 10 trees per acre that have a minimum DBH of 18" and the minimum age of ~160 years. Usually this is a multi-aged stand with approximately two dead standing trees per acre with a minimum DBH of 10". Downed trees are none to few. An old-growth ponderosa pine stand would consist of an overstory of trees that are predominately or entirely ponderosa pine. On the cooler more moist, north facing slopes it may be growing in association with Douglas-fir.	Majority of stand is >100 years old, may show evidence of selective logging that has altered the structure.	Stands regenerated naturally after logging or young to mature stands with significant history of selective logging disturbance that altered composition or structure.	Immature stand of ponderosa pine, often high density of trees, low shrub and herbaceous cover, and very low species diversity.
Fire regime	Frequent low intensity fires are still part of this system.	Fire frequency may be lower or more intense than expected.		
Non-native species	Absent.	May be present with low to moderate frequency in the understory, but have low percent cover.	May be uncommon to frequent but do not dominate or co-dominate understory (<10-20% cover).	May dominate understory.
Disturbance	Roads or other development are mostly non-existant.	Little to no evidence of past logging disturbance over a major proportion of the occurrence. Roads or other development may be present but these occupy less than 3% of the occurrence.	If roads or other development are present they occupy less than 5% of the occurrence.	Roads or other development occupy more than 5% of the occurrence.
③ LANDSCAPE CONTEXT				
Surrounding land	Occurrence surrounded by at least 2000 acres of natural vegetation. None to a few small roads in the surrounding landscape.	Landscape composed of at least 90% natural or semi-natural vegetation; or landscape has very little development or agriculture but has major components of non-native vegetation in at least one physiognomic layer or is composed primarily of young tree plantations.	Landscape is a mosaic of agricultural or semi-developed areas and natural or semi-natural vegetation, the latter composing 25-90% of the landscape, or landscape is dominated by very young tree plantations (cut within last 20 years).	Occurrence surrounded primarily by urban or agricultural landscape, with <25% landscape cover of natural or semi-natural vegetation.

Western Great Plains Cliff, Outcrop, and Shale Barrens

G. Kittel



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ARENARIA HOOKERI BARRENS HERBACEOUS ALLIANCE
- *Arenaria hookeri* Barrens Herbaceous Vegetation

FRANKENIA JAMESII DWARF-SHRUBLAND (PROPOSED)
- *Frankenia jamesii / Achnatherum hymenoides* [undescribed]
- *Glossopetalon spinescens* var. *meionandrum - Frankenia jamesii* [undescribed]

JUNIPERUS MONOSPERMA WOODLAND ALLIANCE
- *Juniperus monosperma / Bouteloua curtipendula* Woodland
- *Juniperus monosperma / Bouteloua eriopoda* Woodland
- *Juniperus monosperma / Bouteloua gracilis* Woodland
- *Juniperus monosperma / Cercocarpus montanus - Ribes cereum* Woodland
- *Juniperus monosperma / Hesperostipa neomexicana* Woodland

OPEN CLIFF SPARSELY VEGETATED ALLIANCE
- Limestone Butte Sparse Vegetation
- Sandstone Butte Sparse Vegetation
- Sandstone Dry Cliff Sparse Vegetation
- Sandstone Great Plains Dry Cliff Sparse Vegetation
- Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

PRUNUS VIRGINIANA SHRUBLAND ALLIANCE

RHUS TRILOBATA SHRUB HERBACEOUS ALLIANCE
- *Rhus trilobata* Rocky Mountain Shrub Herbaceous Vegetation

ROCK OUTCROP SPARSELY VEGETATED ALLIANCE
- Shale Barren Slopes Sparse Vegetation
- Siltstone - Sandstone Rock Outcrop Sparse Vegetation

Overview: The Western Great Plains landscape is generally characterized by relatively low topographic relief, but does include numerous scattered outcrops and erosional features that interrupt the relative flatness of the landscape. The action of the South Platte River to the north, and the Arkansas River to the South have removed great volumes of Tertiary (65- to 2-million-year-old) sedimentary rock layers of the Great Plains in Colorado, leaving remnants of higher ground here and there in the Colorado Piedmont. Along the mountain front the layers of older sedimentary rock have been sharply upturned by the rise of the Rocky Mountains. These differentially eroded layers form conspicuous hogback ridges of hard sandstone and limestone. At the northern edge of Colorado, a scarp cut in the rocks of the High Plains forms the Chalk Bluffs. The Pawnee Buttes are two of the more conspicuous outliers of High Plains rocks near the scarp, as is Scotts Bluff in Nebraska. To the south, the Arkansas River has excavated much of the Tertiary piedmont deposits and exposed Cretaceous marine rocks from Canon City to the Kansas border (Trimble 1980). Mountain-front hogbacks are found here as well. Near the Palmer divide north of Colorado Springs, outcrops are formed by caprock of resistant Oligocene Castle Rock Conglomerate on mesas and buttes. These and other outcrops of the Great Plains are exceptional in having escaped the nearly continuous mantle of windblown sand and silt that softens much of the rest of the Colorado Piedmont (Trimble 1980). This system includes cliffs and outcrops throughout the Western Great Plains. Substrates range from sandstone to limestone. Vegetation is restricted to shelves, cracks and crevices in the rock.

Characteristic species: Cliffs and outcrops support a variety of plant communities, depending on the steepness, exposure, and soil conditions of the site. The tops of the escarpment are often dominated by the adjacent shortgrass or mixedgrass prairie communities. Vegetation of the cliffs and outcrops is typically sparse, and often restricted to shelves, cracks and crevices in the rock, or other areas where soil accumulation allows growth. The lack of vegetation on many sites protects them from fire, and in a few instances the rocky cliffs support disjunct populations of foothills species such as *Pinus ponderosa, Juniperus scopulorum, Pinus flexilis*, and *Cercocarpus montanus*. Sheltered areas on the bluff slopes typically support sparse shrub cover of *Rhus trilobata, Prunus virginiana, Ribes* spp., *Artemisia filifolia, Gutierrezia sarothrae, Opuntia polyacantha*, and *Yucca glauca*, along with prairie grasses such as *Bouteloua gracilis, Aristida longiseta, Hesperostipa comata, Bouteloua curtipendula, Calamovilfa longifolia* and *Vulpia octoflora*. Claystone and limestone layers within the sandstone form gravelly barrens that support a characteristic "cushion plant" community that typically includes *Arenaria hookeri, Oenothera caespitosa, Phlox hoodii, Tetraneuris acaulis, Astragalus sericoleucus*, and other species typical of the nearby grasslands. These barrens are also home to the regionally rare plants *Lomatium (Aletes) nuttallii, Cryptantha cana* and *Parthenium (Bolophyta) alpinum*.

Vegetation of the shale barrens is characterized by a "cushion plant" community, with cover less than 25%, and often much lower. Some occurrences may support a sparse overstory of *Juniperus monosperma.* Typical shrub species are *Frankenia jamesii, Glossopetalon spinescens* var. *meionandrum, Atriplex canescens*, and *Artemisia bigelovii.* Perennial low-growing forbs and sub-shrubs include *Tetraneuris acaulis, Eriogonum* spp., *Oxybaphus rotundifolius, Lesquerella fendleri, Chamaesyce glyptosperma, Townsendia hookeri, Melampodium leucanthum, Zinnia grandiflora, Crypthantha* spp., and *Oönopsis foliosa*. Occurrences may include low cover of bunchgrasses such as *Hesperostipa neomexicana, Achnatherum hymenoides, Aristida purpurea*, and *Bouteloua* spp.. As this community grades into adjacent communities in more sheltered areas below ridgetops, cover and plant height increases.

Environment: In northeastern Colorado this ecological system includes rimrock and erosional remnants of the High Plains escarpment stretching for many miles north of the South Platte River, as well as other isolated buttes and outcrops to the south. Topography ranges from steep rocky bluffs below the escarpments and buttes with intervening swales or gullies to smaller breaks and barrens with gentle slopes. The Ogallala, Arikaree, and White River Formations are the most common cliff and outcrop forming substrates, consisting primarily of sandstones of varying hardness, and often interspersed with limestone, ashy claystone, or volcanic tuff. Shale barrens of the Niobrara and Pierre Formations are also found near the mountain front, where they are associated with conspicuous hogbacks along foothills of the Colorado Front Range. Aspects are often north and east facing, but the system can occur on other exposures.

In southeastern Colorado, occurrences of this system are most often found Cretaceous bedrock of the Middle and Upper Chalk members of the Smoky Hills Member of the Niobrara Formation. The area between Pueblo and Cañon City contains the highest frequency of such shale barrens in southeastern Colorado (Kelso 1999). Slope angles range from flat on summits to moderately steep on side slopes, and exposures are variable, depending on how uplift, regional erosion, or downcutting has occurred (Kelso 1999). Sites feature highly weathered bedrock on the surface, consisting of small flat pieces less than four centimeters long that form a thin surface layer with shallow mineral soil underneath (Kelso et al. 2003). Soils belong to the Penrose series and are typically shallow and fine-grained, with about 60 percent of the particles composed of silts and clays. Soil pH tends to be alkaline with a range from 7.4 to 8.3 (Kelso et al. 2003). Summit flats have shallower soils than slopes, with slope bottoms generally deeper than slope tops (Kelso 1999).

Barrens are generally found on shales, soft limestone (chalk), or shale-derived soils, and are characterized by a high percentage of open, rocky ground between the low-growing shrubs and herbaceous cover. Some occurrences have an overstory of sparse juniper, and may include scattered larger shrubs and bunchgrasses. Shale substrates often form a rocky “pavement” between plants. In the Central Shortgrass Prairie ecoregion, this system may provide suitable habitats for northward range extension of species that are more typical further south (Kelso 1999).

Dynamics: Cliffs, outcrops, and barrens often serve as refugia for endemic species adapted to the particular environmental conditions of the site. Although fire can be an important element that slows or eliminates tree establishment in many of these habitats, the shallow soils over bedrock, and extremes of climate or microclimate, are important factors as well (Anderson, Fralish, and Baskin 1999). For rock outcrop communities with extensive exposed bedrock, fire is typically not an important factor. Differences in microhabitat between rock outcrop sites and the surrounding habitats with deeper soils produce distinctive vegetation of these sites.

Little is known about the system-level effects of disturbance, natural or anthropogenic, in many of these occurrences. Kelso et al. (2003) found no significant effect of disturbance by cattle grazing, camping, road proximity, motorcycle racing, or tracked vehicle maneuvers on the presence of *Mirabilis rotundifolius* in southeastern Colorado. Some barrens species are not well adapted to disturbance, so moderate disturbance produces distinctive plant communities dominated by species that tolerate these activities (Kelso et al. 1999, 2003). Natural disturbance by wind and water erosion may have similar effects, leading to the differentiation of plant communities according to microsite characteristics.

Variation: Substrates are variable from north to south, and can include sandstone, limestone, clay, siltstone, and shale. Vegetation patterns are also variable across the range of the system, and species composition changes with changing latitude.


R. Rondeau

Anderson, R.C., J.S. Fralish, and J.M. Baskin. 1999. Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge University Press, Cambridge, UK.

Kelso, S. 1999. A Comparative Study of the Shale Barrens Flora on the Niobrara Formation in Southeastern Colorado. Report to the Colorado Natural Areas Program.

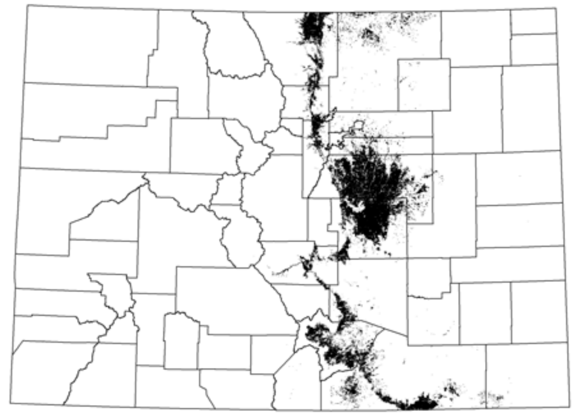
Kelso, S., N.W. Bower, K.E. Heckmann, P.M. Beardsley, and D.G. Greve. 2003. Geobotany of the Niobrara chalk barrens in Colorado: a study of edaphic endemism. Western North American Naturalist 63(3). pp. 299-313.

Trimble, D.E. 1980. The geologic story of the Great Plains. Geological Survey Bulletin 1493, United States Government Printing Office, Washington

Rank:	A	B	C	D
① Condition				
Community structure	Native plants dominate the occurrence.		Altered species composition is usually noticeable.	
Non-native spp.	<1% relative cover.	<3% relative cover.	Usually present but not dominant except in small patches.	
Disturbance	Fragmentation from roads or human development is non-existent or occurs on the edge of the occurrence.	Fragmentation from roads or human development, if present, is limited to a small area that occupies less than 0.5% of the occurrence.	Fragmentation from roads or human development (e.g., oil and gas) are frequent enough to cause an increase in non-native plants, soil compaction, and soil erosion.	Human induced disturbance to the barrens is greater than 30% of occurrence.
Natural processes	Natural disturbances such as erosion are occuring on a natural time frame, and are not accelerated by anthropogenic activities.			
② Landscape Context				
Surrounding land	The occurrence captures the characteristic ecological gradients (including nested patch communities, e.g. washes, saltbush scrub flats) and geomorphic processes, and the occurrence is completely surrounded by other high quality communities. Little altered by agriculture or development (>90% natural).	The occurrence captures the characteristic ecological gradients and geomorphic processes, and is surrounded by other natural communities of at least moderate quality, such as areas that may have been used extensively for grazing or military training currently or in the past. Somewhat altered by agriculture or development (70-90% natural).	Surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation. Adjacent systems surrounding occurrence are fragmented by alteration (20-70% natural).	The area around the occurrence is entirely, or almost entirely, converted to agricultural or urban land use; occurrence is at best buffered on one side by natural communities. The surrounding landscape is primarily intensive agriculture or urban development.
Connectivity	Highly connected to surrounding landscape; retains species interactions and natural processes occurring across communities.	Moderately connected.	Moderately fragmented and isolated, with limited connectivity to other characteristic natural communities.	Highly fragmented and isolated.
③ Size				
Acres	>500	100-500	10-100	< 10

WESTERN GREAT PLAINS FOOTHILL AND PIEDMONT GRASSLAND

G. Dolye



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ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE
- *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation
- *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Herbaceous Vegetation
- *Andropogon gerardii - Sporobolus heterolepis* Western Foothills Herbaceous Vegetation

BOUTELOUA GRACILIS HERBACEOUS ALLIANCE
- *Bouteloua gracilis - Bouteloua curtipendula* Herbaceous Vegetation
- *Bouteloua gracilis - Bouteloua hirsuta* Herbaceous Vegetation
- *Bouteloua gracilis - Buchloe dactyloides* Herbaceous Vegetation
- *Bouteloua gracilis* Herbaceous Vegetation

HESPEROSTIPA COMATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE
- *Hesperostipa comata* Colorado Front Range Herbaceous Vegetation

HESPEROSTIPA COMATA BUNCH HERBACEOUS ALLIANCE
- *Hesperostipa comata - Achnatherum hymenoides* Herbaceous Vegetation

HESPEROSTIPA NEOMEXICANA HERBACEOUS ALLIANCE
- *Hesperostipa neomexicana* Herbaceous Vegetation

NASSELLA VIRIDULA HERBACEOUS ALLIANCE
- *Nassella viridula* Herbaceous Vegetation

PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE
- *Pseudoroegneria spicata - Poa secunda* Herbaceous Vegetation
- *Pseudoroegneria spicata* Herbaceous Vegetation

SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE
- *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Herbaceous Vegetation

Overview: Foothill and Piedmont Grasslands are found at the extreme western edge of the Great Plains, where increasing elevation and precipitation facilitate the development of mixed to tallgrass associations on certain soils. This large patch system typically occurs between 5,250 and 7,200 feet (1,600-2,200 m) in elevation. It is best characterized as a mixed-grass to tallgrass prairie on mostly moderate to gentle slopes, usually at the base of foothill slopes such as the hogbacks of the Rocky Mountain Front Range, where it typically occurs as a relatively narrow elevational band between montane woodlands and shrublands and the shortgrass steppe. The system also extends east on the Front Range piedmont alongside the Chalk Bluffs at the Colorado-Wyoming border, out into the Great Plains on the Palmer Divide, and on piedmont slopes below mesas and foothills in southeastern Colorado and northeastern New Mexico.

Characteristic species: Usually occurrences of this system have multiple plant associations that may be dominated by *Andropogon gerardii, Schizachyrium scoparium, Muhlenbergia montana, Nassella viridula, Pascopyrum smithii, Sporobolus cryptandrus, Bouteloua gracilis, Hesperostipa comata*, or *Hesperostipa neomexicana*. In Wyoming, typical grasses found in this system include *Pseudoroegneria spicata, Festuca idahoensis, Hesperostipa comata*, and species of *Poa*. Typical adjacent ecological systems include foothill shrublands, ponderosa pine savannas, juniper savannas, as well as shortgrass prairie.

Viable populations of Ottoe skipper (*Hesperia ottoe*), Cross-line skipper (*Polites origenes rhena*), Arogos skipper (*Atrytone arogos iowa*), Dusted skipper (*Atrytonopsis hianna turneri*), and Regal fritillary (*Speyeria idalia*) are indicators of a healthy and functioning foothills grasslands system.

Environment: Foothills and Piedmont grasslands are typically found on the comparatively narrow band of hill and mesa landforms dissected by small stream beds at the mountain front, but may extend or occur disjunctly to the east where topography, soils, and precipitation patterns are similar. Soils are typically well-drained alluvial material, often cobbly. In areas where mesa landforms occur, seeps on slopes below the caprock may support more mesic associations. Branson et al. (1961) found xeric tallgrass associations on stony soils of the Rocky Flats alluvium where infiltration rates were significantly higher than for the adjacent mixedgrass system on shale-derived soils. Soil moisture percentages were significantly higher in the stony soil throughout the growing season.

Dynamics: This system is one of the most severely altered systems in the Southern Rocky Mountains ecoregion. Alteration is due to fire suppression, housing and water developments, conversion to hay meadows, overgrazing, etc. Fire suppression has allowed shrub and tree invasion into the grassland and alters the species composition as well (Mast et al. 1997, Mast et al. 1998). Housing and water developments severely fragment and usually destroy the habitat, while agricultural use has converted tall grass prairies into hay meadows dominated by exotic grasses, e.g., smooth brome (*Bromus inermis*). It is very unusual to find excellent occurrences of this system. Threats are very high for this system and therefore, a premium is set on protecting the existing occurrences.

R. Rondeau

Variation: The tallgrass of the foothills and piedmont is disjunct from the Great Plains tallgrass prairie with large expanses of mid-grass and shortgrass prairies in between.

Branson, F.A., R.F. Miller, and I.S. McQueen. 1961. Soil-water availability and use by grasslands on adjacent stony and shale-derived soils in Colorado. Short Papers in the Geologic and Hydrologic Sciences, Articles 147-292. Geological Survey Professional Paper 424-C. U.S. Geologic Survey

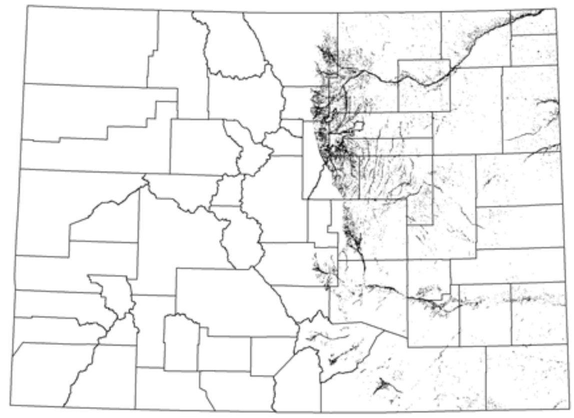
Mast, J. N., T. T. Veblem, and M. E. Hodgson. 1997. Tree invasion within a pine/grassland ecotone: an approach with historic aerial photography and GIS modeling. Forest Ecology and Management 93:181-94.

Mast, J. N., T. T. Veblen, and Y. B. Linhart. 1998. Disturbance and climatic influences on age structure of ponderosa pine at the pine/grassland ecotone, Colorado Front Range. Journal of Biogeography 25:743-755.

Rank:	A	B	C	D
① Condition				
Community structure	If trees are present, these are widely scattered and mature. Species richness is often high, and native bunch grasses or sedges (non-increasers) are dominant.	If trees are present, these are widely scattered and mature. Species richness is often high, and native grasses (non-increasers) are dominant.	Trees and shrubs may have seedlings, juveniles, or saplings present. Alteration is extensive but potentially restorable over several decades.	Native grassland species < 10% cover and 20% relative cover. Alteration of vegetation is extensive and restoration potential is low.
Invasive exotics with major potential to alter structure and composition (e.g., non-native thistle, *Euphorbia esula, Bromus tectorum*)	Absent.	May be present, but in low abundance.	May be prominent but still controllable.	
Other non-native spp.	<5% cover, native species dominant.	<10% cover, native species dominant.	>10% cover.	Dominant.
Native increaser spp. (e.g. *Koelaria micrantha, Guitierizzia sarothrae, and Artemisia frigida*)	< 3% cover.	<10% cover.	Dominant to co-dominant with native species.	
Disturbance	Fragmentation from roads and developments are less than 1% of the occurrence.	Fragmentation from roads and developments are less than 5% of the occurrence.	Fragmentation, vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction.	Vehicle use or livestock grazing disturbance, if present, is extensive and significant enough to have notable impact on species composition and soil compaction. System remains fundamentally compromised despite restoration of some processes. Soil compaction and disturbance are extensive throughout the occurrence.
② Landscape Context				
Connectivity	Connectivity of adjacent systems allows natural ecological processes, e.g., fire and species migrations to occur. No unnatural barriers present.	Adjacent systems surrounding occurrence retain much connectivity. Few non-natural barriers present.	Adjacent systems surrounding occurrence are fragmented by alteration with limited connectivity.	Connectivity is severely hampered.
Surrounding land	At least 90% native and unaltered landscape with very little to no urban development or agriculture.	Surrounding landscape composed of at least 75% natural or semi-natural vegetation, with little urban development within or adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with >50% natural or semi-natural vegetation. Some non-natural barriers are present. Significant disturbance, but easily restorable.	Major human-caused alteration of surrounding landscape. Adjacent systems surrounding occurrence are mostly converted to agricultural or urban uses.
③ Size				
Acres	>10,000 Large enough to support A-ranked occurrenes of disjunct butterflies and skippers, grassland birds as well as a mosaic of plant associations.	5,000-10,000	1,000-5,000	< 1,000

Western Great Plains Riparian Woodland and Shrubland

S. Kettler



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ARTEMISIA CANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE
- *Artemisia cana / Pascopyrum smithii* Shrubland

POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE
- *Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior)* Woodland
- *Populus deltoides - (Salix nigra) / Spartina pectinata - Carex* spp. Woodland
- *Populus deltoides / Carex pellita* Woodland
- *Populus deltoides / Muhlenbergia asperifolia* Forest
- *Populus deltoides / Panicum virgatum - Schizachyrium scoparium* Woodland
- *Populus deltoides / Sporobolus airoides* Woodland
- *Populus deltoides / Sporobolus cryptandrus* Woodland
- *Populus deltoides / Symphoricarpos occidentalis* Woodland

SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE
- *Symphoricarpos occidentalis* Shrubland

SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE
- *Salix exigua* / Mesic Graminoids Shrubland
- *Salix exigua* / Barren Shrubland

ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE
- *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Herbaceous Vegetation

CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE
- *Carex nebrascensis* Herbaceous Vegetation

CAREX PELLITA SEASONALLY FLOODED HERBACEOUS ALLIANCE
- *Carex pellita* Herbaceous Vegetation

ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE
- *Eleocharis palustris* Herbaceous Vegetation

MUHLENBERGIA ASPERIFOLIA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE
- *Muhlenbergia asperifolia* Herbaceous Vegetation

SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
- *Scirpus acutus - Scirpus tabernaemontani* Herbaceous Vegetation

SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
- *Schoenoplectus pungens* Herbaceous Vegetation

SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE
- *Spartina pectinata* Western Herbaceous Vegetation

SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE
- *Sporobolus airoides* Southern Plains Herbaceous Vegetation

TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE
- *Typha (latifolia, angustifolia)* Western Herbaceous Vegetation

Overview: This system is found in the riparian areas of medium and small rivers and streams throughout the Western Great Plains. In Colorado it is found throughout the eastern plains. Streams of the Western Great Plains include both major rivers and perennial to intermittent or ephemeral streams that flow only during part of the year (Matthews 1988). The floodplain communities of the larger perennial rivers such as the Platte and Arkansas, which receive significant snowmelt runoff from the adjacent Rocky Mountains, are included in the Western Great Plains Floodplain ecological system. The vast majority of streams included in the Western Great Plains Riparian and Woodland ecological system have their headwaters on the plains, and are driven primarily by local precipitation and groundwater inflow. While most prairie streams follow this pattern, at the western edge of the Great Plains, the lower reaches of streams that originate in the mountains may extend for some distance out onto the plains, where they share characteristics with the prairie streams. In most years, the peak flow for these streams is associated with the spring runoff, but in some years flash flooding from thunderstorms provides the highest flow (Friedman et al. 1996). Dominant vegetation overlaps broadly with portions of large river floodplain systems, but the overall abundance of vegetation is generally lower. Vegetation may be a mosaic of communities that are not always tree or shrub dominated. Communities within this system range from riparian forests and shrublands to tallgrass wet meadows and gravel/sand flats.

Characteristic species: Occurrences of this system may include riparian forests or woodlands, as well as shrublands, tallgrass or mixedgrass wet meadows, herbaceous wetlands, and gravel/sand flats. Vegetation may be a mosaic of communities that are not always tree or shrub dominated. Stream-side vegetation in this region is primarily deciduous, even in the foothills of the Rocky Mountains.

Dominant species include *Populus deltoides*, *Salix* spp., *Artemisia cana* ssp. *cana*, *Pascopyrum smithii*, *Sporobolus cryptandrus*, *Schizachyrium scoparium*, *Andropogon gerardii*, and *Sorghastrum nutans*. Plant associations of the North American Arid West Emergent Marsh ecological system may occurr along or adjacent to portions of this system. Native prairie fishes and amphibians (e.g., leopard frogs) are indicators of a healthy riparian shrubland and woodland system.

Environment: This system is composed of associations found on alluvial soils in highly variable landscape settings, from deep cut ravines to wide, braided streambeds. Hydrologically, the associated rivers tend to be more flashy with less developed floodplain than on larger rivers, and typically dry down completely for some portion of the year.

Dynamics: Fluvial processes such as channel narrowing, meandering, and flood deposition play a key role in the dynamics of Western Great Plains streams (Friedman et al. 1996, Scott et al. 1996). Various combinations of these three factors may be acting at any particular site, depending on geologic and climate factors, including flow variability, sediment load, and gradient. Channel narrowing results when the stream abandons a portion of the former channel bed or when flow ceases in a channel. Narrowing happens when a period low flow prevents the reworking of the entire channel bed, and allows vegetation to establish. Newly established vegetation reduces erosion and promotes the deposition of fine sediment. On meandering streams, cutbanks on the outside bends gradually erode and the sediments are deposited downstream as point bars on the insides of bends. Vegetation is able to establish on these newly created moist surfaces. Flood deposition can produce bare, moist surfaces for tree establishment that are above the normal channel bed, and protected from normal flow-related disturbance.

Streamflows are highly variable in Western Great Plains streams. It is not known how much flows have changed since settlement, but a certain amount of intra- and inter-annual variation appears to be normal (Matthews 1988). Nearly all prairie steams are susceptible to lack of water during some years if not annually. Although most streams receive groundwater inflow, recharge to groundwater is low due to limited precipitation, and water loss to evapotranspiration can be significant. The minimal to moderate groundwater inflow and the large loss of both groundwater and surface water to evapotranspiration resulted in many high plains streams having little to no flow under pre-settlement, natural conditions, except during spring floods (Covich et al. 1997). Since settlement, trees are no longer suppressed by fires, variation in water flow is regulated by dams and diversions, agricultural activities have increased siltation rates and introduced both non-native species and chemical changes, and native grazers have been largely replaced by domestic cattle.

Additional factors affecting the dynamics of this system include drought, grazing, and fire. Riparian vegetation is affected by climatic drought that reduces soil moisture in the unsaturated zone and decreases streamflows, which reduces recharge and lowers the alluvial water table (Friedman et al. 1997). The elimination of beavers from most of the plains watersheds probably decreased water storage and increased variability in plains streams, although some of these changes were later reversed by dam construction (Friedman et al. 1997). The replacement of native grazers, especially bison, with fenced cattle has changed the regeneration patterns of cottonwood, as has the reduction in fire frequency since settlement.

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Friedman, J.M., W.R. Osterkamp, and W.M. Lewis, Jr. 1996. Channel narrowing and vegetation development following a Great Plains flood. Ecology 77(7):2167-2181.

Friedman, J.M., M.L. Scott, and G.T. Auble. 1997. Water management and cottonwood forest dynamics along prairie streams. Pages 49–71 in F. L. Knopf and F. B. Samson, editors. Ecology and conservation of Great Plains vertebrates. Springer-Verlag, New York, New York, USA.

Matthews, W.J. 1988. North American Prairie Streams as Systems for Ecological Study. *Journal of the North American Benthological Society* 7(4):387-409.

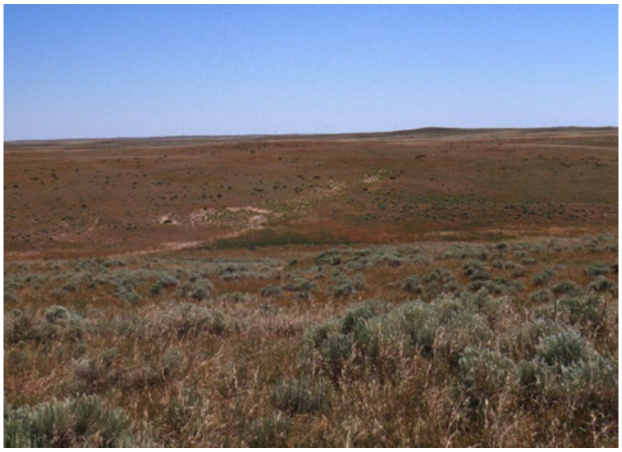
Scott, M.L. J.M. Friedman, and G.T. Auble. 1996. Fluvial processes and the establishment of bottomland trees. Geomorphology 14:327-339.

G. Kittel

Rank:	A	B	C	D
① CONDITION				
Natural hydrologic regime	Intact, including an unaltered floodplain. No or little evidence of alteration due to drainage, flood control, irrigation canals, livestock grazing, digging, burming, vehicle use, etc.	intact or slightly altered by local drainage, flood control, irrigation canals, livestock grazing, digging, vehicle use, roads, etc. Alteration is easily restorable by ceasing such activities.	Natural hydrologic regime altered by upstream dams, local drainage, diking, filling, digging, or dredging. Alteration is extensive but potentially restorable over several decades.	Not restorable. System remains fundamentally compromised despite restoration of some processes.
Community Structure	Community is composed primarily of native species and has a diverse physiognomic structure.	Although species composition is primarily of native species, the physiognomic structure is less diverse than in A-ranked occurrences.	Noticably altered by disturbance.	
Non-native species (e.g., *Tamarix ramosissima, Elaeagnus angustifolia*)	If non-native species are present they are less than 3% canopy cover;	There are few exotic species, and low potential for their	May be widespread but potentially manageable with restoration of most	May be dominant over significant portions of area, with little potential

	and have little potential for expansion.	expansion if restoration occurs.	natural processes.	for control.
Disturbance excessive grazing or other human caused actions e.g, channeling, road construction, vehicle use, etc.	Stream banks are not overly steepened and have not been stripped of vegetation.	Stream banks may show some local deleterious effects.	Stream banks may be severely altered. Disturbance is extensive and significant enough to have notable impact on species composition and soil compaction, causing excessive erosion.	
② LANDSCAPE CONTEXT				
Area hydrology	No evidence of human-caused alteration of hydrology, especially upstream of occurrence and within the watershed. Groundwater pumping is not pervasive in the area, or has not had a detectable impact on hydrologic patterns. Water quality is excellent and supports expected aquatic invertebrates.	Little evidence of human-caused alteration of hydrology, especially upstream of occurrence and within the watershed. Groundwater pumping may be contributing to changes in water availability.	Local or moderate human-caused alteration of hydrology may be present, for example small dams, irrigation ditches, and gravel mines. Groundwater pumping has produced noticable changes from historic hydrologic patterns.	Major human-caused alteration of hydrology. Large dams and numerous diversions are within watershed. Gravel mining may be extensive.
Surrounding land	Uplands surrounding occurrence and within the watershed are largely unaltered by urban or agricultural uses (>90% natural), and distance to nearest cropped, mowed, or developed land is greater than 1 mile.	Uplands surrounding occurrence and within the watershed are largely unaltered by urban or agricultural uses (60 to 90% natural), and retain much connectivity, or uplands are not intensively cropped with center-pivot irrigation, dryland farming, or numerous roads.	Uplands surrounding occurrence or upstream watershed are fragmented by urban or agricultural alteration (20 to 60% natural).	Uplands surrounding occurrence mostly converted to agricultural or urban uses. Riparian occurrence may be reduced to narrow strip with much edge effect.
Connectivity & natural processes	Connectivity to habitats allows natural processes and species migration to occur. No unnatural barriers present.		Limited connectivity. Some barriers are present, and natural processes few.	Connectivity and natural processes are nonexistent.
③ SIZE				
Linear miles	>1.5	1-1.5	0.5-1	< 0.5

WESTERN GREAT PLAINS SANDHILL SHRUBLAND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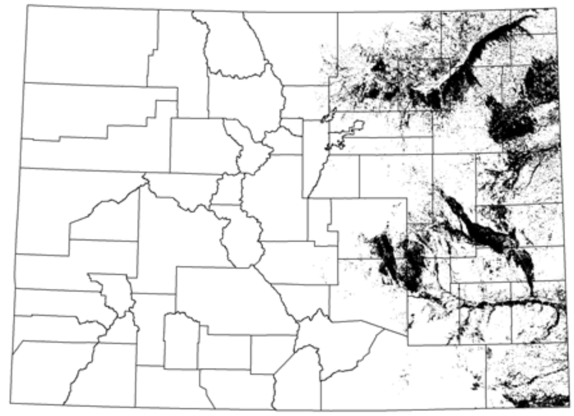
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ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE
Artemisia filifolia / Andropogon hallii Shrubland
Artemisia filifolia / Bouteloua (curtipendula, gracilis) Shrubland
Artemisia filifolia / Calamovilfa longifolia Shrubland
Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii Shrubland
Artemisia filifolia / Sporobolus cryptandrus Shrubland
PRUNUS ANGUSTIFOLIA SHRUBLAND ALLIANCE
Prunus angustifolia / Schizachyrium scoparium Shrubland
QUERCUS HAVARDII SHRUBLAND ALLIANCE
Quercus havardii / Sporobolus cryptandrus - Schizachyrium scoparium Shrubland

Overview: The sandsage prairie ecological system is found primarily in the south-central areas of the Western Great Plains Division. Occurrences range from the Nebraska Sandhill region south to central Texas, although some examples may reach as far north as the Badlands of South Dakota. The greater part of the system occurs in the Central Shortgrass Prairie Ecoregion in eastern Colorado, western Kansas and southwestern Nebraska. The climate is semi-arid to arid for much of the region in which this system occurs. This system is found on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains. In some areas, this system may actually occur as a result of overgrazing in Western Great Plains Tallgrass Prairie or Western Great Plains Sand Prairie. Throughout its range it is closely tied to sandy soils, and this edaphic restriction is characteristic of large patch systems. In addition, this system is likely to intergrade closely with shortgrass prairie, perhaps forming a locally patchy sandsage/shortgrass matrix, and therefore it may be difficult to delimit as a distinct ecological system in places.

Characteristic species: Throughout its range, this system is characterized by a sparse to moderately dense woody layer dominated by *Artemisia filifolia*. These shrubs usually do not grow as clumps but as individuals, and the intervening ground is most often dominated by a sparse to moderately dense layer of tall, mid- or short grasses. Associated species can vary with geography, precipitation, disturbance and soil texture. Graminoid species such as *Andropogon hallii*, *Sporobolus cryptandrus*, *Calamovilfa longifolia, Calamovilfa gigantea, Hesperostipa comata*, and *Bouteloua* spp. are often associated with this system. Other shrub species may also be present including *Yucca glauca, Prosopis glandulosa, Rhus trilobata*, and *Prunus angustifolia*. A few species such as the shrubs *Prunus pumilla* var. *besseyi* and *Amorpha canescens* and the grasses *Panicum virgatum* and *Sorghastrum nutans* are believed to have been formerly more common, but now much decreased, most likely by cattle grazing throughout the growing season (pers. comm. Harvey Sprock and Ben Berlinger, Colorado NRCS).

Greater and lesser prairie-chickens, Cassin's sparrows, and ornate box turtles are indicators of a healthy sandsage prairie system.

Environment: In eastern Colorado, this system is found in extensive tracts on Quaternary eolian deposits along the South Platte, Arikaree and Republican Rivers, between Big Sandy and Rush Creeks, and along the Arkansas and Cimarron Rivers, where it is contiguous with areas in Kansas (Comer et al. 2003).

Dynamics: Fire and grazing are the most important dynamic processes for this type, although drought stress can impact this system significantly in some areas (Ramaley 1939). Excessive grazing can lead to decreasing dominance of some of the grass species such as *Andropogon hallii*, *Calamovilfa gigantea*, *Calamovilfa longifolia* and *Schizachyrium scoparium*.


R. Rondeau

Variation: Colorado's eastern plains exhibit climatic differences from north to south which may be reflected in the local expression of sandsage prairie. Occurrences in southern Colorado experience a longer growing season, lower annual precipitation, and differences in precipitation patterns (Western Regional Climate Center 2004), and may be dominated by different species than northern stands. In the southern range of this system, *Quercus havardii* may also be present and represents one succession pathway that develops over time following a disturbance. *Quercus havardii* is able to resprout following a fire and thus may persist for long periods of time once established (Wright and Bailey 1982).

Comer, P., S. Menard, M. Tuffly, K. Kindscher, R. Rondeau, G. Jones, G. Steinuaer, and D. Ode. 2003. Upland and Wetland Ecological Systems in Colorado, Wyoming, South Dakota, Nebraska, and Kansas. Report and map (10 hectare minimum map unit) to the National Gap Analysis Program. Dept. of Interior USGS. NatureServe.

Ramaley, F. 1939. Sand-hill vegetation of northeastern Colorado. Ecological Monographs 9(1):1-51.

Western Regional Climate Center. 2004. Climate of Colorado narrative and state climate data. Available online at http://www.wrcc.dri.edu

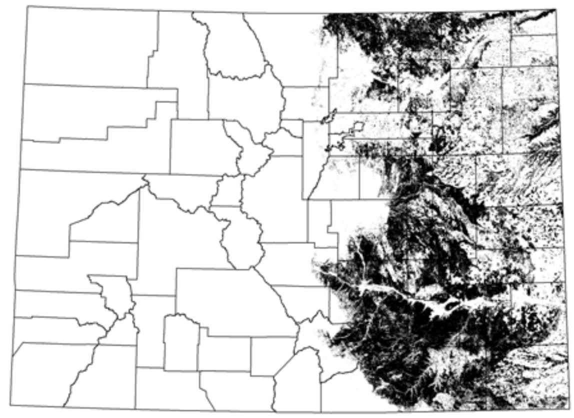
Wright, H.A. and A.W. Bailey. 1982. *Fire ecology: United States and southern Canada.* John Wiley and Sons. NY. 501 p.

Rank:	A	B	C	D
① SIZE				
Acres Size specifications are based on the potential for an occurrence to support Greater or Lesser Prairie Chicken populations.	>100,000	30,000-100,000	14,000-30,000	< 14,000
② CONDITION				
Community structure	A variety of seral stages are represented which could provide habitat for all phases of the lesser or greater prairie-chicken life cycle. The vegetation exhibits a diversity of native short to tall	Heterogenity of seral stages is present throughout the majority of the occurrence or easily re-established through management practices. Native tallgrass species are common.	Much of the occurrence is dominated by a single seral stage, and may be lacking in vegetative species diversity. Native tallgrass species are lacking or present in minor amounts only on	Vegetation on the occurrence has little or no structural diversity and is likely to have low native species diversity. Cover required for nesting and/or breeding of grassland birds is not

	grasses and native forbs interspersed with sparse to somewhat dense low-growing shrubby cover which includes sufficient cover for nesting and broodrearing, as well as open areas suitable for leks.		the most productive or protected sites.	sufficient, or there are no open sites suitable for leks.
Non-native/Invasive spp.	Absent or minimal.	May be present but are contollable.	May be having an impact on the stability of the system, but could be controlled with a sustained effort.	Present and widespread.
Disturbance (e.g. historically tilled areas, roads, oil and gas wells, windmills, stock ponds, etc.)	Alteration from presettlement conditions is minimal or non-existent.	Alteration from presettlement conditions is present but in less than 5% of the habitat.	Alteration from presettlement conditions is present but in less than 10% of the habitat.	More than 10% of the area impacted by anthropogenic alterations.
Internal fragmentation	Internal fencing divisions are at least four square miles in extent. The area retains sufficient internal connectivity to allow natural processes (fire, drought stress) to operate to maintain heterogeneous structure.	Internal fencing divisions average at least one square mile in extent. Fragmentation is minimal, or can be easily mitigated.	Internal fencing divisions are less than one square mile in extent. Internal fragmentation and alteration from natural conditions is present in more than 5% of the occurrence.	The occurrence has a high level of internal fragmentation.
③ Landscape Context				
Surrounding land	Occurrence is surrounded by a native and unaltered landscape with very little to no urban development or cultivated agriculture (>90% natural).	Landscape is composed of at least 70-90% natural or semi-natural vegetation, with little urban development directly adjacent to the occurrence.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with natural or semi-natural vegetation. Adjacent systems surrounding occurrence are fragmented by alteration (20-70% natural).	Major human-caused alteration of surrounding landscape.
Landscape fragmentation	Fencing divisions are at least four square miles in extent. There is little or no fragmentation by cropland, development, trees, or roads.	Fencing divisions average at least one square mile in extent. Fragmentation is minimal, or can be easily mitigated.	Internal fragmentation and alteration from natural conditions is present in more than 5% of the occurrence. Internal fencing divisions are less than one square mile in extent.	Landscape has a high level of internal fragmentation.
Area landuse patterns	Generally stable from year to year, changing at a rate of less than 2% per decade.		May be changing from year to year, at a rate greater than 2% per decade.	
Connectivity	Connectivity of adjacent systems (including other matrix and large patch systems) allows natural ecological processes (e.g. fire) to occur, facilitates migration, and results in greater than 300,000 acres of native prairie.	Connectivity of adjacent systems should result in 150,000 - 300,000 acres of native prairie.	Connectivity of adjacent systems should result in 50,000 - 150,000 acres of native prairie.	Connectivity is severely hampered.

WESTERN GREAT PLAINS SHORTGRASS PRAIRIE

R. Rondeau



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(COMPLEX)
    Blacktailed Prairie Dog Town Grassland Complex
ARISTIDA PURPUREA HERBACEOUS ALLIANCE
    Aristida purpurea Herbaceous Vegetation
BOUTELOUA ERIOPODA HERBACEOUS ALLIANCE
    Bouteloua eriopoda - Bouteloua hirsuta Herbaceous Vegetation
BOUTELOUA GRACILIS HERBACEOUS ALLIANCE
    Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation
    Bouteloua gracilis - Bouteloua hirsuta Herbaceous Vegetation
    Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation
    Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation
    Bouteloua gracilis Herbaceous Vegetation

Overview: This system is found primarily in the western half of the Western Great Plains, east of the Rocky Mountains and ranges from the Nebraska Panhandle south into Texas and New Mexico, although some examples may reach as far north as southern Canada where it grades into Northwestern Great Plains Mixedgrass Prairie.

Characteristic species: In much of its range, this system forms the matrix system with *Bouteloua* spp. dominating. Other associated graminoids may include *Buchloe dactyloides, Hesperostipa comata, Koeleria macrantha (= Koeleria cristata), Pascopyrum smithii (= Agropyron smithii), Aristida purpurea* and *Sporobolus cryptandrus*. Although tallgrass and mixedgrass species may be present especially on more mesic soils, they are secondary in importance to the sod-forming short grasses. Shrub species such as *Artemisia filifolia, Artemisia tridentata,* and *Chrysothamnus* spp. that dominate the Western Great Plains shrubland systems may also be present.

This system, in combination with the associated wetland systems, represents one of the richest areas in the United States for large mammals. Grassland bird species may constitute one of the fastest declining vertebrate populations in North America. A healthy shortgrass prairie system should support prairie dog complexes, viable populations of pronghorn, endemic grassland birds, and other Great Plains mammals. Historically, such areas would also have been populated by bison in sufficient numbers to support populations of wolves.

Environment: This system occurs primarily on flat to rolling uplands with loamy, ustic soils ranging from sandy to clayey.

Dynamics: Large-scale processes such as climate, fire and grazing influence this system. In contrast to other prairie systems, fire is less important, especially in the western range of this system, because the often dry and xeric climate conditions can decrease the fuel load and thus the relative fire frequency within the system. However, historically, fires that did occur were often very expansive. Currently, fire suppression and certain grazing patterns in the region have likely decreased the fire frequency even more, and it is unlikely that these processes could occur at a natural scale. A large part of the range for this system (especially in the east and near rivers) has been converted to agriculture. Areas of the central and western range have been impacted by the unsuccessful attempts to develop dryland cultivation during the Dust Bowl of the 1930s. The short grasses that dominate this system are extremely drought- and grazing-tolerant. These species evolved with drought and large herbivores and, because of their stature, are relatively resistant to overgrazing.

Variation: This system spans a wide range and thus there can be some differences in the relative dominance of some species from north to south and from east to west.

S. Neid

Rank:	A	B	C	D
① SIZE				
Acres	>500,000	250,000-500,000	50,000-250,000	< 50,000
② CONDITION				
Community structure (for pronghorn and endemic grassland birds)	Includes patchiness on a variety of scales, from bare ground and very short grass that may be heavily grazed to mixed taller grass/shrub patches and ungrazed areas. Vegetation should include a strong forb component (25-35%), high-quality winter browse, and a mixture of native grasses.	Natural vegetative conditions are still sufficient to support Great Plains mammal and bird species.	Natural vegetative conditions are still sufficient to support some Great Plains mammal and bird species, but impacts from human activities are heavy and intense management or long time periods may be needed to restore the area to natural conditions.	The community has been highly altered from natural conditions and even with intense management may never completely recover. Unlikely to ever be able to support a diverse fauna of Great Plains species.
Species composition	Native grasses are dominant. Species richness is often high and includes many native grasses as well as a diverse forb component. Cool season grasses such as western wheatgrass, needle-and-thread, and green needlegrass maintain a healthy presence, and the community has not shifted to a sod-dominated phase.	Species richness is often high, and native grasses are dominant. Cool season grasses such as western wheatgrass, needle-and-thread, and green needlegrass are present, but in remnant amounts. Blue grama and buffalograss may have increased in abundance and are beginning to take on a sod appearance.	Species richness is reduced in comparison with higher ranked occurrences. Native bunchgrasses are present but may be nearly equal in canopy cover to non-native species. Native species that increase with livestock grazing may be co-dominant or dominant. Trees and shrubs may have seedlings, juveniles, or saplings present.	Vegetation on the occurrence has little or no structural diversity and is likely to have low species diversity.
Vegetation condition Evaluation should consider that the Great Plains grasslands are very dynamic in nature and the vegetation can change significantly in a few years of high or low rainfall.	Minor or easily restorable impacts from human use to the vegetation and natural processes which have not permanently altered the vegetation structure and composition. The vegetation has not moved outside of what is thought to have been the natural range of variability.	Vegetation structure or composition may be somewhat altered (e.g. increased shrub component or loss of diversity from heavy grazing or lack of fire) but is still dominated by native species.	Plant density and production may be reduced, and litter may be excessive or not present at all. Dead plants or decadent plants may be common. Reproductive capability of native perennial plants is greatly reduced.	Cover required for nesting and/or breeding of grassland birds is not sufficient. Plant vigor may be poor and dead or decadent plants are common. Reproductive capability of native perennial plants severely reduced.
Exotic species	Non-native species may be common on a very minor part of the land area (such as around stock tanks, wells, or corrals).	Non-native species may be present in low abundance (<3% total canopy cover) throughout and abundant in small parts of the area. Invasive exotics with major potential to alter structure and composition occupy <1%.	Non-native species are present but have < 10% cover. Invasive exotics may be prominent in small and discrete patches.	Non-native species are very common to dominant over much of the landscape and have greatly altered native species composition.
Grassland birds	Populations have successful reproductive rates and source populations are stable or increasing.	Populations are stable.	Populations follow rangewide decline.	Populations in sharp decline.
Internal fragmentation	There is little or no internal fragmentation by cropland, development, trees, or roads. The area retains sufficient internal connectivity to allow natural processes (fire, grazing, drought stress)	Fragmentation is minimal, or can be easily mitigated. Barriers to migration are minimal.	Internal fragmentation and alteration from natural conditions is present in more than 5% of the occurrence.	The occurrence has a high level of internal fragmentation, and is heavily impacted by anthropogenic alterations.

	to operate to maintain heterogeneous structure. Barriers to migration are absent or minimal.			
Natural processes	Fires are still part of this system. In the absence of native grazers, livestock grazing acts to maintain the mosaic of different structural stages, although not necessarily compositional stages.	Major natural ecological processes are still able to function or be simulated.	Fire frequency may have been altered, although easily restored. Some ecological processes have been altered and are no longer able to function or be fully restored.	Fire frequency may be greatly altered and difficult to restore.
Alteration from presettlement conditions (e.g. historically tilled areas, roads, oil and gas wells, windmills, stock ponds, fences, etc.)	Minimal or non-existent.	Impacts from human activities are not excessive and natural conditions should be easily restored with some change in management in a relatively short time period (within 10-25 years).		Extensive and significant enough to have notable impact on species composition, soil compaction and stability.
Ground cover & soils	Drainages are natural stable channels with no signs of unnatural erosion. The soil surface should show slight to no evidence of rills, wind scoured areas, or pedestaled plants. Plant cover is adequate to protect from excess soil erosion. Soils have a distinct A-horizon and are very stable (low erosion rate). Soils are not compacted.	Water flow patterns nearly match what is expected for the site; erosion is minor. Soil surface loss or degradation is moderate in plant interspaces with some degradation beneath plant canopies. Slight active pedestalling. Bare areas are of moderate size and sporadically connected. Litter buildup may be present in some areas, Soil structure is degraded and soil organic matter content is significantly reduced. Soil compaction moderately widespread.	Deposition and cut areas common; occasionally connected. Soil surface resistance to erosion significantly reduced in most plant canopy interspaces and moderately reduced beneath plant canopies. Moderately active pedestalling. Bare ground is moderate to much higher than expected for the site. Bare areas are large and often connected. Soil surface loss or degradation may be severe throughout the site. Soil compaction may be widespread.	Water flow patterns unstable with active erosion. Soil surface resistance to erosion may be extremely reduced throughout the site. Abundant active pedestalling and numerous terracettes. Bare ground is much higher than expected for the site. Bare areas are large and generally connected. Soil compaction is extensive throughout the occurrence.
③ LANDSCAPE CONTEXT				
Connectivity	Connectivity of adjacent systems (including other matrix and large patch systems) allows natural ecological processes (e.g. fire) to occur, facilitates migration, and results in greater than 500,000 acres of native prairie.	Connectivity of adjacent systems should result in 300,000 - 500,000 acres of native prairie.	Unalterable barriers prevent natural processes, species interaction and migration to and from the matrix community across most of the adjacent communities and ecological systems.	Connectivity is severely hampered. Ecological processes and species migration cannot occur at a natural scale.
Surrounding land	Occurrence is surrounded by a native and unaltered landscape and is generally surrounded by other high-quality natural communities. Surrounding vegetation is at least 80% natural.	The occurrence is surrounded by a landscape that has had some land conversion but in general is still ecologically connected with many of the adjacent natural communities. Surrounding vegetation is 50-80% natural.	Surrounding landscape is a mosaic of agricultural or semi-developed areas with 20-50% natural vegetation.	The surrounding landscape is almost entirely dominated by lands converted to agricultural or urban uses.

ANIMAL ABSTRACTS

Canyon Treefrog (*Hyla arenicolor*)

Taxonomy
Class: Amphibia
Order: Anura
Family: Hylidae
Genus: *Hyla*

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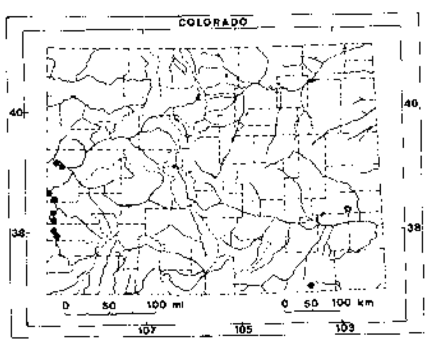
Taxonomic Comments: none.

CNHP Ranking: G5 S2

State/Federal Status: BLM Sensitive Species.

Phenology: *Hyla arenicolor* emerges from winter retreats in May and activity continues until September. Reproduction takes place in May and June. Canyon treefrogs are inactive in cold temperatures and hot, dry weather when they retreat to rock crevices. During the day they can be found resting in small depressions in solid rock near pools of water.



Colorado Distribution (Hammerson 1999)

Global Range: *Hyla arenicolor* occurs from western Colorado and southern Utah south through Arizona and western Texas to central Mexico (Hammerson 1999).

State Range: Colorado is at the northern margin of the canyon treefrogs range. It is known to occur in western Colorado, Mesa and Montrose counties and also Mesa de Maya, Las Animas County. This species had previously not located at Mesa de Maya since 1886 (Hammerson 1999).

Habitat Comments: Canyon treefrogs are primarily terrestrial, and breed in pools along canyon-bottom streams (Hammerson 1999). They are usually found near permanent pools or cottonwoods in rocky canyons with pinyon-juniper communities on slopes (Hammerson 1999). Canyon treefrogs are also found in intermittent streams in deep rocky canyons (Hammerson 1999). They will retreat to rock crevices in hot weather and during the cold season

Distribution/Abundance: There are no quantitative data on trends, but it is assumed that populations are stable (Hammerson 1999). Of the 30-plus records in Colorado, recent observations include Colorado National Monument, John Brown Canyon, and Mesa de Maya. The primary factors justifying a conservation concern for canyon treefrogs are the small number of occurrences, restricted range and relatively low numbers (qualitative judgment). There are no quantitative data on population size or trends. Similarly, threats to this species appear to be modest or localized.

Known Threats and Management Issues: No major pervasive threats are known and Canyon treefrogs often inhabit deep canyons that are difficult to access, which protects populations from human disturbance. The species appears to be secure in Colorado, although it is rare and restricted in its distribution.

Couch's Spadefoot (*Scaphiopus couchii*)

Photo copyright © CNHP

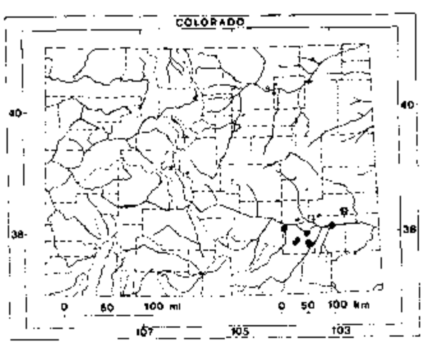
Taxonomy
Class: Amphibia
Order: Anura
Family: Scaphiopodidae
Genus: *Scaphiopus*

Taxonomic Comments: Garcia-Paris et al. (2003) used mtDNA to examine the phylogentic relationships of Pelobatoidea and found that the family Pelobatidae, as previously defined, is not monophyletic (*Pelobates* is sister to Megophryidae, not to *Spea*/*Scaphiopus*). They split the Pelobatidae into two families: Eurasian spadefoot toads (*Pelobates*), which retain the name Pelobatidae, and North American spadefoot toads (*Scaphiopus*, *Spea*), which make up the revived family Scaphiopodidae.

CNHP Ranking: G5 S1

State/Federal Status: Species of special concern (Colorado).

Phenology: *Scaphiopus couchii* emerges from winter retreats in May and activity continues until September. Reproduction takes place in May and June. Most of the activity is nocturnal and it emerges from underground retreats only after summer rains (Hammerson 1999).



Colorado Distribution (Hammerson 1999)

Global Range: *Scaphiopus couchii* occurs from Southeastern California, east-central Arizona (Mulcahy and Setser 2002), southeastern Colorado (Hammerson 1999), and central Oklahoma to the tip of Baja California, Nayarit, Zacatecas, San Luis Potosi (Stebbins 1985, Conant and Collins 1998) and northern Veracruz in Mexico.

State Range: Couch's spadefoot distribution in southeastern Colorado is at the northern edge of the species' range (Stebbins 1985). They are known to occur in Colorado in Bent and Otero Counties near the Purgatoire River at elevations below 4,500 feet (Hammerson 1999).

Habitat Comments: Couch's spadefoot inhabit plains grasslands in Colorado. They spend most of their life buried in the soil, emerging at night only after spring and summer rains (Hammerson 1999). They will burrow in soil or hide in rodent burrows when they are inactive. Eggs and larvae develop in the shallow water of temporary ponds, rain pools, and pools along intermittent streams.

Distribution/Abundance: There are no quantitative data on abundance and trends, but it is assumed that the small number of records indicates a relatively low population size (Hammerson 1999). Trends are assumed to be stable since land use has changed little (Hammerson 1999). An S1 rank is justified by the low number of occurrences and highly restricted state range. However, the secretive nature of Couch's spadefoot makes it difficult to locate, and suggests that strategic searching would reveal more locations.

Known Threats and Management Issues: No major pervasive threats are known and Couch's spadefoot tolerate cattle grazing. Populations should be secure if cattle ranching continues as the primary activity in habitats inhabited by the spadefoot (Hammerson 1999). The green toad tolerates livestock grazing, but conversion of grassland habitat to human uses and pesticide use could negatively impact populations.

Green Toad (*Bufo debilis*)

Photo copyright © CNHP

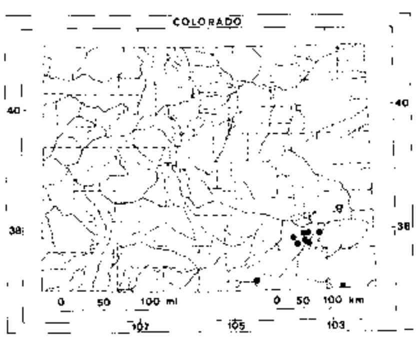
Taxonomy
Class: Amphibia
Order: Anura
Family: Bufonidae
Genus: *Bufo*

Taxonomic Comments: None.

CNHP Ranking: G5 S2

State/Federal Status: no special status.

Phenology: *Bufo debilis* emerges from winter retreats in May and activity continues until September. Most of the activity is nocturnal and it emerges from underground retreats only after summer rains (Hammerson 1999).



Colorado Distribution (Hammerson 1999)

Global Range: *Bufo debilis* occurs from south-central United States to Zacatecas and San Luis Potosi, Mexico, then north to Colorado and Kansas (Conant and Collins, 1998) in the United States.

State Range: *Bufo debilis* is known from several locations in southeastern Colorado in Baca, Bent, Las Animas, and Otero counties.

Habitat Comments: Green toads occur in arid short-grass prairie, usually with scattered cholla and yucca, in areas with seasonal water including gently rolling plains and canyon bottoms (Hammerson 1999). It burrows in soil or hides under rocks, in cracks in soil, or in rodent burrows when inactive. Eggs and larvae develop in the shallow water of temporary ponds, rain pools, and pools along intermittent streams.

Distribution/Abundance: The green toad is known form very few locations in Southeastern Colorado, existing in a limited number of scattered locations. The populations are probably secure as long as cattle ranching remain the primary land use in green toad habitat (Hammerson 1999).

Known Threats and Management Issues: No major pervasive threats are known. The green toad tolerates livestock grazing, but conversion of grassland habitat to human uses and pesticide use could negatively impact populations.

Northern Leopard Frog (*Rana pipiens*)

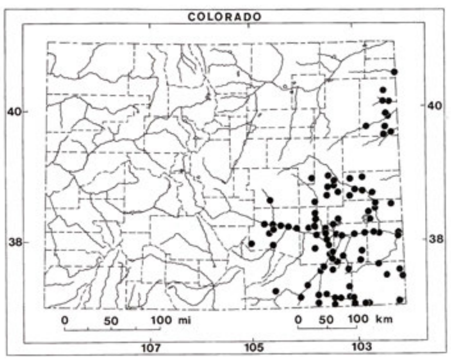
Photo copyright © CNHP

Taxonomy
Class: Amphibia
Order: Anura
Family: Ranidae
Genus: *Rana*

Taxonomic Comments: Much published information on "*Rana pipiens*" actually pertains to other species that have been described or recognized since the early 1970s.

CNHP Ranking: G5 S3

State/Federal Status: Species of special concern (Colorado), and a BLM and Forest Service Sensitive Species.



Colorado Distribution (Hammerson 1999)

Phenology: *Rana pipiens* emerges from winter retreats in March and activity continues until October or November. Breeding commences in March or April and eggs are layed from mid-April through May (Hammerson 1999).

Global Range: *Rana pipiens* ranges from southern Canada and the northern United States south to Maryland, West Virginia, Kentucky, northern Illinois, Missouri, Nebraska, New Mexico, Arizona, and eastern California (Hammerson 1999).

State Range: *Rana pipiens* ranges throughout Colorado except for the southeastern portion of the state.

Habitat Comments: Northern leopard frogs are found in a variety of temporary and permanent aquatic habitats, including streams, rivers, ponds, lakes, ditches, and marshes (Degenhardt et al. 1996). Mass movements away from breeding ponds are sometimes undertaken by adults and young after summer rains (Fitch 1958).

Distribution/Abundance: The formerly abundant northern leopard frog has become scarce in many areas of its range due in part to changes in habitat. In some areas the decline in northern leopard frogs are associated with the presence of increasingly abundant bullfrogs, which may eat Northern leopard frogs.

Known Threats and Management Issues: *Rana pipiens* has become scarce or absent at some locations where non-native bullfrogs have been introduced (Hammerson 1999). Bullfrog larvae that overwinter readily eat *Rana pipiens* eggs (Ehrlich 1979), and could greatly reduce reproductive success of northern leopard frogs (Hammerson 1999). Flood control measures and diversion of water for irrigation has reduced the availability of breeding habitat (Hammerson 1999).

Plains Leopard Frog *(Rana blairi)*

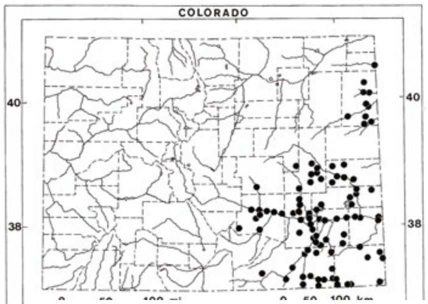
Photo by G. Hammerson

Taxonomy
Class: Amphibia
Order: Anura
Family: Ranidae
Genus: *Rana*

Taxonomic Comments: Formerly considered part of the *Rana pipiens* species complex; hybridizes with *Rana pipiens* and *Rana sphenocephala*. No subspecies are recognized.
CNHP Ranking: G5 S3

State/Federal Status: Species of special concern (Colorado).

Phenology: *Rana blairi* breeds from February through October (Pace 1974), with peak breeding activity occurring after heavy rains (Gillis 1975, Lynch 1985). Eggs, which hatch into tadpoles within three weeks, are laid in large clusters attached to submerged vegetation in shallow water (Degenhardt et al. 1996). Depending upon the timing (month) of egg deposition, the tadpoles may metamorphose into frogs or they may overwinter and then transform during the next spring (Gillis 1975, Scott and Jennings 1985). In the autumn, the adults dig into the mud and debris on the bottoms of streams and ponds to overwinter (Collins 1993).



Colorado distribution (Hammerson 1999)

Global Range: *Rana blairi* ranges westward from Indiana to southern South Dakota and eastern Colorado, and southward to Texas; isolated populations occur in southern Illinois, New Mexico, and Arizona (Stebbins 1985, Brown 1992, Conant and Collins 1998).

State Range: In Colorado, the range of the plains leopard frog generally is complementary to that of the northern leopard frog (*Rana pipiens*) (Hammerson 1999). *Rana blairi* is found at elevations below 6,000 ft (1,850 m) in the Arkansas River drainage in southeastern Colorado and in the Republican River drainage of northeastern Colorado (Hammerson 1999).

Habitat Comments: Plains leopard frogs are found in a variety of temporary and permanent aquatic habitats, including streams, rivers, ponds, lakes, ditches, and marshes (Degenhardt et al. 1996). They are often found great distances from water and for that reason they sometimes are known as "meadow frogs" (Wright and Wright 1949). Mass movements away from breeding ponds are sometimes undertaken by adults and young after summer rains (Fitch 1958). *Rana blairi* is better adapted to dry conditions than the closely-related *Rana pipiens* (Gillis 1975, 1979) and often uses shallow, muddy waters (Scott and Jennings 1985, Stebbins 1985).

Known Threats and Management Issues: *Rana blairi* has become scarce or absent at some locations where non-native bullfrogs have been introduced (Hammerson 1982). *Rana blairi* eggs and young are readily eaten by bullfrog larvae (Ehrlich 1979), and large bullfrog larvae that have overwintered could greatly reduce the reproductive success of plains leopard frogs (Hammerson 1999). Moreover, adult bullfrogs consume adult plains leopard frogs (Mackessy 1998).

BIRDS

American peregrine Falcon (*Falco peregrinus anatum*)

Photo courtesy USFWS

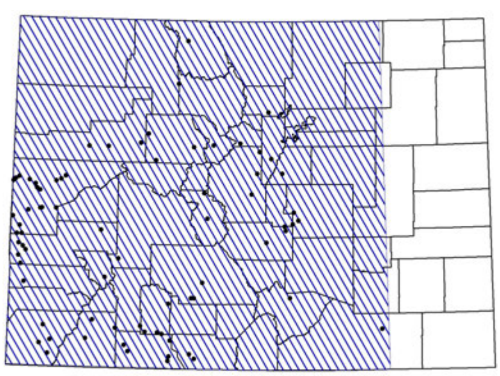
Taxonomy
Class: Aves
Order: falconiformes
Family: falconidae
Genus: *Falco*

Taxonomic Comments: Three of the approximately 20 recognized subspecies occur in North America (Brown and Amadon 1968); only *Falco peregrinus anatum* (the American peregrine falcon) occurs in Colorado (U.S. Fish and Wildlife Service 1984).

CNHP Ranking: G4T3 S2B

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

Phenology: peregrine falcons return to nesting grounds in Colorado in March and begin incubating (3-4 eggs) in April. Incubation lasts 32-35 days and young remain in the nest for 39-46 days (Kingery 1998). Fledging of young is completed by early August. The female does most of the incubating of the eggs; the male supplies her with food and sometimes relieves her at the nest (Johnsgard 1979). The female also does most of the brooding and feeding of the young during the first two weeks after hatching; later, both parents drop prey items into the nest, where the young must compete for them (Johnsgard 1979).



Colorado breeding distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: *Falco peregrinus anatum* nests across Alaska and Canada and throughout much of the western United States to central Mexico (U.S. Fish and Wildlife Service 1999). More northerly-breeding members of this subspecies migrate long distances to wintering areas in South America, whereas more southerly-breeding individuals show more variable migratory behavior (some migrate relatively short distances within western North America and others do not migrate at all) (Yates et al. 1988).

State Range: peregrine falcons breed along the foothills of Colorado's Front Range, the Purgatoire Canyon area, and in the river valleys and canyons of the Western Slope (Kingery 1998).

Habitat Comments: In western North America, peregrine falcons nest on ledges of high cliffs in the foothills and mountains from 4500 to over 9000 ft (1388 to 2776 m) in elevation (U.S. Fish and Wildlife Service 1984). The steepest and most inaccessible locations on the tallest cliffs are preferred, especially those that offer flat, protected ledges at least 18 inches wide, with sheer rock above and below (Johnsgard 1979). peregrine falcons formerly nested at sites that were much more accessible than tall cliffs; human disturbance at these accessible sites has precluded their use by the birds (Kingery 1998). In Colorado, pinyon/juniper woodland occurs in the vicinity of about half of all peregrine falcon nest sites, and ponderosa pine woodland or forest is found at about one-quarter of the sites (Kingery 1998). Preferred habitats for hunting include agricultural lands, meadows, drainage bottoms, marshes, and lakes (U.S. Fish and Wildlife Service 1984). Migrating and wintering birds often are associated with reservoirs, rivers, and marshes, but they also use grasslands and agricultural areas (Andrews and Righter 1992).

Distribution/Abundance: The peregrine falcon was once one of the most widely-distributed birds in the world, occurring on all continents except Antarctica, and on many islands (Hickey and Anderson 1969). Throughout its range, the species has undergone major reductions in numbers and density (Hickey 1969). In the Rocky Mountain region, only one-third of historical peregrine nest sites were still occupied by 1965 (Enderson 1969). In 1977, the Colorado population reached a low of four breeding pairs (Gray 1995). By 1995, due to an intensive program of captive breeding and reintroduction, peregrines occupied 71 breeding sites in Colorado (Kingery 1998). peregrine falcon nest in the western two-thirds of Colorado

Known Threats and Management Issues: The severe population declines experienced by peregrine falcons in North America were primarily due to the effects of pesticides, particularly DDT and dieldrin (Risebrough and Peakall 1988). Through captive breeding and reintroduction programs, many agencies and organizations have successfully restored peregrine falcon populations to portions of the species' historical range, including Colorado (Andrews and Righter 1992). Human disturbance at nest sites may cause nest abandonment (U.S. Fish and Wildlife Service 1984). The increasing popularity of recreational rock climbing in North America is becoming a serious problem for natural resource managers who are trying to protect nesting peregrine falcons (U.S. Fish and Wildlife Service 1999).

Bald Eagle (*Haliaeetus leucocephalus*)

Taxonomy:
Class: Aves
Order: Falconiformes
Family: Accipitridae
Genus: Haliaeetus

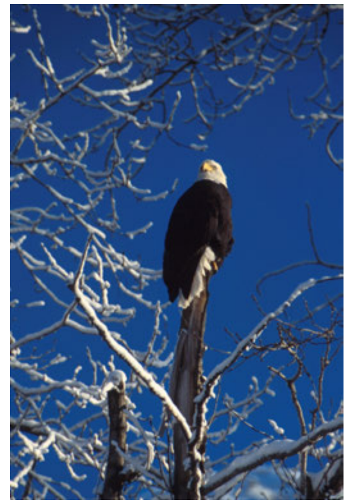


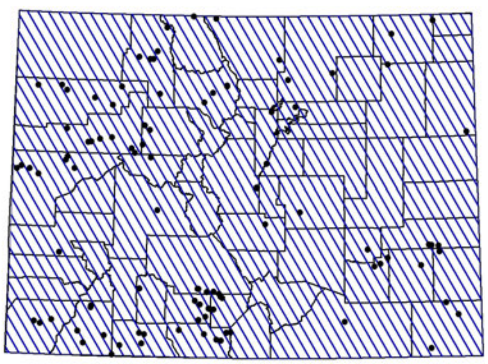
Photo by Mary Kiesling

Taxonomic Comments: None.

CNHP Ranking: G4 S1B, S3N

State/Federal Status: Federally threatened

Phenology: bald eagles begin nesting in late February, and can often be observed feeding their young into late June (Kingery 1998).



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: bald eagles live throughout North America from Alaska to Newfoundland, and from the tip of Florida to southern California.

State Range: bald eagles nest across Colorado (Kingery 1998).

Habitat Comments: bald eagles that nest in Colorado use large, mature cottonwoods or pines, often along rivers, to hold their heavy nests (Kingery 1998). Winter habitats occur along major river systems characterized by the presence of abundant food, protected roost sites, and little or no human disturbance (Keister and Anthony 1983). Roosting habitat consists of tall trees that offer protection from prevailing winds and are generally located near aquatic foraging areas (Buehler et al. 1991).

Distribution/Abundance: Our national bird can now be found in every state in the U.S. In Colorado, statewide mid-winter counts conducted by the Colorado Division of Wildlife during the 1980s have ranged from 400-700 birds. Currently there are about 35 breeding pairs statewide (Kingery 1998). The small breeding population, the numerous threats that exist, and the varying success of nests from year to year, warrants a critically imperiled rank for breeding birds (S1B). The winter population warrants a vulnerable status (S3N).

Known Threats and Management Issues: Major threats to the bald eagle include the loss of critical habitat components such as nest trees (Weekes 1974), perch sites, and winter roosts (Hansen et al. 1981) to natural or man-induced causes. Human activity and disturbance can alter foraging patterns, distribution, habitat use, reduce reproductive success, reduce foraging efficiency, increase energy expenditures, and increase stress (Stalmaster and Kaiser 1998, Brown and Stevens 1997, Fernandez and Azkona 1993, Stalmaster 1983). Additional threats to this species include high pesticide use, poisoning, poaching, and loss of nesting habitat due to the enduring popularity of waterfront development.

Burrowing Owl (*Athene cunicularia*)

Photo © by Don Baccus
dhogaza@pacifier.com

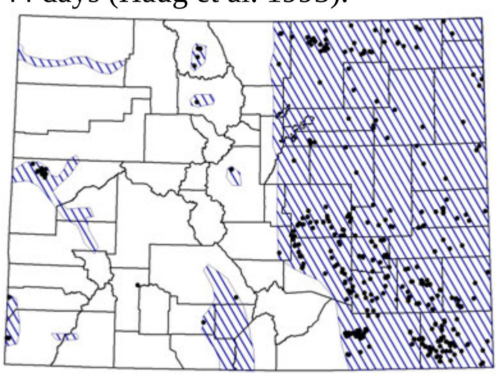
Taxonomy:
Class: Aves
Order: Strigiformes
Family: Strigidae
Genus: Athene

Taxonomic Comments: This species has been variously placed in the genus *Speotyto* or in *Athene*. The American Ornithologists' Union (1998) now places it in *Athene*.

CNHP Ranking: G4 S4

State/Federal Status: Threatened status (Colorado) and Forest Service sensitive species.

Phenology: Birds migrate south from Colorado during September and October and return during March and April. Eggs are usually laid (typically 7-9) in late March or Early April and are incubated for approximately one month by the female (males provide food). Young fledge after 44 days (Haug et al. 1993).



Colorado distribution (Andrews and righter 1992, Kingery 1998, CNHP data)

Global Range: In North America burrowing owls breed from south-central British Columbia (nearly extirpated), southern Alberta, southern Saskatchewan, southern Manitoba south through western U.S., central Mexico, to central and southern Florida (AOU 1983).

State Range: Breeding records cover much of the state, although it is more common on the plains of eastern Colorado (Andrews and Righter 1992, Kingery 1998).

Habitat Comments: This species is found in dry open treeless areas and is associated with burrowing mammals. Burrows are usually surrounded by bare ground and provide protection from weather extremes (Haug et al. 1993). Although capable of digging their own burrows where burrowing mammals are absent, burrowing owls usually use existing burrows, particularly those of prairie dogs.

Distribution/Abundance: The Primary range of the burrowing owl is the eastern plains, but they are also uncommon in mountain parks and Western valleys of Colorado. Although there are numerous occurrences of burrowing owls in Colorado, habitat losses and declines in good habitat areas warrant conservation attention.

Known Threats and Management Issues: Human-related impacts can be detrimental to burrowing owl populations. Agricultural activities, road-kills and development, as well as the eradication of burrowing mammals (i.e. prairie dog), threaten this species. Additionally, domestic cats are known to predate on burrowing owls (Haug et al. 1993).

Cassin's Sparrow (*Aimophila cassinii*)

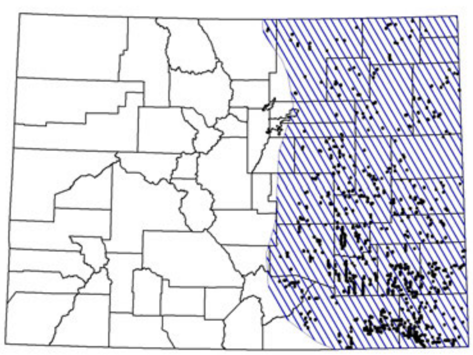
Taxonomy:
Class: Aves
Order: Passeriformes
Family: Emberizidae
Genus: *Aimophila*

Taxonomic Comments: None.

CNHP Ranking: G5 S4B

State/Federal Status: USFS sensitive species.

Phenology: Cassin's sparrows begin arriving in Colorado around mid-April and nesting occurs from early June through mid-July (Kingery 1998). Fledging has been noted as late as the first week of August.



Colorado distribution (Andrews and righter 1992, Kingery 1998, CNHP data)

Global Range: The breeding range for the Cassin's sparrow extends primarily across southeastern Arizona, New Mexico (except northwest), central and northeastern Colorado, southwestern Nebraska, west-central Kansas, and western Oklahoma south to northern Mexico and central and southern Texas. The species is also a permanent resident in southeastern Arizona, southern New Mexico, western and south-central Texas, and northern Mexico (AOU 1983).

State Range: Cassin's sparrows are common to abundant summer residents in the southeastern plains of Colorado. They are regularly found in the southeastern part of the state (from Las Animas, Huerfano, Pueblo, and El Paso Counties east to the border) and irregularly into the northeast (Andrews and Righter 1992; Kingery 1998). They are considered accidental in the eastern foothills in summer and winter (two records) (Andrews and Righter 1992).

Habitat Comments: The Cassin's sparrow inhabits open grassland and short-grass plains with scattered bushes, shrubs, sagebrush, or yucca (Kingery 1999). They nest on or near ground at the base of a cactus, yucca, shrub, or clump of grass, or up to one foot above the ground in a shrub or cactus (Kingery 1999).

Known Threats and Management Issues: The loss of grassland with a shrub component through conversion to agriculture, suburban development, and desert scrublands is the primary threat to Cassin's sparrow habitat (Ruth 2000). There is some evidence that overgrazing can reduce the abundance of Cassin's sparrows (Ruth 2000).

Curve-billed Thrasher (*Toxostoma curvirostre*)

Taxonomy
Class: Aves
Order: Charadriiformes
Family: Scolopacidae
Genus: *Phalaropus*

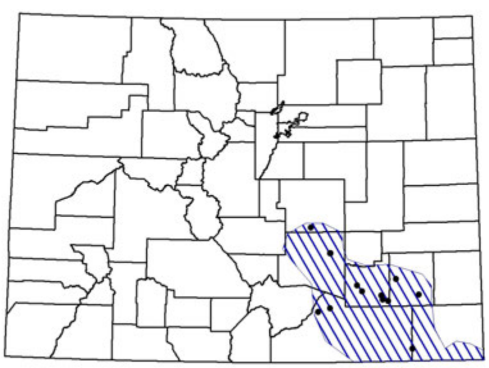
Photo copyright © Don Baccus, dhogaza@pacifier.com

Taxanomic Comment: May be comprised of more than one species (Tweit 1996). Sibley and Monroe (1990) suggest that this taxon appears to constitute a superspecies with *T. ocellatum*, but this hypothesis is not supported by phylogenetic analysis of Zink et al. (1999), who state that the relationships of *T. curvivrostre* and *T. ocellatum* are problematic, and the two taxa do not appear to be sister species. The curve-billed thrasher is placed in Sturnidae in Sibley and Ahlquist (1984).

CNHP Ranking: G5 S3

State/Federal Status: None

Phenology: Nesting phenology for curve-billed thrasher remains spotty because so few nests have been observed in Colorado (Kingery 1998). In other areas of there range nest-building begins in April and nesting ranged from nests with eggs in late April to fledging in October.



Colorado distribution (Andrews and Righter 1994, Kingery 1998,CNHP data)

Global Range: Curve-billed thrashers are year round residents in northwestern Arizona, northeastern New Mexico, southeastern Colorado, western Oklahoma, southwestern Kansas, and central Texas south to southern Mexico (AOU 1998).

State Range: Curve-billed thrashers have a restricted range in southeastern Colorado occurring in only six Colorado counties (Baca, Bent, Crowley, Las Animas, Otero, and Pueblo)

Habitat Comments: Curve-billed thrashers in Colorado nest primarily in cholla grassland, but sometimes also open pinyon-juniper woodlands and riparian areas. They are vagrant in shortgrass prairie, agricultural areas, and riparian areas (Andrews and Righter 1992, Kingery 1998).

Distribution/Abundance: Curve-billed thrashers are at the northern edge of their range and there population estimates indicate only 3000 individuals in Colorado. The restricted distribution and small population size of the curve-billed thrasher are factors contributing to their status as a bird of conservation concern.

Known Threats and Management Issues: There are no identified threats to this species in Colorado.

Ferruginous Hawk (*Buteo regalis*)

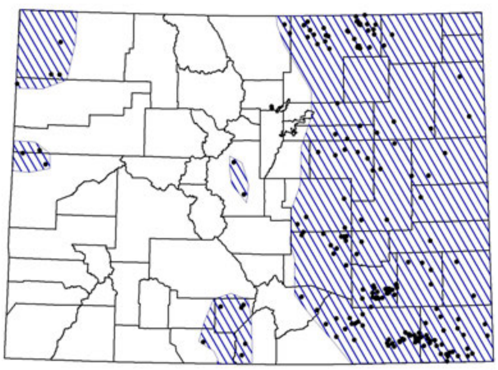
Photo by EDM International, Inc.

Taxonomy
Class: Aves
Order: Falconiformes
Family: Accipitridae
Genus: *Buteo*

Taxonomic Comments: There are no subspecies documented for this species.

CNHP Rank: G4S3B, S4N

Phenology: Ferruginous hawks begin arriving in Colorado around February or March and egg-laying begins around mid-March. Nests with young are present around the end of May and fledging occurs near the end of July, 38-50 days after hatching (Kingery 1998).



Colorado distribution (Kingery 1998)

Global Range: The ferruginous hawk breeds from eastern Washington, southern Alberta, southern Saskatchewan, extreme southwestern Manitoba (Bechard and Schmutz 1995), south to eastern Oregon, Nevada, northern Arizona, northern New Mexico, Texas panhandle, extreme western Oklahoma, and to western Kansas.

State Range: In Colorado the ferruginous hawk occurs in extreme northwestern Colorado, the Grand Valley, and throughout the eastern plains.

Distribution and Abundance: About 1,200 birds winter in Colorado (Johnsgard 1990), comprising about twenty percent of the total winter population in the United States (Andrews and Righter 1992). Kingery (1998) reported about 50 nest sites in Colorado, primarily on the eastern plains. Populations were stable in Colorado between 1979 and 1992 (Bechard and Schmutz 1995). The Breeding Bird Survey indicates a large increase within the continent and a stable population within Colorado. Local population declines are attributed to the effects of cultivation, grazing, poisoning small mammals, mining and fire in nesting habitats (Bechard and Schmutz 1995). Colorado's breeding ferruginous hawks are uncommon, probably because of human reduction of the primary winter prey base (prairie dog colonies), small population size, and human encroachment into available habitat.

Habitat Comments: The ferruginous hawks inhabit open grasslands, shrublands and deserts (Bechard and Schmutz 1995). Breeding pairs nest in isolated trees, on rock outcrops, structures such as windmills and power poles, or on the ground. Winter populations concentrate around prairie dog towns (Andrews and Righter 1992).

Known Threats and Management Issues: Local population declines are attributed to the effects of cultivation, grazing, poisoning small mammals, mining and fire in nesting habitats (Bechard and Schmutz 1995). Colorado's breeding population is considered vulnerable (S3B) based on human reduction of the primary winter prey base (prairie dog colonies), small population size, and human encroachment into available habitat (CNHP 2008).

Gray Vireo (*Vireo vicinior*)

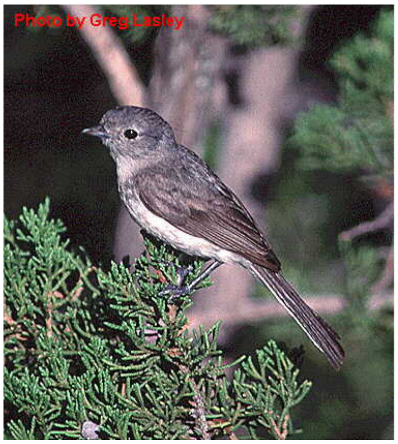


Photo © Greg Lasley [*http://www.mbr-pwrc.usgs.gov/Infocenter/i6340id.html*](http://www.mbr-pwrc.usgs.gov/Infocenter/i6340id.html)

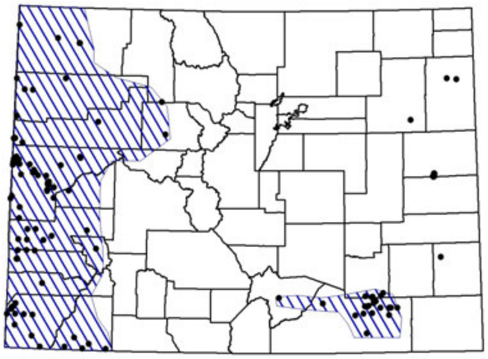
Taxonomy
Class: Aves
Order:Passeriformes
Family: Vireonidae
Genus: *Vireo*

Taxonomic Comments: none.

CNHP Ranking: G4 S2B, SZN

State/Federal Status: None

Phenology: Gray vireos arrive in Colorado in the spring, and return to wintering territories in Mexico in the fall.



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data

Global Range: Gray vireos breed in southwestern North America, in Utah, western Colorado, New Mexico, Arizona, Nevada, California and Texas, and winter in western Mexico. Colorado represents the northeastern portion of its breeding range (National Geographic Society 1987).

State Range: The gray vireo is characterized as an uncommon and very local summer resident in Colorado (Andrews and Righter 1992). The species is confined to the western and south-central counties. There are 56 records of gray vireos from at least 16 Colorado counties.

Habitat Comments: Pinyon-juniper woodlands. In La Plata County, gray vireos were found most often in the lower elevations where Utah juniper was dominant. In their winter range in Mexico, gray vireos are heavily dependent on the fruit of elephant trees (*Bursera microphylla*). Barlow (1977) suggests that large tracts of undisturbed habitat are required to support individual pairs, given the size of territories he observed in Texas and Arizona. In addition, habitat fragmentation increases vulnerability to cowbird brood parasitism.

Distribution/Abundance: The gray vireo is a migrant that breeds in southwestern North America and winters in western Mexico. Colorado includes the northeastern portion of its breeding range (National Geographic Society 1987). Breeding has been recorded in at least five areas in Colorado, and is suspected in many more locales (Andrews and Righter 1992). Breeding Bird Survey data for this species are scarce and do not adequately sample gray vireos at any scale (Colorado Bird Observatory 1997). Historical management of pinyon-juniper habitat may have negatively impacted the ecological integrity over large areas (Ron Lambeth, pers. comm.), and consequently may impact the gray vireo. The occurrence of wildfire may exacerbate the problem of weedy invasion into this bird's habitat. Although considered globally secure, few breeding occurrences, lack of knowledge on population status, and limited range within the state, are all factors which contribute to the S2B rank in Colorado.

Known Threats and Management Issues: Threats and reasons for range contractions are largely unknown. Pinyon-juniper woodlands are subject to grazing and clearing to increase grassland. There are no studies to date on the effects of habitat fragmentation and conversion, grazing, changes in fire regimes, changes to upslope habitats from water diversion, off-road vehicle use, or levels of disturbance. Habitat fragmentation or the presence of livestock that facilitate brood parasitism by the brown-headed cowbird (*Molothrus ater*) would be detrimental (USDA Forest Service 1994). Gray vireos are considered a common host for the cowbird, but rates of parasitism and impacts on productivity are unknown (Ehrlich et al. 1988). Changes in fire regime that bring about an increase in fire extent or frequency may be detrimental (USDA Forest Service 1994).

Lewis's Woodpecker (*Melanerpes lewis*)

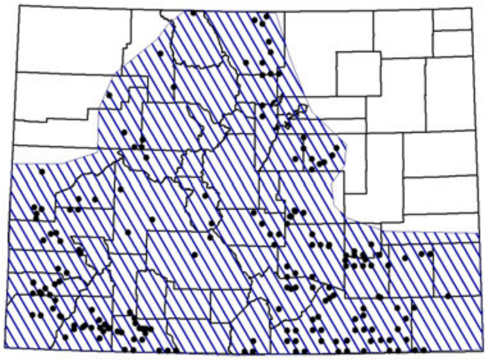
Class: Aves
Order: Piciformes
Family: Picidae
Genus: *Melanerpes*

Taxanomic Comment: The Lewis's woodpecker has often has been placed in the monotypic genus *Asyndesmus* (AOU 1983).

CNHP Ranking: G4 S4

State/Federal Status: USFS sensitive species.

Phenology: Phenology: Lewis's woodpecker begin nest building in April, egg-laying occurs from April to mid-June, and incubation lasts for approximately one month (Kingery 1998). Young fledge from the end of May to the beginning of June (Kingery 1998).



Colorado distribution (Andrews and righter 1994, Kingery 1998, CNHP data)

Global Range: The Lewis Woodpecker has a large range in western U.S. and adjacent southern Canada extending from southern British Columbia, southwestern Alberta, Montana, southwestern South Dakota and northwestern Nebraska south to south-central California, central Arizona, southern New Mexico, and eastern Colorado.

State Range: Lewis woodpecker is widespread in southern Colorado and can be fairly common in some areas. They can also be found along the Front Range of Colorado from Denver to the Wyoming border.

Habitat: Lewis's woodpeckers inhabit open forest and woodland, often logged or burned, including oak, coniferous forest including ponderosa pine and pinyon-juniper, riparian woodland, and orchards (AOU 1983). Much of the range is in southern Colorado foothills, valleys, canyons, and mesas. They tend to nest in a natural cavity, abandoned flicker whole, or previously used cavity, 1-52 m above ground. Sometimes Lewis's woodpeckers will excavate a new nesting cavity, generally in a standing dead tree, dead branch of a living tree, or utility pole. Mated pairs may return to the same nest site in successive years. They feed mainly on insects including ants, beetles, flies, grasshoppers, or tent caterpillars.

Distribution/Abundance: Lewis's woodpecker is widespread in southern Colorado and can be fairly common in some areas. Its habitat requirements appear to be met in many areas (Siemers 1997). There is no evidence of statewide declines and its habitat requirements appear to be met in many areas. There are many breeding occurrences within their range in Colorado and Kingery (1998) confirmed over 100 breeding pairs in the state.

Known Threats and Management Issues: There are no known statewide threats to this species, however, it is vulnerable to loss of nesting sites (large snags) such as may result from forest management practices and degradation of riparian habitats by drought and overgrazing. Such habitat alteration evidently is the reason for the declines occurring in coastal areas of British Columbia and Washington (DeSante and George 1994). This species is tolerant of nondestructive intrusion.

Long-billed Curlew (*Numenius americanus*)

Taxonomy
Class: Aves
Order: Charadriiformes
Family: Scolopacidae
Genus: *Numenius*

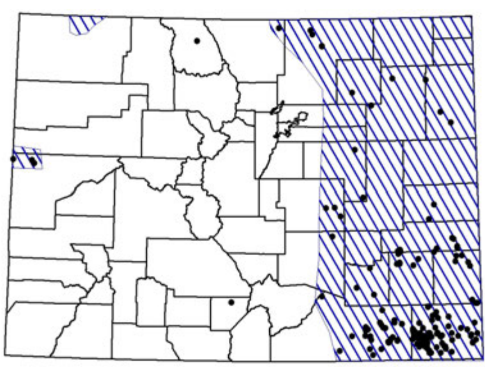
Photo copyright © CNHP

Taxonomic Comments: May constitute a superspecies with the Eurasian curlew (*N. arquata*) (AOU 1988).

CNHP Ranking: G5 S2B, SZN

State/Federal Status: USFS and BLM sensitive species; species of special concern (Colorado).

Phenology: Long-billed curlews raise only one brood per year, and nesting fits into a compact time period (Kingery 1998). Adults arrive on the breeding grounds in April; most clutches are laid in May, and hatch from early to mid June (Kingery 1998). Most of the precocial young can fly by the first of July (Kingery 1998).



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: The current range of the long-billed curlew has contracted from historic times (Kingery 1998). The historical range extended from Canada to Illinois, northern California, and northern Texas (Kingery 1998). The current breeding range includes southwest North Dakota, western South Dakota, western Nebraska (the sandhills area), eastern Colorado, southwestern Kansas, northwestern Oklahoma, the western panhandle of Texas, and eastern New Mexico (Johnsgard 1979).

State Range: In Colorado, the heaviest concentration extends from Baca County west in Las Animas County to the Purgatoire River. A second population breeds north of the Arkansas River from eastern El Paso and Pueblo counties to Kansas. A small contingent apparently nests on the Western Slope (Kingery 1998).

Habitat Comments: Breeding long-billed curlews are most often associated with shortgrass prairie, grazed mixed grass prairie, or combinations of short grasses, sage, and cactus, often on gently rolling terrain (Johnsgard 1979). They are considered an indicator species for healthy native grasslands (Kingery 1998). Favored nest sites are damp, grassy hollows in prairie vegetation or long slopes hear lakes or streams (Johnsgard 1979). Nests are frequently located near ponds, playas, or lakes (Kingery 1998). The presence of water may influence initiation of nesting the first year and site fidelity may induce them to return even if the nearby water has dried up (Kingery 1998). The nest is simply a slight hollow lined with a varying amount of grasses or weeds (Johnsgard 1979). At times the birds nest in loose colonies, and the frequently place their nests beside dried cow dung, presumably for better concealment (Johnsgard 1979). Long-billed curlews sometimes nest in wheat fields or fallow fields (Andrews and Righter 1992). There diet consists primarily of insects, worms, burrow-dwelling crustaceans, mollusks, toads, eggs and nestlings of other birds, and few berries (Ehrlich et al. 1988).

Distribution/Abundance: In Colorado, the species is documented from 86 breeding occurrences, mostly on the eastern plains of the state. No population estimates are available for Colorado, but based on its historical abundance throughout the eastern plains, the species is probably in decline (Andrews and Righter 1992). The Breeding Bird Survey indicates a stable continental population, but does not adequately sample within Colorado (Mike Carter, pers. comm.). The species' low population compared to historical accounts, disturbance to breeding areas, and lack of protected breeding habitat are factors contributing to the imperiled status of this species in Colorado (S2B).

Known Threats and Management Issues: Declines in range and population had led to concern about the long-billed curlew’s status (Kingery 1998). Long-billed curlews share an unfortunate bond with other shortgrass prairie specialists because of threats to remaining shortgrass habitat. Almost all species, including songbirds, raptors, and shorebirds, are declining. Conversion of prairies to agriculture caused much of the decline of this species (Kingery 1998, Ehrlich et al. 1988). In the early 1900s, long-billed curlew’s size and taste made them a popular main dish (Kingery 1998).

McCown's Longspur (*Calcarius mccownii*)

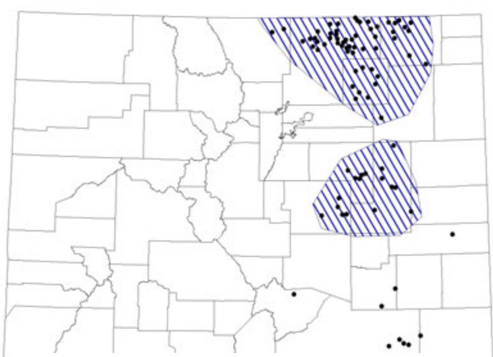
Taxonomy
Class: Aves
Order: Passeriformes
Family: Emberizidae
Genus: *Calcarius*

Taxonomic Comments: No subspecies described.

CNHP Ranking: G5 S2B

State/Federal Status: USFS sensitive species.

Phenology: McCown's longspur's usually return to breeding areas in April (Byers *et al.* 1995). Eggs are usually laid (typically 2-5) in late May or Early June and are incubated for approximately one month by the female (males provide food). Young usually fledge by the end of July (Kingery 1998). McCown's longspurs form flocks by early August and leave the breeding grounds by September (Byers et al. 1995).



Colorado distribution (Andrews and righter 1994, Kingery 1998, CNHP data)

Global Range: The summer breeding range for McCown's longspurs extends southward from southern Canada to Colorado (Bailey and Niedrach 1965, Andrews and Righter 1992, With 1994, Price et al. 1995). Primary breeding areas are in Montana and in southern Alberta and Saskatchewan (Byers et al. 1995). Substantial reductions of the species' breeding range have occurred historically (Krause 1968).

State Range: In Colorado, the center of breeding activity for McCown's longspurs is located in northern Weld County but recent observations indicate that the species also breeds in areas farther to the south, including Washington, Elbert, Lincoln, and Kit Carson counties (Kingery 1998). The winter range extends southwestward from western Oklahoma through Texas, and into Mexico; it includes parts of extreme southern Arizona and New Mexico (With 1994).

Habitat Comments: McCown's longspurs breed on open, flat, semi-arid expanses of shortgrass prairie or structurally similar habitats such as heavily grazed or other sparsely-vegetated grasslands (Byers et al. 1995, With 1994). These birds tend to be more numerous on breeding grounds in dry years than in wet years (Krause 1968). Wintering grounds also tend to be sparsely-vegetated areas, including shortgrass prairie, overgrazed grasslands, plowed agricultural fields, and dry lake beds (With 1994). The female constructs a nest of dried weed stems and grasses in a hollow scraped in the ground, often beneath a shrub or clump of grass (Terres 1980, Byers et al. 1995).

Distribution/Abundance: The breeding range for McCown's longspur in Colorado does not extend much beyond northern Weld and northeastern Larimer counties (Andrews and Righter 1992). Although globally secure (G5), this species' limited range in the state, low number of breeding occurrences, assumed small population, and loss of high quality habitat (from existing range management practices) justify a state imperiled status in Colorado (S2B).

Known Threats and Management Issues: Habitat loss constitutes the greatest threat to this species. Breeding habitat is especially vulnerable to agricultural and urban development and was substantially reduced during the twentieth century (see refs. in With 1994; Byers et al. 1995). McCown's longspurs are vulnerable to direct mortality from pesticides (McEwan and Ells 1975). Although some McCown's longspurs are relatively tolerant of human disturbance (With 1994), others may abandon active nests if disturbed (Felske 1971, Strong 1971).

Mountain Plover (*Charadrius montanus*)

Taxonomy
Class: Aves
Order: Charadriiformes
Family: Charadriidae
Genus: *Charadrius*

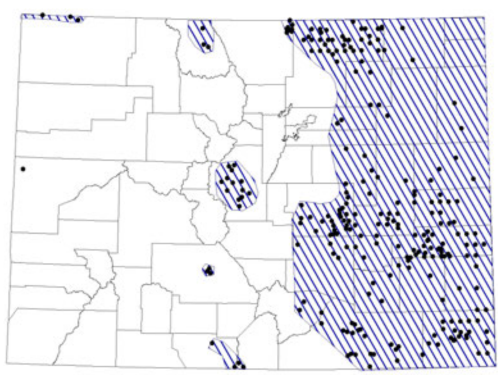
Taxonomic Comments: Formerly known as *Eupoda montana*.

CNHP Ranking: G2 S2B, SZN

State/Federal Status: Forest Service and BLM sensitive species; species of special concern (Colorado).

Photo copyright © CNHP

Phenology: Mountain plovers arrive on their breeding areas in Colorado in late March (Graul 1975, Knopf and Rupert 1996), when males often return to the same territories they occupied the previous year (Graul 1973). Eggs are usually laid in April and May and fledging occurs in June in July (Kingery 1998). Some females can have two clutches per summer and the second clutch may not fledge until early August (Kingery 1998). Mountain plovers begin to leave their breeding territories and form flocks shortly after the chicks fledge, which occurs in early July in Colorado (Knopf and Rupert 1996).



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: Mountain plovers breed in parts of Montana, Wyoming, Colorado, New Mexico, and in adjacent portions of Utah, Oklahoma, and Texas (Knopf 1996a). An isolated breeding population occurs in the Davis Mountains of western Texas (Knopf 1996a). In late summer, birds form flocks and disperse widely across the western and southern Great Plains before migrating to their wintering range (Knopf 1996a). Mountain plovers winter in California, southern Arizona, southern Texas, and Mexico (see refs. in Knopf 1996a).

State Range: In Colorado, the greatest numbers of breeding mountain plovers occur in Weld County (Graul and Webster 1976). The breeding range of this species has undergone a dramatic long-term contraction, both in Colorado (Andrews and Righter 1992) and throughout the western Great Plains (Graul and Webster 1976).

Habitat Comments: Breeding mountain plovers occupy open habitats with low-growing vegetation, especially shortgrass prairie characterized by the presence of blue grama grass and buffalo grass (Graul 1975, Graul and Webster 1976, Knopf and Miller 1994). In grasslands where vegetation grows taller than approximately three inches in height, mountain plovers use intensively grazed areas (Graul and Webster 1976), prairie dog towns (Shackford 1991), and fallow or recently plowed agricultural fields (Shackford et al. 1999). Mountain plover nests often are situated very close to dried cow manure piles, perhaps to provide disruptive coloration and thereby reduce the probability of nest predation, or perhaps to help the birds more easily relocate their nests (Graul 1975, Knopf and Miller 1994). On their wintering grounds in California, mountain plovers use plowed or burned agricultural fields and heavily grazed annual grasslands (Knopf and Rupert 1995). In Texas, wintering mountain plovers use coastal prairies, alkaline flats, plowed fields, and Bermuda grass fields (Oberholser 1974).

Distribution/Abundance: Breeding Bird Survey data indicate a decline of two-thirds in the continental population during the period 1966-1993 (Knopf 1996b). Once widely distributed in eastern Colorado (Bailey and Niedrach 1965), mountain plovers underwent a dramatic range reduction due to loss of habitat as native prairie was converted to cropland (see refs. in Andrews and Righter 1992). Habitat loss to agricultural activities also has severely reduced the species' breeding range outside Colorado (Samson and Knopf 1994).

Known Threats and Management Issues: Threats to mountain plovers habitat include gas, oil, and mineral extraction activities, a lack of livestock grazing, and spring plowing (the timing and extent). Human disturbance at nest sites may cause nest abandonment (Graul 1975, Miller and Knopf 1993).

Prairie Falcon (*Falco mexicanus*)

Taxonomy:
Class: Aves
Order: Falconiformes
Family: Falconidae
Genus: Falco

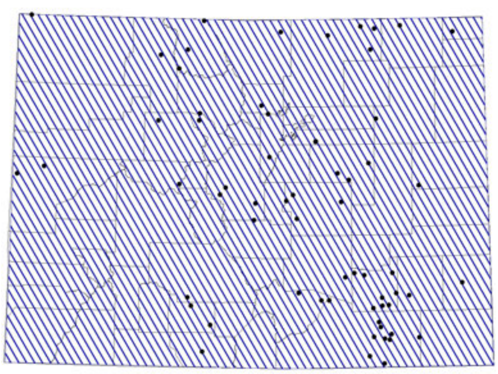
Taxonomic Comments: None.

CNHP Ranking: G5 S4B,S4N

State/Federal Status: No special status.

Photo by R. J. Long

Phenology: Laying may begin as early as April in Colorado. Clutch size usually is 4-5 egg and. incubation lasts 29-33 days (Kingery 1998). Young are tended by both parents and they remain at nest site 36-41 days with fledging completed by the end of July (Kingery 1998).



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: Prairie falcons breed throughout North America from southern British Columbia east to southern Saskatchewan, south through Colorado, Arizona, Baja California and central Mexico.

State Range: Prairie falcons nest across Colorado (Kingery 1998).

Habitat Comments: Prairie falcons primarily inhabit open areas in mountains, steppe, plains, or prairies (AOU 1983). They typically nest in a pot hole or well-sheltered ledge on rocky cliff or steep earth embankment, 10 to more than 100 meters above the ground. Vertical cliffs with rock structure overhanging the site are preferred. Nests typically are placed on south-facing aspects, with overhangs offering some protection from solar radiation. They may use an old nest of a raven, hawk, eagle, etc.

Distribution/Abundance: Prairie falcons are widespread throughout Colorado with moderate numbers of nesting pairs. Kingery (1998) recorded over 50 confirmed nests in Colorado.

Known Threats and Management Issues: The major threat to prairie flacons is direct human disturbance. The effect of human disturbance depends on a number of factors, including the type of activity, proximity to the nest or roost site, time of year and duration of the activity (Steenhof 1998). Falcons are most sensitive just prior to egg laying.

Rufous-crowned Sparrow (*Aimophila ruficeps*)

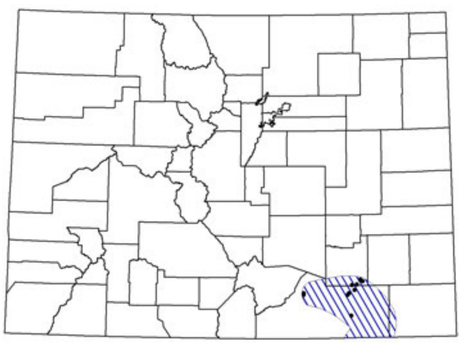
Taxonomy:
Class: Aves
Order: Passeriformes
Family: Emberizidae
Genus: *Aimophila*

Taxonomic Comments: None.

CNHP Ranking: G5 S2

State/Federal Status: No special status.

Phenology: Rufous-crowned sparrows are permanent residents of Colorado around and nesting occurs from early May through June (Kingery 1998). Fledging has been noted as late as July.



Righter 1992, Kingery 1998, CNHP data)

Global Range: The rufous-crowned sparrow is a permanent resident that ranges from central California, northern Arizona, southwestern New Mexico, southeastern Colorado, northwestern and central Oklahoma, south discontinuously to southern Baja California and Mexico.

State Range: Rufous-crowned sparrows are uncommon residents of southeastern Colorado in eastern Las Animas County and extreme southwestern Baca County (Kingery 1998).

Habitat Comments: In Colorado, rufous-crowned sparrows nest in mixed shrub habitats, often on moderately grazed grassy and rocky hillsides (Kingery 1998). They have been found in juniper woodland, pinyon-juniper woodland, scrub oak woodland, and mixed shrubland in southeastern Colorado. They nest on or near ground in a depression often at the base of a shrub or tuft of grass, or up to three foot above the ground in a low shrub (Kingery 1998).

Distribution/Abundance: The rufous-crowned sparrow is a resident in Las Animas and Baca counties. Breeding Bird Survey data indicate a stable continental population, but downward trends were reported in the central part of the species range by Stokes and Stokes (1996). No trends or population studies are available, but the rufous-crowned sparrow occurs in a restricted range of about 5 % of the Colorado. Because of its restricted range within the state with few protected occurrences, this species consideration as a priority species in Colorado.

Known Threats and Management Issues: No threats to this species have been identified in Colorado.

Sage Sparrow (*Amphispiza belli*)

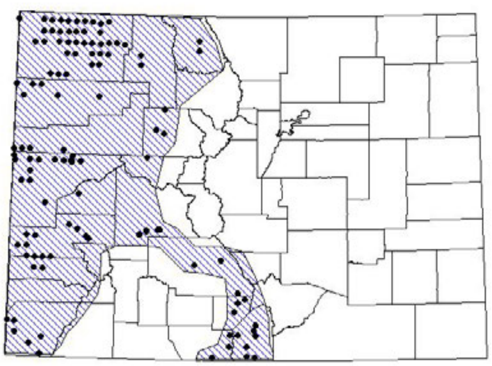
Taxonomy:
Class: Aves
Order: Passeriformes
Family: Mimidae
Genus: *Amphispiza*

Taxonomic Comments: none

CNHP Ranking: G5 S3B

State/Federal Status: No special status.

Phenology: Sage sparrows begin to return to Colorado in February and reach full numbers by mid-April. Courtship begins in Early June and the young are fledged by mid-August (Kingery 1998).



1992, Kingery 1998, CNHP data)

Global Range: The breeding range for the Sage sparrow extends primarily across the Great Plains and onto the Columbia Plateau, but the species is also a permanent resident west over the Sierras and onto the California coastline (National Geographic Society 1987)

State Range: According to Andrews and Righter (1992) a population is known in the southeastern portion of the San Luis Valley, but this species is probably most common in northwestern Colorado, in Moffat County (Kingery 1998). This species is known from Costilla, Alamosa, and Saguache Counties in the San Luis Valley (CNHP 1997).

Habitat Comments: Sage sparrows select sizable, low-elevation stands of sagebrush or mixed sagebrush and greasewood for nesting (Kingery 1998). However, high-country and plains sagebrush do not make suitable nesting habitat for this species, nor do sagebrush parks of less than 30 acres (Knick and Rotenberry 1995).

Distribution/Abundance: Sage sparrows occur locally in the lower elevation sagebrush steppes of western Colorado (Kingery 1998). There are at least 12 occurrences in Mesa County and perhaps more than 50 in Moffat County. This species occurs locally despite the abundance of available habitat (Andrews and Righter 1992), which may suggest that it selects for particular habitat features as yet unknown to us. This species is considered of conservation concern within the state because of a loss in sagebrush shrubland habitat occurring throughout its range and the species' relatively small numbers.

Known Threats and Management Issues: The losses of sagebrush shrubland habitat occurring throughout its range as well as the relatively low population size are two factors that threaten this species (CNHP 2008). Some of the activities that reduce or fragment sagebrush habitat include land conversion to tilled agriculture, urban and suburban development, and road and power-line rights of way.

Short-eared Owl (*Asio flammeus*)

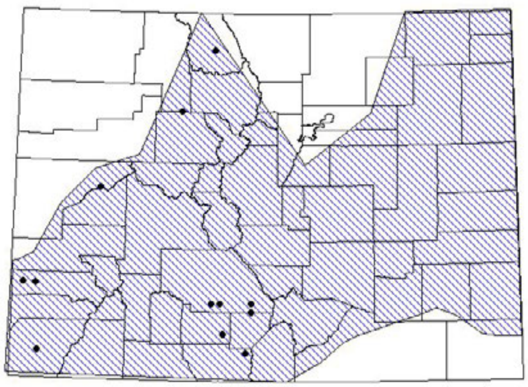
Taxonomy:
Class: Aves
Order: Strigiformes
Family: Tytonidae
Genus: *Asio*

Taxonomic Comments: The genetic distance (based on allozyme data) between *Asio otus* and *A. flammeus* is unusually large for congeneric bird species; further study of their phylogenetic relationships is warranted. Eight or nine subspecies are recognized, of which five or six are island endemics. *Asio f. flammeus*, the nominate form, is the only subspecies recognized in North America (Holt and Leasure 1993).

CNHP Ranking: G5 S2B

State/Federal Status: USFS sensitive species.

Phenology: In Colorado short-eared owls nests and fledges their young between Late-May and August (Kingery 1998).



Colorado distribution (Andrews and Righter 1992, Kingery 1998, CNHP data)

Global Range: The breeding range in North America extends from northern Alaska to northern Labrador, south to California, Utah, Colorado, Missouri, Illinois, Ohio, and Virginia.

State Range: In Colorado short-eared owls breed in North Park, the San Luis Valley, and northeastern Colorado. There are a few breeding records from southeastern Colorado and the Four Corners areas, which suggest very scattered breeding populations in those areas (Kingery 1998).

Habitat Comments: The short-eared owl inhabits open fields, marshes, dunes, and grasslands (National Geographic Society 1987), as well as shrub-steppes and agricultural lands (Kingery 1998). They nest on the ground amid vegetation tall and dense enough to conceal the incubating female (Clark 1975).

Wilson's Phalarope (*Phalaropus tricolor*)

Taxonomy
Class: Aves
Order: Charadriiformes
Family: Scolopacidae
Genus: *Phalaropus*

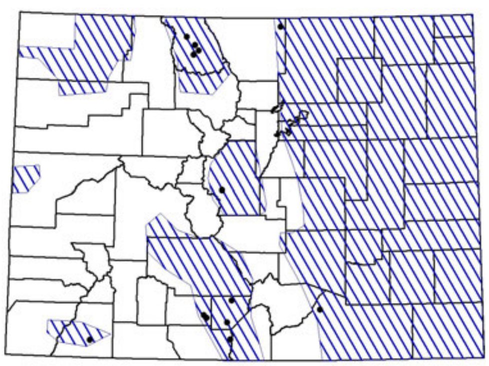
Photo © Don Baccus, dhogaza@pacifier.com

Taxanomic Comment: None.

CNHP Ranking: G5 S4B S4N

State/Federal Status: None

Phenology: Wilson's phalarope initiate nesting in Colorado around mid-May and egg-laying begins around the beginning of June (Kingery 1998). Nests with young are present from June to July and fledging ends in early August (Kingery 1998). Southward migration begins in mid-June (mostly females).



Colorado distribution (Andrews and Righter 1994, Kingery 1998,CNHP data)

Global Range: Wilson's phalarope is known from nearly all of the U. S. and the southern provinces of Canada. They have a large breeding range, mainly in the interior portion of western North America and the Great Lakes region. The birds migrate northward through U.S. (mostly over interior prairies west of Mississippi River, uncommon along east coast) mainly in April-May (Terres 1980).

State Range: Wilson's phalaropes are widespread in migration and are found wherever there is open water. In summer, they breed in more restricted areas. They are common in the San Luis Valley and in North Park, but are more uncommon in North Park, Western Valleys, and on the Great Plains (Andrews and Righter 1992).

Habitat Comments: Wilson's phalarope nest in shallow marshes and wet meadows (AOU 1998). They nest on the ground in wet meadows, grassy marshes, and along edges of shallow inland waters. The nest is a well-concealed scrape, lined with grass. The wetlands they have the following three characteristics: open water, emergent vegetation, and open shoreline (Hohn 1967, Prescott et al. 1995, Naugle 1997). Nesting habitat varies widely, including wetlands, wet meadows, upland grasslands, and road rights-of -way (Hohn 1967, Faanes and Lingle 1995, Dinsmore and Schuster 1997)

Distribution/Abundance: Although this species is common during the migration, Kingery (1998) confirmed only 21 nests in Colorado, mostly in the San Luis Valley and South Park. No population estimates are available for Colorado, but based on its historical abundance, the species is probably in decline due to the draining of wetlands on the Great Plains (Kingery 1998). The species' low population compared to historical accounts, disturbance to breeding areas, and lack of protected breeding habitat are factors contributing to their status as a bird of conservation concern.

Known Threats and Management Issues: Although globally secure, locally the birds may be limited by suitable habitat. The species has declined in some areas due to loss and degradation of wetlands. It is an “accidental and unsuitable host” of the Brown-headed Cowbird (*Molothrus ater*), an obligate brood parasite. Studies have found that grasslands and previously grazed areas provided habitat for nesting, but areas with cattle present during the breeding season are less suitable (Renken and Dinsmore 1987, Kantrud and Higgins 1992).

FISH

Suckermouth Minnow (*Phenocobius mirabilis*)

Photo courtesy USGS, http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=617

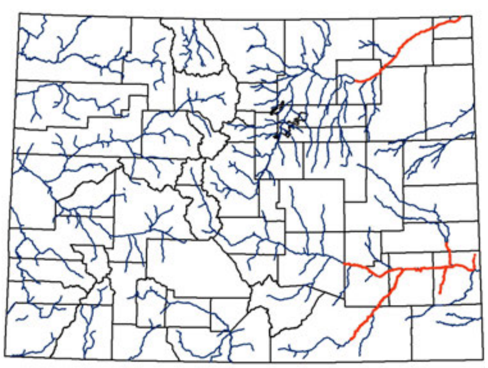
Taxonomy
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Phenocobius*

Taxanomic Comment: None.

CNHP Ranking: G5 S2

State/Federal Status: State endangered (Colorado)

Phenology: Suckermouth minnows are year round residents of eastern plains streams in Colorado. They have a long reproductive period that extends from April through August, which may be an adaptation to the fluctuations in the flows of plains streams (Woodling 1985).



Colorado distribution (Hanophy 2006)

Global Range: Suckermouth minnows native range extended from the Mississippi River basin from Ohio and West Virginia to Wyoming, Colorado, and New Mexico, and from southeastern Minnesota to northern Alabama and southern Oklahoma; western Lake Erie drainage, Ohio. Isolated populations occur in some Gulf Coast drainages including Sabine Lake, Louisiana and Texas, Galveston Bay, Texas, Colorado River, Texas, and upper Pecos River, New Mexico (Page and Burr 1991).

State Range: In Colorado, suckermouth minnows are limited to the eastern plains in the mainstem of the South Platte and in lower reaches of the Purgatoire River, and the lower mainstem and some tributaries of the Arkansas River.

Habitat Comments: Suckermouth minnows are usually found in riffle areas of warm prairie streams of all sizes with low to moderate currents and year round flows. It is tolerant of silty waters and does not appear to require permanent flows. Their preferred substrate is gravel and sandy gravel and they live on riffle bottoms in both mid-channel and side-channel areas (Woodling 1985).

Distribution/Abundance: The suckermouth minnow occurs throughout most of the Mississippi River basin. In Colorado, the species is limited to the eastern plains including portions of the mainstem South Platte River, some tributaries of the Arkansas River (Woodling 1985).

Colorado's populations are at the western margin of the species' range. Threats appear to remain high for the species, primarily taking the form of habitat loss through alteration of hydrological regime. Populations of the western tributaries of the South Platte River may be extirpated (Propst 1982) and declining sharply in the remainder of the South Platte, although not in the Arkansas River (Tom Nesler, pers. comm.). The species is ranked as state-imperiled (S2) because of its limited range in Colorado and consistent declines throughout its range.

Known Threats and Management Issues: Threats appear to remain moderately high for this species. This may be due to the species' narrow food niche and habitat deterioration as a result of increased siltation, water diversion, and nutrient enrichment (Propst 1982). Other potential threats include: fragmentation by diversions, culverts, or other structures, competition or predation by exotics, and hydrologic changes to parameters such as turbidity and intermittency. For some native fishes, decreases in turbidity and increased late summer flows that reduce intermittency may be a negative impact; especially if those conditions favor non-native predators or competitors.

Flathead Chub (*Platygobio gracilis*)

Taxonomy
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Platygobio*

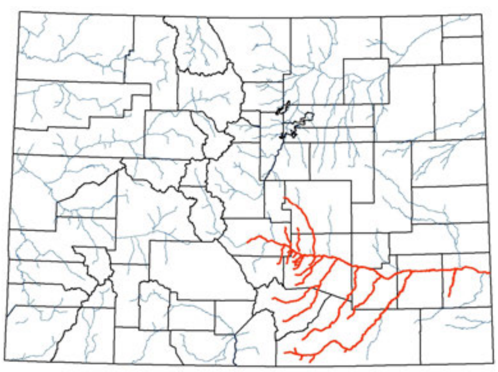
Photo by Garold Sneegas

Taxonomic Comment: The flathead chub was removed from the genus *Hybopsis* and returned to the monotypic genus *Platygobio* by Mayden (1989) and by Coburn and Cavender (1992). This treatment was followed by Sublette et al. (1990) and in the 1991 AFS checklist (Robins et al. 1991).

CNHP Ranking: G5 S3

State/Federal Status: USFS and BLM sensitive species; state species of special concern (Colorado).

Phenology: Flathead chubs are year round residents of eastern plains streams in Colorado. Little is known about the biology of this species, but it is thought that they spawn in early spring because larval chub are present in late May (Woodling 1885).



Colorado distribution (Hanophy 2006)

Global Range: Flathead chubs are widely distributed that ranges from the McKenzie River in Canada south through the plains states bordering the Rocky Mountains to New Mexico and Arkansas (Woodling 1985).

State Range: In Colorado, flathead minnows are restricted to the Arkansas River Basin of the eastern plains. Populations extend up the mainstem of the Arkansas to Florence, Colorado (Woodling 1985).

Habitat Comments: Flathead chubs are usually found in turbid flowing (moderate to strong current) waters in main channels of small to large rivers (Woodling 1985). They inhabit shallow to fairly deep water over mud, rock, or sand. In Kansas, they have been reported in shallow pools, but also in strong current over clean sand bottoms (Collins et al. 1995). Flathead chubs may move into smaller streams to spawn (Scott and Crossman 1973).

Distribution/Abundance: The flathead chub occurs throughout a large portion of central North America occurring from Canada to the State of New Mexico. However, they have decreased in abundance in the lower Missouri River as a result of human-caused changes in the river (e.g., reservoir construction) and could be extirpated from the lower river if trends continue (Grady and Milligan 1998). In Colorado, the species is limited to the Arkansas River Basin (Woodling

1985). Colorado's population is ranked as state-imperiled (S3) because of its limited range and consistent declines throughout its range.

Known Threats and Management Issues: Flathead chubs are threatened in the southern part of the range by the construction of dams and reservoirs. Dewatering and stream channelization have modifies the flood regime and contributed to declines in Kansas (Collins et al. 1995). Backwater productivity may contribute importantly to the prey base, so reduction in natural flooding patterns may be detrimental (Fisher et al. 2002). As a result, dams and other impoundment structures should be prohibited in Flathead chub habitat. Flathead chub are extirpated from the upper Arkansas River in Colorado, apparently due to pollution from mining. The recolonization of the upper Arkansas after water quality improvement appears to be prevented by a large water diversion structure (Woodling 1985).

INVERTEBRATES

Colorado Blue (*Euphilotes rita coloradensis*)

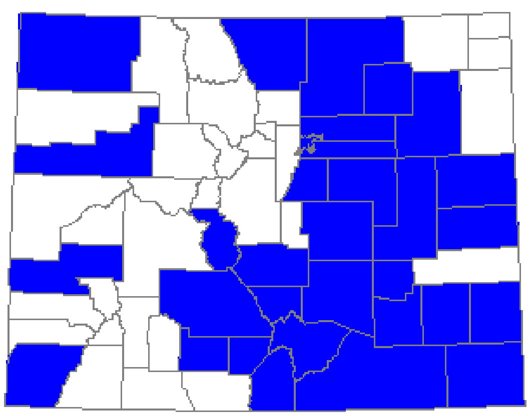
Taxonomy:
  Class: Insecta
  Order: Lepidoptera
  Family: Lycaenidae
  Genus: *Euphilotes*

Taxonomic Comments: There are four recognized subspecies of *Euphilotes rita* in North America: *rita*, *coloradensis*, *spaldingi*, and *mattoni* (Miller and Brown 1981).

CNHP Rank: G3G4T2T3 S2

State/Federal Status: None.

Phenology: One flight, mostly August (Scott 1986). Brood coincides with blooming of hostplant. Adults nectar exclusively on larval hostplant and are most easily encountered there (Stanford pers. comm).



Global Range: The buckwheat blue, *Euphilotes rita* is distributed exclusively in the southwestern United States, from the Mojave Desert of southern California to New Mexico and northward from Nevada to Utah, northern New Mexico, and southern Wyoming.

State Range: Subspecies *coloradensis* distributed from eastern Colorado (east of the divide) north to south-central Wyoming (Scott 1986). Known from 27 counties east of the Continental Divide in Colorado (Opler et al. 2006): Adams, Alamosa, Arapahoe, Baca, Bent, Chaffee, Cheyenne, Costilla, Crowley, Custer, Denver, Douglas, El Paso, Elbert, Fremont, Kit Carson, Larimer, Las Animas, Lincoln, Morgan, Otero, Prowers, Pueblo, Rio Grande, Saguache, Washington, Weld. (Subspecies *rita* is known from four counties west of the Divide in Colorado: Garfield, Moffett, Montezuma, and Montrose).

Habitat Comments: This subspecies is encountered in Upper Sonoran Desert and plateau country and in undisturbed prairies from 1524 to 2133m in elevation (5000 to 7000 ft.) (Ferris and Brown 1981). Found in undisturbed prairie sites where the food plant, bushy eriogonum, (*Eriogonum effusum*) grows abundantly (Stanford pers. comm). Habitats require light to moderate grazing by wildlife or cattle. The larval hostplant is bushy eriogonum (*Eriogonum effusum*) and other *Eriogonum*.

Distribution/Abundance: The full species is widespread and common in the southwestern United States the Colorado blue subspecies is a regional endemic, restricted to eastern Colorado and extreme southeastern Wyoming (Opler et al 2006). The distribution is spotty and local and the species occurs only where the conditions are appropriate for the host plant. For these reasons, the Colorado blue is considered as state-imperiled (S3).

Known Threats and Management Issues: Threats to habitat include cropland conversion of prairie habitat, removal of grazing regimes, weedy invasions, and suburban development, all resulting in habitat fragmentation. Some grazing is needed to prevent crowding out of the host plant by grasses.

Elsa Sphinx (*Sagenosoma elsa*)

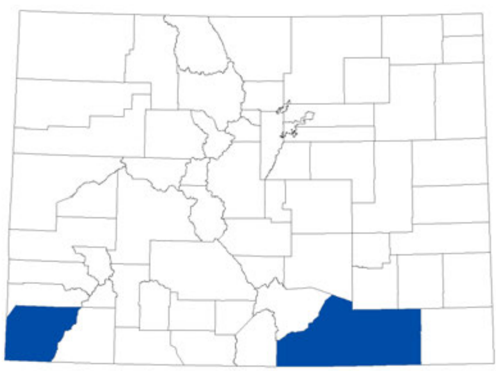
Taxonomy:
- Class: Insecta
- Order: Lepidoptera
- Family: Sphingidae
- Genus: *Sagenosoma*

Taxonomic Comments: None.

CNHP Rank: G4 S1?

State/Federal Status: None.

Phenology: Little is known about the life cycle of the elsa sphinx moth, but it occurs from at least May through July and it may have a longer flight period (Opler et al 2006).



Colorado distribution (Opler et al. 2006)

Global Range: Elsa's sphinx has a limited distribution and ranges from southern Utah and southern Colorado south to Arizona and New Mexico (Opler et al. 2006).

State Range: In Colorado the species has been recorded in the extreme southwest and extreme south east portions of the state (Opler at al. 2006).

Habitat Comments: The habitat associations for this species have not been reported (Opler et al 2006).

Distribution/Abundance: Little is known about the range-wide distribution and abundance of this species range. There is only one record of this species in CNHP's database and it is from Las Animas County.

Known Threats and Management Issues: No information on the threats for this species is currently available (Opler et al. 2006). More research is needed on the population status of and the ecological requirements of this species from throughout its range.

Northern Oak Hairstreak (*Satyrium favonius ontario*)

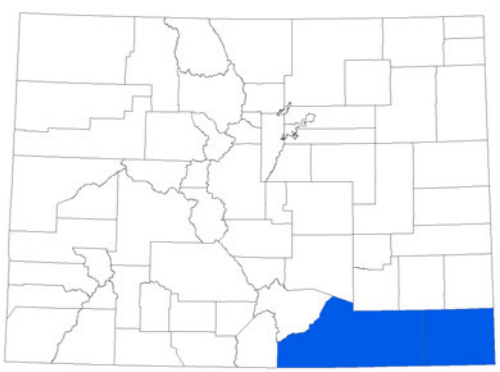
Taxonomy:
- Class: Insecta
- Order: Lepidoptera
- Family: Lycaenidae
- Genus: *Satyrium*

Taxonomic Comments: The species was previously placed in *Fixsenia* and *Harkenclenus*, but is now placed in *Satyrium* (Opler and Warren 2002). The northern oak hairstreak intergrades in SC to subspecies *favonius*. The two were formerly treated as separate species. *S. favonius* is sometimes placed in the genus *Euristrymon*.

CNHP Rank: G3G4T2T3 S2

State/Federal Status: None.

Phenology: One flight, mostly in May and June (Scott 1986). Brood coincides with blooming of hostplant. Adult's nectar on flowers (Opler et al 2006).



Colorado Distribution (Opler *et al*. 2006)

Global Range: The northern oak hairstreak is distributed from Ontario (formerly), Massachusetts south spottily to Georgia; west to Michigan, Kansas, Colorado, and Arizona. This species is widespread, but very local.

State Range: Subspecies *ontario* occurs only in extreme southeastern Colorado in Baca and Las Animas counties.

Habitat Comments: The northern oak hairstreak inhabits a variety of dry oak dominated forest and woodland situations including sometimes barrens. The larval host plant includes a variety of oaks (*Quercus* species including *gambelii*).

Distribution/Abundance: The full species is widespread in the eastern United States the, but Colorado is at the northwestern edge of the species range and it is quite rare in the state (Opler et al. 2006) In Colorado, the distribution is spotty and local and the species occurs only where the conditions are appropriate for the host plant. For these reasons, the species is considered as state rare (S2).

Known Threats and Management Issues: The main threat to the conservation of butterflies is the loss of habitat and loss of butterfly food plants. Protection of the larval food plant, *Quercus gambellii*, in southeastern Colorado is the main management activity needed to preserve the northern oak hairstreak in the state.

Simius Roadside Skipper (*Amblyscirtes simius*)

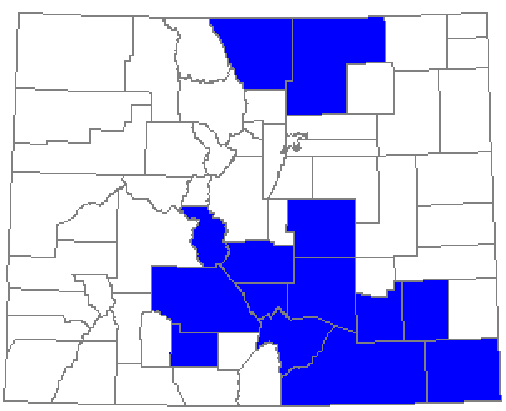
Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Hesperiidae
Genus: "*Amblyscirtes*"

Taxonomic Comments: No subspecies reported for the simius roadside skipper (Miller and Brown 1981). This species may belong in a separate genus because of mating habits and genitalic differences uncharacteristic for the genus *Amblyscirtes* (Scott 1986).

CNHP Rank: G4 S3

State/Federal Status: None.

Phenology: *Adult stage*: In the Rocky Mountain region, the flight period begins in late-May and continues through July, depending on elevation and latitude (Scott 1986, Ferris and Brown 1981). The adult stage occupies from five to seven days in nature, depending on the weather, and current moisture conditions. This species is usually uncommon, but may swarm briefly in wetter years (Ferris and Brown 1981). Males are usually active very early in the day. In sunny, calm weather, males perch on hilltops and small prairie prominence to await females, usually from 7:30 to 10:30 in the morning (Scott 1986, Ferris and Brown 1981). *Early stages*: The eggs are laid singly under the leaves of the hostplant (Scott 1986).



Colorado Distribution (Opler *et al*. 2006)

Global Range: In shortgrass prairie, ranges from southern Saskatchewan south to Sonora, Mexico, through Montana, Wyoming, Colorado, Arizona, New Mexico, and Texas (Scott 1986, Ferris and Brown 1981).

State Range: Known from 14 counties in Colorado (Opler et al. 2006): Baca, Bent, Chafee, Custer, El Paso, Fremont, Huerfano, Larimer, Las Animas, Otero, Pueblo, Rio Grande, Saguache, and Weld.

Habitat Comments: The Simius roadside skipper occupies shortgrass and mixed-grass prairie and open pinyon-juniper or ponderosa pine woodland up to 2800m (9000 ft.) (Scott 1986, Ferris and Brown 1981). This species occurs in hilly prairie, and there seems to be a correlation with shaley substrates (Stanford pers., comm.).

Larval Hostplant: The known hostplant is blue grama (*Bouteloua gracilis*) (Scott 1986).
Adult Food Sources: Adults sip nectar of many flowers, including blue beardstongue (*Penstemon* sp.) (Scott 1986), possibly prickly pear cactus (*Opuntia* sp.) (Opler and Krizek 1984).

Distribution/Abundance: The simius roadside skipper is very widespread occurring on shortgrass prairie from Mexico, western Texas, New Mexico and Arizona northward to the Black Hills and Saskatchewan. However, because it has a spotty distribution throughout its range and its habitat is continually being lost and fragmented make this a species of conservation concern.

Known Threats and Management Issues: Existing threats include conversion of habitat for housing developments, mismanagement of grazing regimes, or agricultural use resulting in habitat fragmentation and reduction in good cover of the hostplant. Shortgrass prairie areas containing the hostplant should be maintained as should habitats that include hilltops and abundant nectar sources.

Sulphur-tipped Clubtail (*Gomphus militaris*)

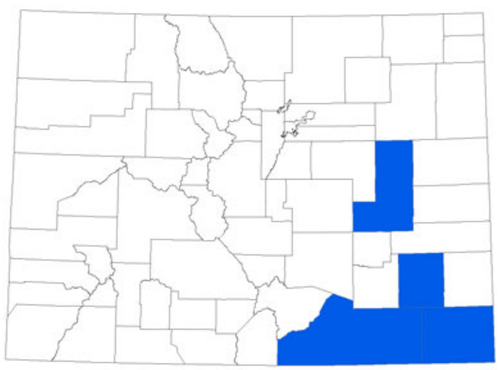
Taxonomy:
Class: Insecta
Order: Odonata
Family: Gomphidae
Genus: *"Amblyscirtes"*

Taxonomic Comments: None.

CNHP Rank: G5 S2

State/Federal Status: None.

Phenology: In Colorado, the sulphur-tipped clubtail is in flight from May to early August.



Global Range: Sulphur-tipped clubtails inhabit the southern and the shortgrass prairie from Mexico to the Nebraska-South Dakota border and including extreme eastern New Mexico and Colorado (NatureServe 2008).

State Range: The sulpur-tipped clubtail is found in southeastern Colorado and ranges north to the middle of the state. The species has been recorded from Baca, Bent, Las Animas, and Lincoln counties in Colorado (Kondratieff 2004).

Habitat Comments: The Sulphur-tipped clubtail inhabits mud-bottomed ponds, lakes, and slow parts of streams and rivers.

Distribution/Abundance: The sulphur-tipped clubtail has a limited range in Colorado with very few known occurrences. Colorado's population is ranked as state rare (S2) because of the species limited range and because of alteration, loss and draining of most of the seasonal and ephemeral wetlands of the prairie region (CNHP 2008).

Known Threats and Management Issues: Habitat destruction poses the greatest single threat to dragonflies. The most effective means of conservation is therefore to preserve as much of the critical habitat as possible, although with wetlands disappearing at such a high rate, this task is difficult. One important observation in the history of South African dragonfly conservation has been the positive effect farm dams have had on populations; with wetlands quickly being fragmented and/or destroyed, farm dams now provide some of the best sanctuaries for dragonflies (Samways 1992).

MAMMALS

Black-tailed Prairie Dog (*Cynomys ludovicianus*)

Taxonomy
Class: Mammalia
Order: Rodentia
Family: Sciuridae
Genus: *Cynomys*

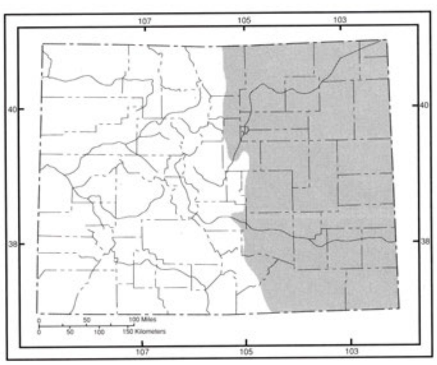
Photo © copyright by Desert USA
desertusa.com

Taxonomic Comments: Of the two recognized subspecies, only one occurs in Colorado (*Cynomys ludovicianus ludovicianus*).

CNHP Ranking: G4 S3

State/Federal Status: None.

Phenology: Black-tailed prairie dogs have only one estrous cycle and one litter per year (Fitzgerald et al. 1994) In Colorado, they breed in early February and March with gestation lasting from 30 to 35 days (Fitzgerald et al 1994. Weaning takes place in lat May and early June.



Colorado distribution (Fitzgerald et al. 1994)

Global Range: Of the five species of prairie dogs in North America, *Cynomys ludovicianus* is the most widely distributed (Hoogland 1996). Today the species occurs in isolated patches throughout its historical range, which included much of the Great Plains from southern Saskatchewan (Canada) to northern Mexico (Hoogland 1996).

State Range: In Colorado, black-tailed prairie dogs occupy suitable habitat in the eastern 40 percent of the state, inhabiting shortgrass prairie and other areas of low-growing vegetation (Fitzgerald et al. 1994). Throughout its range, the species occurs in much lower densities and in smaller colonies than it did historically (Fitzgerald et al. 1994, Hoogland 1996).

Habitat Comments: *Cynomys ludovicianus* occupies shortgrass and mixed-grass prairie habitats with well-drained, friable soils that permit the construction of complex burrow systems. The shrubs and herbaceous vegetation within colonies of black-tailed prairie dogs tend to be shorter than those located within colonies of Gunnison's and white-tailed prairie dogs because black-tailed prairie dogs clip tall plants (without eating them) to increase the detection of approaching aerial and terrestrial predators (King 1955, Pizzimenti 1975, Fitzgerald et al. 1994, Hoogland

1995). Through their foraging behavior and their clipping of tall plants, black-tailed prairie dogs have dramatically changed the composition of plant communities throughout their range (Hoogland 1996). In addition, the presence of prairie dog towns greatly increases the zoological diversity of prairie ecosystems by attracting predators and many other animals (i.e., Tyler 1970, Campbell and Clark 1981, Clark et al. 1982, Hoogland 1995).). In addition, the presence of prairie dog towns greatly increases the zoological diversity of prairie ecosystems by attracting predators and many other animals (i.e., Tyler 1970, Campbell and Clark 1981, Clark et al. 1982, Hoogland 1995).

Distribution/Abundance: The Black-tailed prairie dog remains a common species in Colorado. The range is large and total numbers are high. Trends are probably stable at this time; however, current populations are restricted in distribution compared to early historic records, which is the reasoning behind their status as a state-imperiled (S3) mammal. A few populations are protected in local government open spaces, national grasslands, and on well managed private ranches.

Known Threats and Management Issues: Black-tailed prairie dogs have been subjected to extermination programs (public and private) for more than 100 years (Hoogland 1995). Outbreaks of plague (caused by the bacillus *Yersinia pestis* and transmitted by fleas) continue to reduce or even eliminate some colonies (Barnes 1982, Ebasco Serv., Inc. 1989). As in the past, however, the greatest threats to black-tailed prairie dogs come from humans due to conflicts with agricultural and other economic interests.

Southern Plains Woodrat (*Neotoma micropus*)

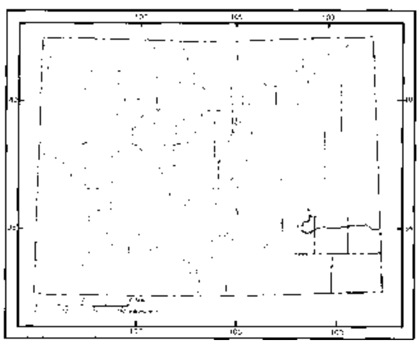
Taxonomy
Class: Mammalia
Order: Rodentia
Family: Cricetidae
Genus: *Neotoma*

Taxonomic Comments: This southern plains woodrat hybridizes with *N. floridanus* in Oklahoma, but introgression apparently is insubstantial. The species may hybridize with *N. leucodon* in southeastern Colorado, western Oklahoma, northern Texas, Chihuahua, and possibly Coahuila (Braun and Mares 1989).

CNHP Ranking: G5 S3

State/Federal Status: None.

Phenology: Southern plains woodrats are capable of having one or two litters per year (Fitzgerald et al. 1994). Gestation lasts usually 33-35 days after which 2 to 3 young are born. Young are weaned reportedly in 30 days or 20-28 days. Females will breed within 1 year of being born (females born in early spring may breed in summer of same year).



Colorado distribution (Fitzgerald et al. 1994)

Global Range: The range of the southern plains woodrat extends from southeastern Colorado to south-central Kansas, southward through western Oklahoma, Texas, New Mexico, and northeastern Mexico (northern Chihuahua, eastern San Luis Potosi, and southern Tamaulipas) (NatureServe 2008).

State Range: In Colorado, the species is largely restricted to the eastern plains, south of the Arkansas River (Fitzgerald et al 1994).

Habitat Comments: The southern plains woodrat inhabits a variety of semiarid and desert grassland, particularly shortgrass prairie with cholla, and desert shrubland. Woodrats will build houses at the base of a cholla and will sometimes den under a rock ledge or on a rock outcrop (Fitzgerald 1994).

Distribution/Abundance: The Southern Plains woodrat is documented from the southeastern plains of Colorado south of the Arkansas River (Armstrong 1972), with a few specimens from Crowley and Bent counties north of the river (Fitzgerald et al. 1994). Data and observations suggest that this species is not abundant in Colorado and is susceptible to human disturbance. The species is considered globally secure (G5), but vulnerable in Colorado (S3) because of its restricted state range and potential sensitivity to some land management regimes.

Known Threats and Management Issues: No threats are reported for the southern plains woodrat.

Swift Fox (*Vulpes velox*)

Photo by J. P. Gionfriddo

Taxonomy
Class: Mammalia
Order: Carnivora
Family: Canidae
Genus: *Vulpes*

Taxonomic Comments: Some taxonomists consider swift foxes and kit foxes (*Vulpes macrotis*) to be distinct subspecies within a single species which they designate *Vulpes velox*. We follow the more common classification in which these two foxes are regarded as distinct species (NatureServe 2008).

CNHP Ranking: G3 S3

State/Federal Status: Forest Service sensitive; species of special concern (Colorado).

Phenology: Swift fox mate from late December to February and the young are born from March to early May following a gestation period of 51 days (Fitzgerald et al. 1994). Four to five offspring are produced per female and they first come above ground at four to five weeks of age (Fitzgerald et al. 1994). Young of the year disperse in September and October and females may breed in their first year (Fitzgerald et al. 1994).

Colorado distribution (Fitzgerald et al. 1994)

Global Range: Swift foxes formerly occurred throughout the Great Plains from Canada to Texas. Populations were severely depleted from the 1830s through the 1950s. Swift fox numbers remain very low throughout the northern portion of the species' former range (NatureServe 2008).

State Range: In Colorado, swift foxes inhabit the eastern third of the state, where they live in low densities on areas of native shortgrass prairie (Fitzgerald et al. 1994).

Habitat Comments: Swift foxes inhabit shortgrass, midgrass, and mixed-grass prairies, where they prefer well-drained, friable soils (Bee et al. 1981, Nowak 1999). Dens are excavated on slopes, ridges, or flat areas that afford good views of surrounding lands (Fitzgerald et al. 1994).

Distribution/Abundance: In Colorado, this species is known from the eastern plains of the state (Fitzgerald et al. 1994), which is the south-central part of the species' range (Fitzgerald et al.

1994). Historical numbers of this species were greatly reduced as a result of predator control programs, but the species has been experiencing local recoveries in Colorado and in nearby states (J. Fitzgerald, pers. comm.). Current surveys by the CDOW and the University of Northern Colorado determined that the swift fox is relatively common in appropriate habitat (shortgrass prairie) (J. Fitzgerald, pers. comm.). Banning the use of poisons on public land and reducing the use of other poison control techniques have assisted the increase in the population size of this species. Threats to the species include agricultural conversion, trapping, shooting, poisoning, and predation (Egoscue 1979, Loy 1981, Fitzgerald et al. 1994). *Vulpes velox* is considered vulnerable globally (G3) and in Colorado (S3).

Known Threats and Management Issues: Swift foxes occupy only 10 percent of their former range (Smeeton 1993, Allardyce 1995). Swift fox populations plummeted during the last half of the 18th century and the early 19th century as a consequence of widespread and indiscriminate poisoning that targeted wolves (*Canus lupus*) (Stephens and Anderson 2005). Other factors responsible for the reductions in their distribution and population sizes include trapping, hunting, predator and rodent control programs, attacks by unleashed dogs, collisions with automobiles, and habitat loss (Bailey 1926, Kilgore 1969, Hillman and Sharps 1978). Swift foxes are not as cautious as many other canids and so they are trapped and poisoned relatively easily (Egoscue 1979). In southeastern Colorado, predation by coyotes is a major source of mortality of swift foxes (Andersen et al. 1998).

Townsend's Big-eared Bat (*Corynorhinus townsendii*)

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

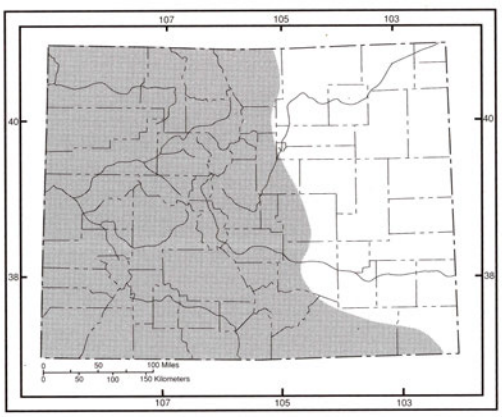
Photo copyright © CNHP

Taxonomic Comments: The generic name was recently changed from *Plecotus* to *Corynorhinus*.

CNHP Ranking: G4T4 S2

State/Federal Status: BLM sensitive; USFS sensitive; state species of undetermined status (Colorado).

Phenology: The Townsend's big-eared bat hibernates from early fall through early spring. Young are born in May or June (only one offspring per female). The females congregate in nursery colonies where they share metabolic heat; warm nursery sites are critical for the survival of the young (Humphrey and Kunz 1976). No long-distance migrations have been reported for *C. townsendii* (Barbour and Davis 1969, Fitzgerald et. al 1994). Site fidelity is high and individual bats tend to return each year to the same hibernation (Humphrey and Kunz 1976) and nursery (Pearson et. al 1952) roosts.



Colorado distribution (Fitzgerald et al. 1994)

Global Range: Townsend's big-eared bat is widely distributed throughout western North America.

State Range: *Corynorhinus townsendii* occurs throughout Colorado except on the eastern plains, and is found in mines, caves, and human-made, cave-like structures at elevations up to 9,500 ft (2,930 m) (Colorado Division of Wildlife 1984).

Habitat Comments: Townsend's big-eared bats occur in a wide range of habitats including semi-desert shrublands, pinyon-juniper woodlands, and dry coniferous forest (Fitzgerald et al. 1994). Because they naturally roost (and hibernate) in caves, their presence is strongly correlated with the availability of caves or cave-like roosting sites (Pierson et al. 1999). Population densities are highest in areas with substantial surface exposures of cavity-forming rock (i.e., limestone, sandstone, gypsum, or volcanic) and in old mining areas (Pierson et al. 1999). Hibernacula generally are characterized by stable low temperatures and moderate airflow (Colorado Division of Wildlife 1984) and they are thought to be a population limiting factor for Townsend's big-eared bats (Fitzgerald et al. 1994). Big-eared bats emerge from their daytime roosts after dark and feed on insects (especially moths) which they capture in flight or glean from foliage

(Colorado Division of Wildlife 1984, Nowak 1999). Much of their feeding occurs over water or sagebrush, or along the edges of patches of vegetation (Fitzgerald et. al 1994)

Distribution/Abundance: Only 11 maternity roosts and 30 hibernacula have been documented in Colorado (Pierson et. al 1999). Almost all known colonies in Colorado are very small (< 30 bats); known historical records of big-eared bats in Colorado include only about 350 individuals (Pierson et. al 1999). Available evidence suggests that dramatic declines in the sizes of Colorado colonies of big-eared bats may have occurred historically (Pierson et. al 1999).

Known Threats and Management Issues: Townsend's big-eared bats have very specific habitat requirements with regard to temperature and humidity levels at roosting sites; relatively few sites offer conditions appropriate for roosting by these bats (see refs. cited by Pierson et. al 1999). Moreover, *C. townsendii* is highly vulnerable to human disturbance (Colorado Division of Wildlife 1984, Nowak 1999). Unlike many other species of bats, Townsend's big-eared bats do not seek shelter in protected crevices when roosting, but instead they cluster in highly visible locations (i.e., cave ceilings) where they are easily disturbed (Handley 1959, Barbour and Davis 1969). In Colorado, human visitation and disturbance rates at nursery and hibernation caves are very high (Pierson et. al 1999). In addition to human disturbance, other factors that threaten *C. townsendii* include the closure of abandoned mines (loss of roosting habitat), the impoundment of toxic materials (direct mortality), pesticide spraying (reduction of insect prey base), vegetation conversion and livestock grazing (loss of foraging habitat), and timber harvesting (loss of foraging and roosting habitats) (Pierson et. al 1999).

Yellow-faced Pocket Gopher (*Cratogeomys castanops*)

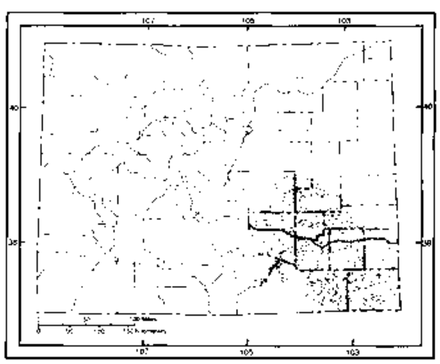
Taxonomy
Class: Mammalia
Order: Rodentia
Family: Geomyidae
Genus: *Cratogeomys*

Taxonomic Comments: This yellow-faced pocket gopher was formerly regarded as a subgenus of *Pappogeomys* (Wilson and Reeder 2005)

CNHP Ranking: G5 S4

State/Federal Status: None.

Phenology: Yellow-faced pocket gophers breeds from March to June and produce more than one litter per year with from one to five offspring per litter (Fitzgerald et al. 1994).



Colorado distribution (Fitzgerald et al. 1994)

Global Range: In U.S.: The yellow-faced pocket gopher ranges from the Arkansas River drainage in southeastern Colorado and western Kansas south through Oklahoma Panhandle, western Texas, and eastern New Mexico to the Rio Grande; also immediately east of Rio Grande in central New Mexico. (NatureServe 2008).

State Range: In Colorado, the species is largely restricted to the eastern plains, south of the Arkansas River (Fitzgerald et al. 1994).

Habitat Comments: The southern plains woodrat inhabits a variety of semiarid and desert grassland, particularly shortgrass prairie with cholla, and desert shrubland. Woodrats will build houses at the base of a cholla and will sometimes den under a rock ledge or on a rock outcrop (Fitzgerald et al. 1994).

Distribution/Abundance: The Yellow-faced pocket gopher is found in almost 20% of Colorado in 13 counties. They are not uncommon and appear largely unthreatened; however, there are few protected occurrences and trends are downward, perhaps from competition with other gophers. The species is considered globally secure (G5), and secure in Colorado (S4) because of its wide distribution and abundant numbers.

Known Threats and Management Issues: There are no documented threats to the species in Colorado; however, local displacement by Geomys may warrant monitoring.

REPTILES

Black-necked Gartersnake (*Thamnophis cyrtopsis*)

Taxonomy
Class: Reptilia
Order: Squamata
Family: Colubridae
Genus: *Thamnophis*

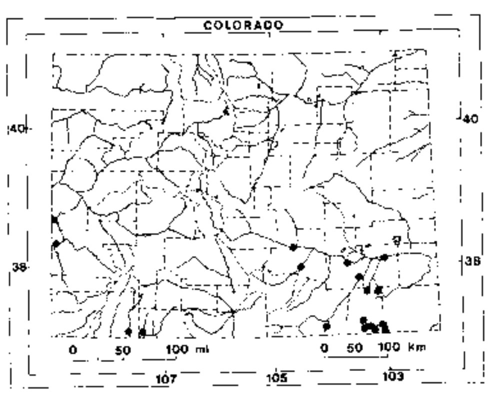
Photo copyright © CNHP

Taxonomic Comments: *Thamnophis cyrtopsis* was for many years referred to as *T. eques*. *Thamnophis cyrtopsis* includes "*Thamnophis vicinus*," formerly regarded as a distinct species but now regarded as a localized color pattern morph of *T. cyrtopsis* occurring in Michoacan, Mexico (NatureServe 2008).

CNHP Ranking: G5 S2?

State/Federal Status: None.

Phenology: In Colorado, black-necked gartersnakes leave their hibernacula in mid-April and remain active through September (Hammerson 1999). Reproduction in Colorado is not well known (Hammerson 1999). Newborn have been observed in August in Colorado. Farther south births have been recorded in April with four broods observed (14 to 22 young) from late June to mid-July (Hammerson 1999).



Colorado distribution (Hammerson 1999)

Global Range: The range of this species extends from southern Colorado and Utah south through Arizona, New Mexico, western and central Texas, and much of Mexico to Guatemala, at elevations from near sea level to around 2,700 meters (8,700 feet) (NatureServe 2008). The distribution is spotty in many areas.

State Range: In Colorado, the species occurs in the southeastern Colorado, in Mesa County in west-central Colorado, and in southwestern Colorado in Archuleta and La Plata counties at or below 6,500 feet (Hammerson 1999).

Habitat Comments: This snake occurs in a wide range of habitats, from desert flats, dry grasslands, and tropical lowlands to pine-oak habitats and cloud forest in mountains. In the southwestern United States it is often in the vicinity of permanent and intermittent streams, spring seepages, and irrigation canals, usually in canyons, foothills, or mountains (Stebbins 2003). It inhabits rocky hillsides and limestone ledges, and wooded ravines and cedar brakes, in the Texas Hill Country (Tennant 1984). This snake wanders far from water into adjacent grassland, desert, woodland, and shrubland, but mostly it is restricted to the vicinity of consistent water sources in the arid Southwest (Jones 1990).

Distribution/Abundance: The black-necked gartersnake occurs in the southwestern U.S. south to Guatemala (Stebbins 1985). The species is at the northern edge of its range in Colorado and is known from both southeastern and southwestern portions of the state (Hammerson 1999). The black-necked gartersnake is considered imperiled in Colorado (S2?) because of its relatively small state range and apparent low numbers (CNHP 2008). Several observers noted that this species occurs in low densities (Geoff Hammerson, pers. comm.; Chris Pague, unpbl. data; Lauren Livo, pers. comm.). There are no data to indicate trends.

Known Threats and Management Issues: Threats are generally low except for local mortality from road traffic.

Triploid Colorado Checkered Whiptail (*Aspidoscelis neotesselata*)

Photo copyright © CNHP

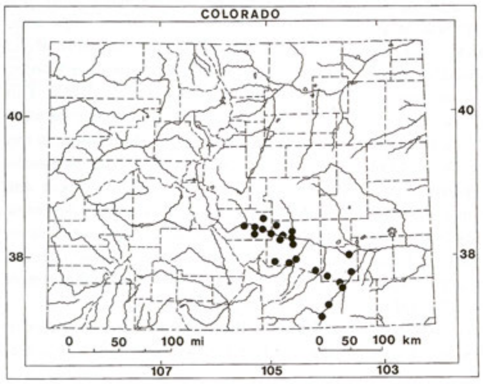
Taxonomy
Class: Reptilia
Order: Squamata
Family: Teiidae
Genus: *Aspidoscelis*

Taxonomic Comments: Reeder et al. (2002) examined phylogenetic relationships of the whiptail lizards of the genus *Cnemidophorus* based on a combined analysis of mitochondrial DNA, morphology, and allozymes. They determined that *Cnemidophorus* in the traditional sense is paraphyletic and thus in need of nomenclatural revision. Rather than subsume all cnemidophorine species (including *Kentropyx*) in a single large genus (*Ameiva*), they proposed a split that placed the North American "*Cnemidophorus*" clade in the monophyletic genus *Aspidoscelis*; under this arrangement, South American taxa remain in the genus *Cnemidophorus*.

CNHP Ranking: G2G3 S2

State/Federal Status: State special concern (Colorado).

Phenology: Females with eggs can be found from June to July and up to two clutches of one to four eggs can be produced per year (Hammerson 1999). Eggs can be retained for as short as one day or for longer than 7 days (Hammerson 1999). *Aspidoscelis neotesselata* enters hibernation between late August and mid-October and emerges in April (Knopf 1966). This species consists entirely of females and is parthenogenetic (Hammerson 1999). In parthenogenetic species, reproduction is asexual, with egg cells developing without having been fertilized by male gametes; females raised in total isolation from the egg stage to sexual maturity produce eggs that develop into fertile female offspring (Hammerson 1999). The species originated through hybridization between a female *Aspidoscelis marmoratus* and a male *Aspidoscelis septemvittatus*, followed by hybridization between one of these hybrids and a male *Aspidoscelis sexlineatus* (Walker et al. 1997a). Because members of a parthenogenetic population are genetically identical, they would be expected to tolerate and cooperate with each other to a greater extent than would be expected in a non-parthenogenetic population (Hamilton 1964a,b). Indeed, in outdoor enclosure experiments, parthenogenetic whiptails tended to share burrows much more often (and interacted aggressively much less often) than non-parthenogenetic whiptails, suggesting a greater degree of intraspecific tolerance (Leuck 1982, 1985).



Colorado distribution (Hammerson 1999)

Global and State Range: *Aspidoscelis neotesselata* occurs only in southeastern Colorado, where it is patchily distributed in Fremont, Pueblo, Otero, and Las Animas counties (Hammerson 1999). In Otero County there are several sites near Higbee, Colorado and south into adjoining Las Animas County that constitute the only area where coexistence between diploid and triploid stages in any complex of parthenogenetic *Aspidoscelis* is known to occur (Walker and Cordes 1998).

Habitat Comments: *Aspidoscelis neotesselata* occupies juniper woodland, pinyon-juniper woodland arid, rocky canyons, rocky hillsides, shrubby areas, and open savannahs associated with the Arkansas, Huerfano, Apishapa, and Purgatoire rivers and their tributaries (Walker et al. 1997a,b). The diet of *Aspidoscelis neotesselata* consists of invertebrates, including grasshoppers, beetles, caterpillars, termites, spiders, and moths (Paulissen et al. 1993). Whiptails dig burrows in which they spend the night; these burrows are defended against conspecifics and are used night after night (Knopf 1966).

Distribution/Abundance: The triploid Colorado checkered whiptail has a very limited distribution in southeastern Colorado that extends from the area of Pueblo Reservoir, south and east along the Arkansas River, and includes the canyons south of the Arkansas River in Las Animas County, Colorado. The scarcity, limited distribution, degree of threats, and lack of knowledge are all important reasons for the current rank of the triploid Colorado checkered whiptail.

Known Threats and Management Issues: Habitat loss has caused the extirpation of *Aspidoscelis neotesselata* from several sites where it formerly occurred (Walker et al. 1997b) and it continues to threaten the survival of populations of this species (Walker et al. 1997b, Walker and Cordes 1998).

Massasauga (*Sistrurus catenatus*)

Taxonomy
Class: Reptilia
Order: Squamata
Family: Viperidae
Genus: *Sistrurus*

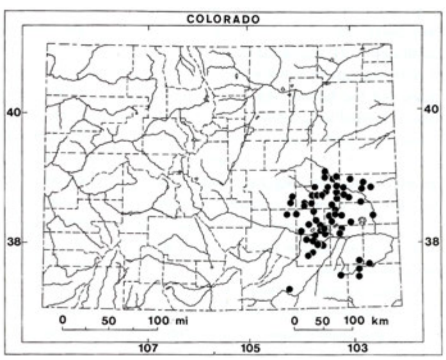
Photo by G. Hammerson

Taxonomic Comments: The eastern massasauga (also known as the pigmy rattlesnake) is a distinct species, *Sistrurus miliarius*.

CNHP Ranking: G3G4 S2

State/Federal Status: USFS and BLM sensitive species of special concern (Colorado).

Phenology: Massasauga's mate between March and November (Reinert 1981) and they are ovoviviparous (fully formed eggs are retained and hatched inside the maternal body, with the release of live offspring). Massasauga's in Colorado gave birth to litters of 5 to 7 young between late August and late September and females appear to give birth once every two years (Hobert et al. 2004).



Colorado distribution (Hammerson 1999)

Global Range: The massasauga is extirpated over most of its historical range in the United States (Mackessy 1998). The massasauga now occurs in disjunct populations that extend obliquely to the southwest from the Great Lakes region of southern Ontario and New York through the central and Great Plains states to Texas, southern New Mexico, southeastern Arizona, and Mexico (Minton 1983). Over most of its range the species occurs below 5,000 ft (1,542 m) in elevation (Minton 1983).

State Range: In Colorado, the species occurs at elevations below 5,500 ft (1,696 m) in the southeastern quarter of the state (Hammerson 1999). The greatest concentration of these snakes is found in southern Lincoln County (Mackessy 1998).

Habitat Comments: In the dry southwestern portions of their range, including Colorado, this small rattlesnake occupies river bottoms, dry grasslands, and shortgrass prairies with sandy soil (Hobert 1997, Hammerson 1999). Use of relatively cool, moist rodent burrows for shelter enables massasauga's to exploit these arid habitats without excessive loss of moisture (Ernst 1992). Massasaugas hibernate (singly) in rock crevices, rodent or crayfish burrows, hollow logs, and other protected sites ("hibernacula") from October or November through March or April (Mackessy 1998). Although they can withstand a freezing body temperature for a short time, massasauga’s select hibernacula below the frost line (Klauber 1972). Evidence of seasonal migrations between winter and summer habitats has been found in Colorado (Hobert 1997)

Distribution/Abundance: Colorado occurrences are at the western margin of the species' range and are apparently disjunct from other populations. This species occupies high plains grasslands in much of southeastern portion of the state (Hammerson 1999). The massasauga is considered imperiled in Colorado largely because of the small, disjunct range and the modest population size. Massasauga’s appear to be sparsely distributed across their historic range in Colorado, and are likely in decline in Colorado as they are over most of their range in the U.S. and Canada (Mackessy 1997).

Known Threats and Management Issues: Over much of the species' range, habitat loss and alteration has destroyed most colonies of this species (Seigel 1986). Because of their habit of resting on warm, paved roads at night, many massasauga are killed by motor vehicles (Lowe et al. 1986, Mackessy 1998). Like other rattlesnakes, massasaugas are often willfully destroyed because they are venomous, and many are taken by collectors (Klauber 1972, Lowe et al. 1986).

Texas Horned Lizard (*Phrynosoma cornutum*)

Taxonomy
Class: Reptilia
Order: Squamata
Family: Phrynosomatidae
Genus: *Phrynosoma*

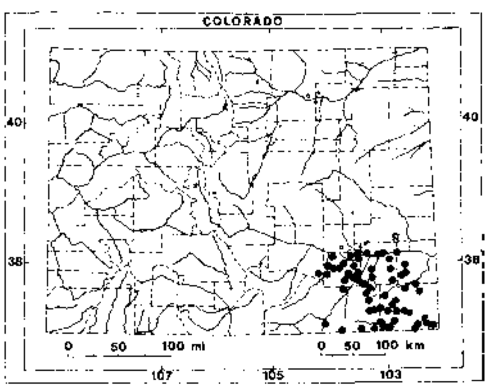
Photo copyright © CNHP

Taxonomic Comments: None.

CNHP Ranking: G4G5 S3

State/Federal Status: BLM sensitive species, State special concern (Colorado).

Phenology: In Colorado, Texas horned lizards emerge from hibernation by mid-April and activity ends by late September or early October. Texas horned lizard mate in May or June and eggs are laid from late May through July (Hammerson 1999). Clutch sizes in Colorado appear to be around 12 eggs hatchlings are present from mid-August to mid-September (Hammerson 1999).



Colorado distribution (Hammerson 1999)

Global Range: The range of the Texas horned lizard extends from extreme southwestern Missouri and central Kansas to southeastern Colorado, and south and west throughout most of Oklahoma and Texas, eastern and southern New Mexico, and southeastern Arizona to northern Mexico (Hammerson 1999). This species has been introduced and is established in several areas in the southeastern United States, including North Carolina, and elsewhere (NatureServe 2008).

State Range: In Colorado, the species occurs in the southeastern portion of the state, primarily south of the Arkansas River.

Habitat Comments: This lizard inhabits open arid and semiarid regions with sparse vegetation (deserts, prairies, playa edges, bajadas, dunes, foothills) with grass, cactus, or scattered brush or scrubby trees, especially where there is large patches of bare soil (Hammerson 1999). The lower limit of juniper growth marks the upper limit of this lizard's habitat in canyons and at the foot of mesas (Hammerson 1999). Soil may vary in texture from sandy to rocky. When inactive, individuals burrow into the soil, enter rodent burrows, or hide under rocks (Hammerson 1999).

Distribution/Abundance: This species ranges from the south-central Great Plains to northern Mexico (Stebbins 1985). Colorado is at the northern margin of its range. There are approximately 50 records known from southeastern Colorado, mostly south of the Arkansas

River (CNHP 2008). Good data on trends and abundance are lacking, but the species is common at several sites (Geoff Hammerson, pers. comm.; Mackessy et al. unpbl. data). Conservation concern stems from its restricted range, and from potential and realized threats (Price 1990). Notable declines have occurred in Texas and Oklahoma (Donaldson et al. 1994). This species has historically suffered habitat loss in Colorado and is subject to over collection for use in the pet trade (Mackessy 1997). Mortality from road traffic may also be an important local threat. Mackessy et al. (unpbl. data) found 62 individuals, 23 of which were road killed.

Known Threats and Management Issues: This species has historically suffered habitat loss in Colorado and is subject to over collection for use in the pet trade (Mackessy 1997). Mortality from road traffic may also be an important local threat. Mackessy et al. (unpbl. data) found 62 individuals, 23 of which were road killed.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation

State Common Name Xeric Tallgrass Prairie

Global Scientific Name: *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation

Global Common Name: Western Bluestem Tallgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Tall sod temperate grassland
Alliance:	Big Bluestem - (Yellow Indiangrass) Herbaceous Alliance

Global Rank: G2?

Global Rank Reasons: *Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation (CEGL001463) is considered by the Colorado Heritage Program to be a regional endemic that occurs along the eastern foothills of the Rocky Mountains in Colorado and on basalt outcrops in the southeastern portion of the state. There are twenty documented occurrences of this association in Colorado with no high-quality sites occurring. Information about the number of occurrences, areal extent or condition outside of Colorado is not available, thus the G2? rank.

Subnational Rank: S2

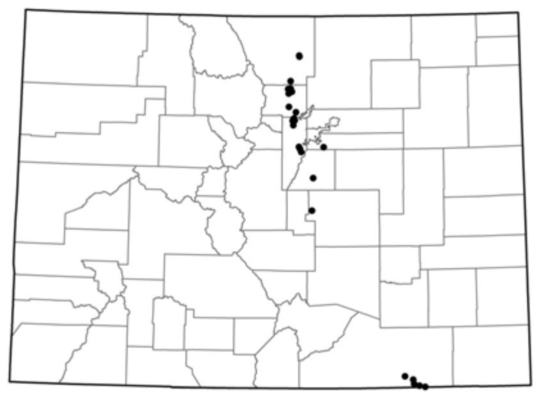
Subnational Rank Reasons: There are twenty documented occurrences of this association in Colorado. Of these occurrences, none is ranked A, five are ranked B, and forty percent are not considered viable (ranked D or H). Colorado's Front Range and southeastern Colorado have been surveyed to a large extent by the Colorado Natural Heritage Program, so few if any additional high-quality occurrences can be expected in Colorado. This association is known from about 4000 acres. Over half this amount is contained within one occurrence. Given that a vast area where this association may have formerly occurred has been developed, converted to agricultural use, or invaded by weedy species, it can be confidently assumed that this association occurs in less than ten percent of its former habitat. This association remains very threatened by development along the Front Range, gravel mining operations (e.g., near Rocky Flats), and invasion by woody species in response to a lack of fire.

General Description: This community occurs in nearly level to gently sloping (0-20% slope), park-like openings in ponderosa pine forests at 3700-4100 feet elevation. It occurs along the eastern foothills of the Rocky Mountains in Colorado and on basalt outcrops in the southeastern portion of the state. Most stands occurred on eastern or northern aspects. Mean annual precipitation is 38-48 cm. Soils are loamy: clay loam, sandy loam and sandy clay loam (Taylor and Holst 1976). Parent materials are sandstone, siltstone, and claystone (Veseth and Montagne 1980).

Vegetation: Stands are dominated by the tall grasses *Andropogon gerardii* and *Schizachyrium scoparium*. *Calamovilfa longifolia* may be common on more coarse-textured soils, whereas *Festuca idahoensis* may be common in mesic stands. *Bouteloua curtipendula* and *Carex inops* ssp. *heliophila* are other important graminoids. Common forbs include *Pediomelum argophyllum (= Psoralea argophylla)* and *Artemisia ludoviciana*. *Gutierrezia sarothrae* is a common dwarf-shrub (Taylor and Holst 1976, Culwell and Skow 1981, 1982, Pase and Thilenius 1968).

Similar Communities: The Colorado expression of this vegetation type is different enough that it may warrant splitting into two different associations. *Festuca idahoensis* does not occur in Colorado stands (while common in Montana stands), and *Muhlenbergia montana* occurs in most Colorado stands, many times common to abundant. In Colorado this type occurs on moderately clayey soils with a lot of coarse fragments in the upper horizons. One article suggests this allows good infiltration and limits evaporation, allowing the tall grasses to survive where they are probably only getting about 15 inches of precipitation per year (Branson et al. 1965).

Regional Distribution: The *Andropogon gerardii - Schizachyrium scoparium* association occurs along the eastern foothills of the Rocky Mountains in Colorado and on basalt outcrops in the southeastern portion of the state. As currently defined this association also occurs in Montana, Wyoming, and Oklahoma.



Colorado Distribution: Considered to be a regional endemic in Colorado that occurs along the eastern foothills of the Rocky Mountains and on basalt outcrops in the southeastern portion of the state.

Elevation Range in Colorado: 3,700.00 - 4,100.00 ft / 1,127.76 - 1,249.68 m

Site Geomorphology: This community is found on mesa tops, sideslopes and upper slopes on basalt, sandstone, limestone and shale.

Soil: This association occurs on moderately clayey soils with a lot of coarse fragments in the upper horizons.

Successional and Ecological Processes: Pfister et al. (1977) and Cooper and Pfister (1984) describe a *Pinus ponderosa / Andropogon* spp. Habitat Type from southeast Montana, and Hansen and Hoffman (1988) and Hoffman and Alexander (1987) describe a *Pinus ponderosa / Carex heliophila* Habitat Type from southeast Montana and the Black Hills of South Dakota. The herbaceous understory of these pine-dominated woodlands can be similar to the *Andropogon gerardii - Schizachyrium scoparium* Herbaceous Vegetation. It seems possible that the grassland type is seral to these woodland associations.

Adjacent Vegetation: Adjacent vegetation on the side slopes include *Quercus gambelii*, *Rhus trilobata*, *Cercocarpus montantus* and occassional *Pinus ponderosa* and *Juniperus* as you move higher up the slope. Bottom slopes transition into xeric shortgrass prairie.

Management: This association remains very threatened by development along the Front Range, gravel mining operations (e.g., near Rocky Flats), and invasion by woody species in response to a lack of fire.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Artemisia bigelovii / Achnatherum hymenoides* Shrubland
State Common Name Plains Escarpment Prairies (Limestone Breaks)

Global Scientific Name: *Artemisia bigelovii / Achnatherum hymenoides* Shrubland
Global Common Name: Flat Sagebrush / Indian Ricegrass Shrubland

Community Classification

System:	International Vegetation Classification
Class:	Shrubland
Subclass:	Evergreen shrubland
Group:	Extremely xeromorphic evergreen shrubland
Subgroup:	Natural/Semi-natural extremely xeromorphic evergreen shrubland
Formation:	Broad-leaved and microphyllous evergreen extremely xeromorphic subdesert shrubland
Alliance:	Bigelow Sagebrush Shrubland Alliance

Global Rank: G3Q
Global Rank Reasons: This species is only documented from southeastern Colorado.

Subnational Rank: S3Q
Subnational Rank Reasons: Only found in SE Colorado in 3 counties. Less than 20 occurrences are documented, but 21-100 are expected to occur.

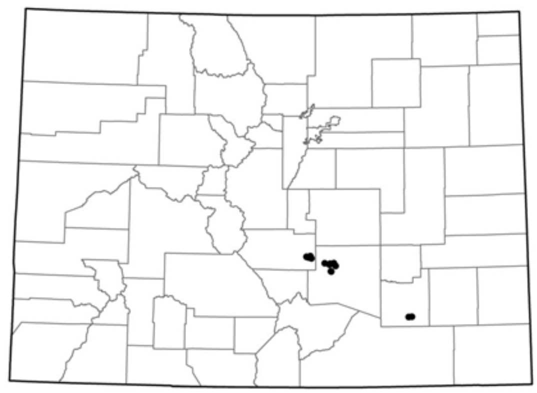
General Description: Stands included in this dwarf-shrubland association are found in southeastern Colorado on breaks and shale plains in the shortgrass steppe west to the foothills near the Front Range. Climate is semi-arid, continental with 70-80% of the 25-35 cm of mean annual precipitation occurring during the growing season (April to September). Soils are typically shallow, well-drained, calcareous loams and clay loams, derived from limestone, sandstone, shale and alluvium. The soil surface has high cover of bare soil and rock. Vegetation included in this association has sparse to moderately dense cover of microphyllous evergreen dwarf-shrubs less than 0.5 m tall. A sparse to moderately dense graminoid layer dominated by perennial medium-tall bunch grasses and short grasses is also present. Forb cover is generally sparse. Scattered scale-leaved and needle-leaved evergreen trees may be present.

Vegetation: *Stipa neomexicana* may be as abundant or more abundant than *Achnatherum hymenoides* on some sites. *Frankenia jamesii* may occur commonly in this community and sometimes dominates the shrub layer on sites near Pueblo. This association contains a sparse dwarf-shrub layer usually less than 20% of the total canopy cover. The dominant dwarf-shrub is *Artemisia bigelovii*. *Yucca glauca, Krascheninnikovia lanata, Frankenia jamesii*, and *Glossopetalon spinescens* var. *meionandrum* may be present to codominant. *Glossopetalon spinescens* var. *meionandrum* is more common on steeper shale breaks slopes. *Gutierrezia sarothrae* may become codominant on degraded ranges. Dominant grasses include *Achnatherum hymenoides (= Oryzopsis hymenoides), Hesperostipa neomexicana (= Stipa neomexicana), Bouteloua gracilis, Pleuraphis jamesii (= Hilaria jamesii), Sporobolus cryptandrus, Aristida purpurea*, and less commonly *Pascopyrum smithii,* *Bouteloua curtipendula, Muhlenbergia torreyi*, and *Schizachyrium scoparium*. On slopes, cushion plants like *Arenaria hookeri, Eriogonum lachnogynum, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Paronychia sessiliflora* are common. Other forbs such as *Astragalus missouriensis, Heterotheca villosa, Melampodium cinereum, Picradeniopsis oppositifolia, Stanleya pinnata*, and *Zinnia grandiflora* are present. Alien annuals such as *Bromus japonicus, Bromus tectorum, Salsola kali*, and *Descurainia sophia* may be present to common depending on disturbance, and amount and season of precipitation. Scattered shrubs such as *Atriplex canescens, Cercocarpus montanus, Ericameria nauseosa (= Chrysothamnus nauseosus), Lycium pallidum*, and *Rhus trilobata*, and the trees *Pinus edulis* and *Juniperus monosperma* are occasionally present.

Similar Communities: The vegetation in some stands included in this association may be too sparse to be classified in a dwarf-shrubland. A review is needed to determine if *Artemisia bigelovii / Bouteloua gracilis* Dwarf-shrub Herbaceous Vegetation (CEGL001742) and this association (CEGL000990) could be merged.

Regional Distribution: Stands included in this alliance occur on shale and limestone breaks in the short grass steppe and the limestone hills near the Front Range within the Arkansas River basin in southeastern Colorado.

Colorado Distribution: Association documented from Pueblo, Fremont and Otero Counties in SE Colorado.



Elevation Range in Colorado: 4,429.13 - 5,905.51 ft / 1,350.00 - 1,800.00 m

Site Geomorphology: Commonly found on soils which are derived from the Niobrara and Greenhorn formations. It has also been found on the Louver Alluvium, a Bull Lake Glaciation outwash deposit.

Soil: Sites are nearly level to moderately steep (2-45%) with very high bare soil and rock ground cover (>80%). Soils are typically shallow, well-drained, calcareous, channery loams and clay loams, derived from limestone, shale and, uncommonly, sandstone and alluvium. It is commonly found on soil mapped as Penrose channery loam, Penrose - Minnequa complex and Midway clay loam.

Successional and Ecological Processes: -

Adjacent Vegetation: Adjacent vegetation includes *Bouteloua gracilis*-dominated grasslands and *Pinus edulis - Juniperus monosperma* woodlands.

Management: Livestock grazing must be managed carefully to prevent the loss of highly palatable mid grasses such as *Schizachyrium scoparium, Bouteloua curtipendula, Hesperostipa neomexicana*, and *Achnatherum hymenoides*. The effects of fire on this vegetation are unknown. However, the vegetation is usually too sparse to carry a fire under most circumstances.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Bouteloua eriopoda - Pleuraphis jamesii* Herbaceous Vegetation
State Common Name Shortgrass Prairie

Global Scientific Name: *Bouteloua eriopoda - Pleuraphis jamesii* Herbaceous Vegetation
Global Common Name: Black Grama - Galleta Shortgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Short sod temperate or subpolar grassland
Alliance:	Black Grama Herbaceous Alliance

Global Rank: G3
Global Rank Reasons: This transitional Colorado Plateau-Chihuahuan Desert grassland has had its range significantly reduced by the impacts of livestock grazing over the last 150 years, particularly during years of extreme drought. Few examples remain that have not been significantly impacted by grazing and altered fire regimes. Overall, high-quality occurrences are not likely to exceed 50 in number. Inventory of potential occurrences in both the Chihuahuan Desert and Colorado Plateau ecoregions is needed. The range of this association is not likely to extend much further north than southern Utah, as *Bouteloua eriopoda* is known only from the Colorado River drainage (including the Virgin River) south of Moab.

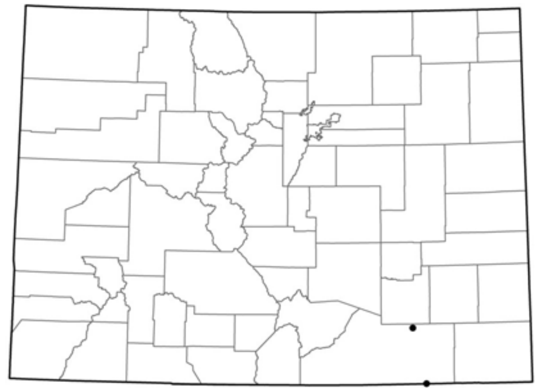
Subnational Rank: SU
Subnational Rank Reasons: More scientific information is needed on this association before a state rank can be assigned.

General Description: Stands occur on flat to gently sloping plains, basin floors, mesatops, and less often on steeply sloping mesa sides. Substrates are variable and include loam to clay-loam soils derived from basalt outcrop, shale, clay and sandstone, and coarser textured soils derived from black cinders and sandstone. *Bouteloua eriopoda* and *Pleuraphis jamesii (= Hilaria jamesii)* dominate the low to moderate herbaceous cover. Associates include low cover of several graminoid species. Shrubs are few and scattered.

Vegetation: This association is characterized by *Bouteloua eriopoda* and *Pleuraphis jamesii (= Hilaria jamesii)* codominating an open to moderately dense perennial graminoid layer. Associates include low cover of *Aristida purpurea, Bouteloua gracilis, Hesperostipa neomexicana (= Stipa neomexicana), Muhlenbergia porteri, Sporobolus airoides, Sporobolus cryptandrus*, and *Sporobolus flexuosus*. Forb cover and diversity are low. Scattered shrubs and dwarf-shrub may be present, including *Atriplex canescens, Ephedra torreyana, Ephedra viridis, Ericameria nauseosa*, and *Gutierrezia sarothrae* (Francis 1986).

Similar Communities: -

Regional Distribution: Documented in Arizon, Colorado, New Mexico, and Utah. This Colorado Plateau association is known from the upper Rio Puerco watershed in northwestern New Mexico, Wupatki National Monument and Petrified Forest National Park in north-central Arizona, and scattered small sites at Capitol Reef National Park in southeastern Utah. It extends south to the Sevilleta National Wildlife Refuge in central New Mexico in the transition zone with the northern Chihuahuan Desert. Also found in southeastern Colorado, in Las Animas County.



Colorado Distribution: Documented from only two occurrences in Las Animas County in Colorado.

Elevation Range in Colorado: 4,500.00 - 4,700.00 ft / 1,371.60 - 1,432.56 m

Site Geomorphology: In Colorado stands occur on rocky slopes below sandstone outcrops along edge of Mesa.

Soil: Substrates are variable and include weakly developed Entisols and Entisol-Mollisol complexes often with loam to clay-loam soils derived from basalt outcrop, shale, clay and sandstone, and coarser textured soils derived from black cinders and sandstone.

Successional and Ecological Processes: The distribution of *Bouteloua eriopoda* centers on the southwestern U.S. and northern Mexico, and *Pleuraphis jamesii* is characteristic of the Great Basin, indicating that this is a transitional grassland between these regions (Muldavin et al. 1998d).

Adjacent Vegetation: -

Management: This association's range has been significantly reduced by the impacts of livestock grazing over the last 150 years, particularly during years of extreme drought. Few examples remain that have not been significantly impacted by grazing and altered fire regimes

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Bouteloua gracilis - Pleuraphis jamesii* Herbaceous Vegetation
State Common Name Shortgrass Prairie

Global Scientific Name: *Bouteloua gracilis - Pleuraphis jamesii* Herbaceous Vegetation
Global Common Name: Blue Grama - Galleta Shortgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Short sod temperate or subpolar grassland
Alliance:	Blue Grama Herbaceous Alliance

Global Rank: G2G4
Global Rank Reasons: Historically, most sites supporting this association have been converted to dryland or irrigated cropland in the plains. Overgrazing by livestock has changed some of these grasslands to sparse desert grasslands or desert scrubland. In addition, the reduction of fire frequency, either by livestock grazing the fine fuels that carry fires or by active suppression, has allowed the invasion of trees and shrubs. Loss to urban development has been significant in recent decades. Transformation to pinyon/juniper woodlands or desert grassland/scrubland, and urban development continue the negative trend. More classification and survey work are needed to distinguish this type from closely related grasslands over its relatively broad geographic range, and to inventory its extent and condition.

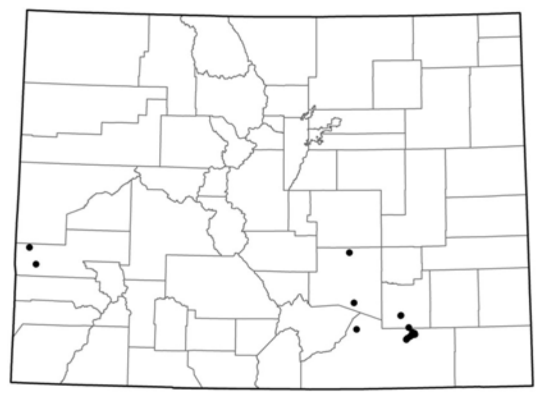
Subnational Rank: S3
Subnational Rank Reasons: Documented mostly from southeastern Colorado. This association is degraded over most of the range by continuous summer grazing. Conversion of the habitat to cropland or urban development, and reduction of fire frequency have also impacted this association.

General Description: This grassland association occurs on level to gently rolling plains, mesas, and alluvial flats in the southeast part of Colorado and in the Colorado Plateau. Stands are codominated by the graminoids *Bouteloua gracilis* and *Pleuraphis jamesii (= Hilaria jamesii)*. This codominance distinguishes this vegetation type from several closely related grasslands. Canopy cover is relatively sparse to moderately dense. Forb cover is generally sparse but may be diverse. Scattered dwarf-shrubs, shrubs and cacti are not uncommon.

Vegetation: This association is characterized by an open to moderately dense (20-80% cover) herbaceous layer that is codominated by the graminoids *Bouteloua gracilis* and *Pleuraphis jamesii (= Hilaria jamesii)*. These short and medium-tall perennial bunch grasses may form a sod-like ground cover with patches of bare ground, especially where grazing by livestock encourages a prostrate growth form. Other grasses include *Buchloe dactyloides, Muhlenbergia torreyi, Sporobolus cryptandrus, Aristida* spp., *Achnatherum hymenoides (= Oryzopsis hymenoides), Pascopyrum smithii, Hesperostipa comata (= Stipa comata)*, or *Hesperostipa neomexicana (= Stipa neomexicana)*. Forb cover is generally sparse but may be diverse. Characteristic species include *Sphaeralcea coccinea, Grindelia squarrosa, Cryptantha* spp., *Machaeranthera pinnatifida, Ratibida* spp., and *Zinnia grandiflora*. Scattered dwarf-shrubs, shrubs and cacti, such as *Gutierrezia sarothrae, Artemisia bigelovii, Artemisia frigida, Krascheninnikovia lanata, Prosopis glandulosa* (southern stands), *Yucca glauca, Opuntia imbricata*, and *Opuntia polyacantha*, are not uncommon.

Similar Communities: Codominance of *Bouteloua gracilis* and *Pleuraphis jamesii* distinguishes this vegetation from several closely related grasslands.

Regional Distribution: These grasslands are found in the southern shortgrass steppe of southeastern Colorado and eastern New Mexico, and alluvial flats and mesas of the Colorado Plateau in New Mexico and Utah, south to Sevilleta National Wildlife Refuge in central New Mexico.



Colorado Distribution: This association is documented from SE Colorado in Las Animas, Pueblo, and Otero Counties. One occurrence is also found in SW Colorado in Montrose County.

Elevation Range in Colorado: 4,460.00 - 5,787.00 ft / 1,359.41 - 1,763.88 m

Site Geomorphology: -

Soil: Sites are flat to undulating, with shallow to moderately deep, loam to silty clay loam-textured soil.

Successional and Ecological Processes: -

Adjacent Vegetation: This community may intergrade with other graminoid dominated communities. It may also occur in a mosaic with *Juniperus* spp.

Management: Keeping this habitat type intact and managing for overgrazing and tree and shrub invasion/succession would benefit this association.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Cercocarpus montanus - Rhus trilobata / Andropogon gerardii* Shrubland

State Common Name Mountain Mahogany - Skunkbush / Big Bluestem Shrubland

Global Scientific Name: *Cercocarpus montanus - Rhus trilobata / Andropogon gerardii* Shrubland

Global Common Name: Mountain Mahogany - Skunkbush / Big Bluestem Shrubland

Community Classification

System:	International Vegetation Classification
Class:	Shrubland
Subclass:	Deciduous shrubland
Group:	Cold-deciduous shrubland
Subgroup:	Natural/Semi-natural cold-deciduous shrubland
Formation:	Temperate cold-deciduous shrubland
Alliance:	Mountain-mahogany Shrubland Alliance

Global Rank: G2G3
Global Rank Reasons: Documented from less than 10 occurrences in Colorado. More surveys are needed to increase occurrence information.

Subnational Rank: S2S3
Subnational Rank Reasons: Six occurrences have been documented in Colorado but more are expected to occur.

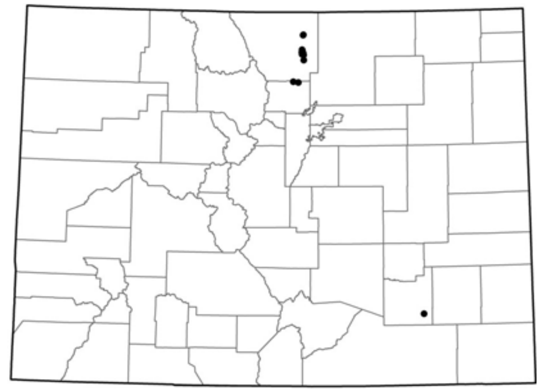
General Description: This montane shrubland has been documented from the Northern Front Range and southeastern Colorado. It is found on side slopes, saddles, swales and benches of foothills, mountains and canyons. *Cercocarpus montanus* and *Rhus trilobata* are dominant and may vary in presence depending on the aspect of the slope. The herbaceous layer is dominated by the graminoid, *Andropogon gerardii*. Sites are generally xeric and rocky with moderate to very steep slopes or on ridges. This community type is often patchy and interspersed within the *Pinus ponderosa* / *Cercocarpus montanus* / *Stipa comata* association.

Vegetation: Vegetation in this association includes broad-leaved deciduous shrubs, dominated by *Cercocarpus montanus* or *Rhus trilobata*. Other shrubs and dwarf shrubs may be present too. The sparse to moderately dense herbaceous layer is usually less than 1 m tall and dominated by the graminoid *Andropogon gerardii* with other graminoids present to abundant. Generally forb cover is sparse. Annuals are seasonally present. Other associated species include *Atriplex canescens*, *Stipa comata*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Sporobolus cryptandrus*, *Schizachyrium scoparium* and *Artemisia frigida*,

Similar Communities: -

Regional Distribution: This association has only been documented from the Northern Front Range and southeastern Colorado.

Colorado Distribution: In Colorado this community is documented from Larimer, Boulder and Las Animas Counties.



Elevation Range in Colorado: 4,300.00 - 5,900.00 ft / 1,310.64 - 1,798.32 m

Site Geomorphology: Sites are generally xeric and rocky with moderate to very steep slopes on rocky sandy soils or where colluvium accumulates. The geology is composed of a sedimentary sandstone strata.

Soil: Substrates are typically thin, well-drained, poorly developed, lithic soils with abundant rock outcrops. Soil textures are typically sandy loam.

Successional and Ecological Processes: -

Adjacent Vegetation: Adjacent vegetation at higher elevations includes woodland and forests dominated by species of *Juniperus, Quercus, Pinus* or *Pseudotsuga menziesii*. At lower elevations there are often grasslands or shrub savannas dominated by mid or short grasses species of *Aristida, Bouteloua, Elymus, Muhlenbergia, Pseudoroegneria* or *Hesperostipa*.

Management: -

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Cercocarpus montanus / Hesperostipa comata* Shrubland
State Common Name Mixed Foothill Shrublands

Global Scientific Name: *Cercocarpus montanus / Hesperostipa comata* Shrubland
Global Common Name: Mixed Foothill Shrublands

Community Classification

System:	International Vegetation Classification
Class:	Shrubland
Subclass:	Deciduous shrubland
Group:	Cold-deciduous shrubland
Subgroup:	Natural/Semi-natural cold-deciduous shrubland
Formation:	Temperate cold-deciduous shrubland
Alliance:	Mountain-mahogany Shrubland Alliance

Global Rank: G2
Global Rank Reasons: This association is a regional endemic with moderate environmental specificity. It is distributed primarily along the northern portion of the Colorado Front Range between 5800 and 7500 feet on dry, coarse, gravely soils. While there are several known locations for this association, the majority of them have been heavily impacted by anthropogenic activities. Most stands of this association have been invaded by exotic species as a result of livestock grazing. Much of the potential habitat for this association has been surveyed by the Colorado Natural Heritage Program, so the potential for finding new, locations is low. This association remains highly threatened. Threats include residential development, sand and gravel mining, fire suppression, overgrazing, and invasion by non-native plant species. These threats will not lessen over time because the center of this association's distribution is in the heart of the Colorado Front Range, an area undergoing rapid growth.

Subnational Rank: S2
Subnational Rank Reasons: Although numerous large stands exist, almost all are degraded to some extent by invasion of weedy species, lack of periodic fire, and intensive grazing. *Bromus tectorum*, has invaded many stands very heavily and almost all stands to some extent. This is thought to significantly alter community composition and ecological functions (Bock and Bock. 1988, Bedunah 1992). Suppression of periodic fires has probably decreasesd the cover of *Cercocarpus montanus* and allowed accumulation of additional light fuels. Disturbance from livestock grazing is likely to have reduced *Stipa comata* cover and increased cover of species such as *Artemisia frigida, Opuntia polyacantha,* and *Bromus tectorum.*

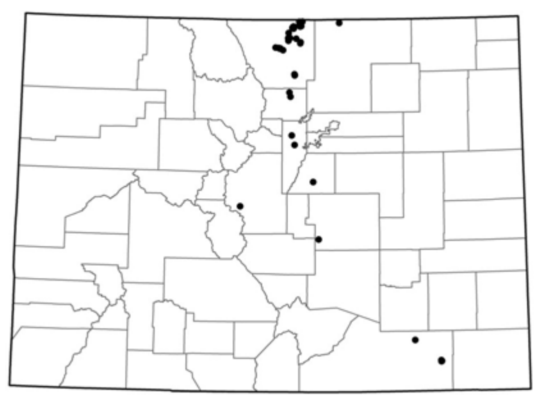
General Description: Stands of this association have been described from the eastern flank of the foothills of the northern Front Range in north-central Colorado from Douglas to Larimer counties. This association is found on topographic features including hogbacks, ridges, mesas, canyons and slopes. Slopes vary from moderate to steep (up to 60%), and aspects are mostly southerly. Parent materials are primarily igneous and metamorphic residuum and colluvium. Most soils are classified as Entisols.

This is an open-canopy shrubland dominated by the broad-leaved deciduous shrub *Cercocarpus montanus* (typically with 20-35% canopy cover), with *Rhus trilobata* always present in lower abundance. The succulent species *Opuntia polyacantha* is usually present, as well as the suffrutescent species *Artemisia frigida, Artemisia ludoviciana*, and *Eriogonum umbellatum*. The herbaceous layer is dominated by the perennial bunchgrass *Hesperostipa comata (= Stipa comata)*, with 5-20% canopy cover. The other commonly present grass is *Bouteloua gracilis*. *Muhlenbergia montana* is typically absent or has low cover. Both perennial and annual forbs occur in the herbaceous layer in low abundance; some of the more important species include *Erigeron pumilus, Astragalus parryi*, and *Allium textile*.

Vegetation: This shrubland association is characterized by an open to moderately dense short-shrub layer (<2 m) dominated by the broad-leaved deciduous shrub *Cercocarpus montanus* (typically with 20-35% canopy cover), with an herbaceous layer dominated by *Hesperostipa comata* and *Bouteloua gracilis*. Other shrubs often include a few *Ribes cereum* or *Rhus trilobata* on most sites and occasional *Pinus ponderosa* or *Juniperus scopulorum* trees. Dwarf-shrubs *Artemisia frigida* and *Opuntia polyacantha* are typically present. The herbaceous layer is a mixture of grasses and forbs. Along with *Hesperostipa comata* and *Bouteloua gracilis*, associated species include *Allium textile, Artemisia ludoviciana, Astragalus parryi, Eriogonum umbellatum, Elymus albicans (= Elymus lanceolatus ssp. albicans), Erigeron pumilus, Helianthus pumilus, Heterotheca villosa, Lesquerella montana*, and *Scutellaria brittonii*. Introduced annual grass *Bromus tectorum* is often present.

Similar Communities: This community often intergrades with other *Cercocarpus montanus* communities (*Cercocarpus montanus / Pseudoroegneria spicata, Cercocarpus montanus / Muhlenbergia montana, Cercocarpus montanus / Stipa scribneri)* or grasslands dominated by *Stipa comata, Bouteloua gracilis*, and *Pascopyrum smithii.* In northern Larimer County, the *Cercocarpus montanus / Stipa comata* association often occurs on warmer slopes (generally south facing) while the *Cercocarpus montanus / Pseudoroegneria spicata* community often occurs on cooler slopes (generally north facing).

Regional Distribution: Stands of this association have been described from the eastern flank of the foothills of the Colorado Front Range.



Colorado Distribution: This association occurs in large stands along the northern Front Range of the Colorado Rocky Mountains (mainly Jefferson, Boulder, Park, Douglas and Larimer Counties), in small patches on the Chalk Bluffs along the Colorado-Wyoming line in Weld County, and on rock outcrops in southeastern Colorado (El Paso and Las Animas Counties).

Elevation Range in Colorado: 5,700.00 - 7,400.00 ft / 1,737.36 - 2,255.52 m

Site Geomorphology: This association typically occurs on rock outcrops of various geologic formations along the northern foothills of the Front Range of the Colorado

Rocky Mountains. Most stands are on moderately steep slopes up to 20-30%, usually facing from east to south to west. Surface exposure of bare ground and rock and gravel may be as much as 50%. Parent materials are primarily igneous and metamorphic residuum and colluvium.

Soil: Most soils are classified as Entisols. They are poorly developed, well-drained, and coarse-textured, with much exposed bare ground and rock.

Successional and Ecological Processes: Fire has probably been suppressed in most stands and would be expected to reduce the canopy cover of the *Cercocarpus montanus* but not totally eliminate it. In some stands, the lack of fire may have allowed *Juniperus scopulorum* or other woody tree species to form an open canopy woodland. *Cercocarpus montanus* will resprout following moderate intensity fires (FEIS 1998), however, many stands invaded by *Bromus tectorum* could burn very hot because of increased fuel loads.

Adjacent Vegetation: -

Management: Many anthropogenic activities threaten the long-term viability of this association. Threats include residential development, sand and gravel mining, fire suppression, overgrazing, and invasion by non-native plant species.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Cercocarpus montanus / Hesperostipa neomexicana* Shrubland
State Common Name Foothills Shrubland

Global Scientific Name: *Cercocarpus montanus / Hesperostipa neomexicana* Shrubland
Global Common Name: Mountain Mahogany / New Mexico Feathergrass Shrubland

Community Classification

System:	International Vegetation Classification
Class:	Shrubland
Subclass:	Deciduous shrubland
Group:	Cold-deciduous shrubland
Subgroup:	Natural/Semi-natural cold-deciduous shrubland
Formation:	Temperate cold-deciduous shrubland
Alliance:	Mountain-mahogany Shrubland Alliance

Global Rank: G2G3
Global Rank Reasons: This plant association is reported from southeastern Wyoming on the Hartville Uplift and is documented by 16 occurrences in eastern Colorado from Larimer and Boulder counties and Mesa de Maya in Las Animas County. It may also occur south of Mesa de Maya in northeastern New Mexico (Muldavin pers. communication).

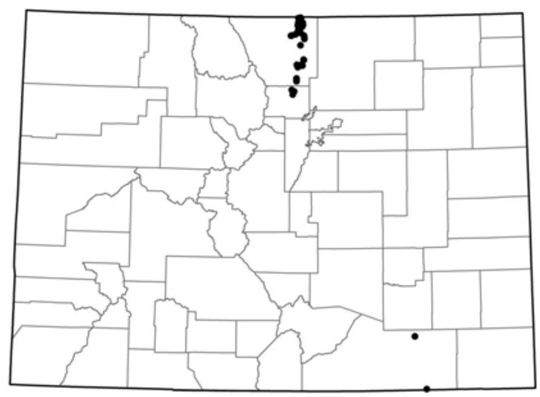
Subnational Rank: S2S3
Subnational Rank Reasons: Less than 20 occurrences have been documented in Colorado, but more are thought to exist. Most stands are not highly threatened by grazing activities as the forage is generally sparse and topography is steep in this community. Residential development is a threat in Larimer and Boulder counties, Colorado.

General Description: This association occurs on outcrops of various sedimentary geologic formations. Most stands are on moderately steep east to south to west facing slopes up to 20-30%. Some occurrences are on nearly flat to shallow slopes where bedrock is exposed as a relatively flat "pavement". The exposure of the sedimentary rock seems to be an important factor in determining the distribution of this community. The vegetation in general is sometimes very sparse, mainly growing in cracks in the bedrock, to fairly dense on more moist aspects or deeper soils. *Cercocarpus montanus* is the dominant species and *Rhus trilobata* is often scattered throughout the stand but contributes little canopy cover. *Juniperus scopulorum* and *Pinus ponderosa* may be present in some stands in low abundance. The understory may be very sparse on bedrock "pavement" to very dense on sites where soils are deeper. *Stipa neomexicana* is dominant to co-dominant in most stands in good condition. Numerous other grasses and forbs occur in most stands consistently but with low abundance.

Vegetation: The vegetation in general is sometimes very sparse, mainly growing in cracks in the bedrock, to fairly dense on more moist aspects or deeper soils. *Cercocarpus montanus* is the dominant species but may be sparse on steep, rocky slopes or shaley outcrops (around 10% canopy cover), but may be more abundant (around 25-35% canopy cover) on deeper soils and/or more moderate slopes or moist aspects. *Rhus trilobata* is often scattered throughout the stand but contributes little canopy cover. *Juniperus scopulorum* and *Pinus ponderosa* may be present in some stands in low abundance. The understory may be very sparse on bedrock "pavement" to very dense on sites where soils are deeper. *Stipa neomexicana* is dominant to co-dominant (approximately 3-25% canopy cover) in most stands in good condition. On red sands derived from Fountain Formation sandstones *Schizachyrium scoparium* and *Bouteloua curtipendula* may be dominant or co-dominant (approximately 5-20%) but *Stipa neomexicana* is present with at least moderate canopy cover. Numerous other grasses occur in most stands consistently but with low abundance (*Oryzopsis hymenoides, Stipa comata, Pseudoroegneria spicata (*or *Elymus lancelolata X Pseudoroegneria spicata), Aristida purpurea, Bouteloua gracilis, Bouteloua curtipendula, Schizachyrium scoparium).* Numerous forbs are common but present in low abundance (*Hymenoxys acaulis, Paronychia jamesii, Eriogonum spp., Helianthus pumilus, Artemisia frigida, Opuntia polyacantha). Helianthus pumilus, Artemisia frigida,* and *Opuntia polyacantha* may increase with heavy grazing. Fire may reduce the abundance of *Opuntia* (Thomas 1991). Exotic species do not seem to readily invade most stands, possibly because of the xeric nature of the sites.

Similar Communities: -

Regional Distribution: Known from three Colorado counties; two along the Front Range and one in the southeastern portion of the state.



Colorado Distribution: This plant association is known from the Front Range of Colorado in Larimer and Boulder counties and Mesa de Maya in Las Animas County.

Elevation Range in Colorado: 4,600.00 - 7,150.00 ft / 1,402.08 - 2,179.32 m

Site Geomorphology: This community is found on slopes and bluff outcrops of Niobrara shale, Lykins sandstone, Fountain, Ingleside, Jelm, Forelle and Sundance Formations. Most stands are on moderate slopes up to 50%, but some occur on nearly flat to shallow slopes where bedrock is very exposed.

Soil: Soils are typically fine grained sandstone with calcareous cross bedding, sometimes with gympsum and limestone included on east facing slopes. Bedrock, boulders, and cobbles predominate and cover approximately 50-75% of the soil surface.

Successional and Ecological Processes: This community often intergrades with other *Cercocarpus montanus* communities (*Cercocarpus montanus / Stipa comata, Cercocarpus montanus / Pseudoroegneria spicata* ((or *Elymus lanceolata X Pseudoroegneria spicata*)), *Cercocarpus montanus / Muhlenbergia montana, Cercocarpus montanus / Stipa scribneri)* or grasslands dominated by *Stipa comata, Bouteloua gracilis,* and *Pascopyrum smithii. Cercocarpus montanus* is known to provide winter browse for a variety of native ungulates and may provide habitat for birds. Fire has probably been suppressed in most stands and would be expected to reduce the canopy cover of the *Cercocarpus montanus* but not totally eliminate it. Fire would rarely carry through the entire stand in sparsely vegetated stands on bedrock pavements.

Adjacent Vegetation: -

Management: -

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Hesperostipa neomexicana* Herbaceous Vegetation
State Common Name Great Plains Mixed Grass Prairie

Global Scientific Name: *Hesperostipa neomexicana* Herbaceous Vegetation
Global Common Name: New Mexican Feathergrass Mixedgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Medium-tall bunch temperate or subpolar grassland
Alliance:	New Mexico Needlegrass Herbaceous Alliance

Global Rank: G3
Global Rank Reasons: The community is naturally limited and rare and has been impacted in some areas by residential development, mining, and overgrazing. It is estimated that rangewide there are only 30-50 occurrences of this community totaling less than 5000 acres. Threats include continued impacts by residential development, heavy livestock grazing, or mining operations.

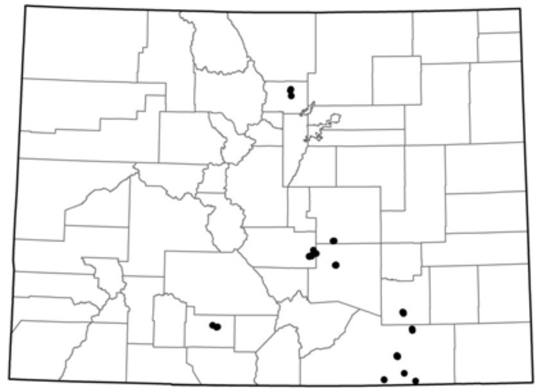
Subnational Rank: S3
Subnational Rank Reasons: At least 30-50 occurrences are known or expected to occur in Colorado. Habitat loss/disturbance due to development, mining operations and grazing are of prime concern for this association.

General Description: This *Hesperostipa neomexicana (= Stipa neomexicana)* community occurs on extremely dry and warm sites in the southeastern Colorado Great Plains, along the adjacent Rocky Mountain foothills, and in the San Luis Valley of south-central Colorado. It has been documented on rocky (basalt), steep, southerly slopes at the higher elevations of its range or on any aspect on limestone or shale outcrops at lower elevations. The community is a grassland that is most often heavily dominated by the cool-season, bunchgrass *Hesperostipa neomexicana*. *Bouteloua gracilis* is nearly always present in this community and is more abundant in degraded stands or on ecotones to finer textured soils.

Vegetation: The grassland association is most often heavily dominated by the cool-season, bunchgrass *Hesperostipa neomexicana*. Good condition stands have abundant *Hesperostipa neomexicana* with many plants having touching or overlapping canopies. *Bouteloua gracilis* is nearly always present in this community and is more abundant in degraded stands or on ecotones to finer textured soils. In these cases cover of *Stipa neomexicana* is usually reduced. *Oryzopsis hymenoides* is present in most stands rangewide. *Bouteloua curtipendula* is often present in stands in southeastern Colorado and along the Colorado Front Range. Common forbs and sub-shrubs which normally occur in low abundance include *Eriogonum jamesii*, *Hymenoxys acaulis*, *Yucca glauca*, *Opuntia polyacantha*, *Gutierrezia sarothrae*, and *Mirabilis multiflora*. Widely scattered *Juniperus monosperma*, *Cercocarpus montanus*, and *Pinus ponderosa* may occur in some stands.

Similar Communities: -

Regional Distribution: The association is only known from the southeast Colorado Great Plains, along the adjacent Rocky Mountain foothills, and in the San Luis valley of south-central Colorado. It may also occur in extreme northeastern New Mexico.



Colorado Distribution: This community has been documented from Boulder, El Paso, Fremont, Las Animas, Otero, Pueblo, and Rio Grande Counties.

Elevation Range in Colorado: 4,800.00 - 8,800.00 ft / 1,463.04 - 2,682.24 m

Site Geomorphology: This association has been found on rocky (basalt), steep, southerly slopes at the higher elevations of its range or on any aspect on limestone or shale outcrops at lower elevations.

Soil: -

Successional and Ecological Processes: It is assumed that fire would have historically reduced the tree and shrub abundance in most stands. The vegetation appears to produce enough fuel to carry fires. Some stands are being invaded by *Juniperus monosperma*, possibly as a result of fire suppression and/or altered grazing regimes.

Adjacent Vegetation: Adjacent community types include *Bouteloua gracilis - Hilaria jamesii* Herbaceous vegetation, *Juniperus monosperma* / *Hesperostipa neomexicana* Woodland, *Krascheninnikovia lanata* / *Achnatherum hymenoides* Dwarf-shrubland.

Management: -

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Pascopyrum smithii* Herbaceous Vegetation
State Common Name Western Slope Grasslands

Global Scientific Name: *Pascopyrum smithii* Herbaceous Vegetation
Global Common Name: Western Wheatgrass Mixedgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Medium-tall sod temperate or subpolar grassland
Alliance:	Western Wheatgrass Herbaceous Alliance

Global Rank: G3G5Q
Global Rank Reasons: This association is found in 8 U.S states and 2 Canadian provinces. It appears to be secure globally.

Subnational Rank: S2
Subnational Rank Reasons: Less than 20 occurrences are documented from 3 counties in Colorado.

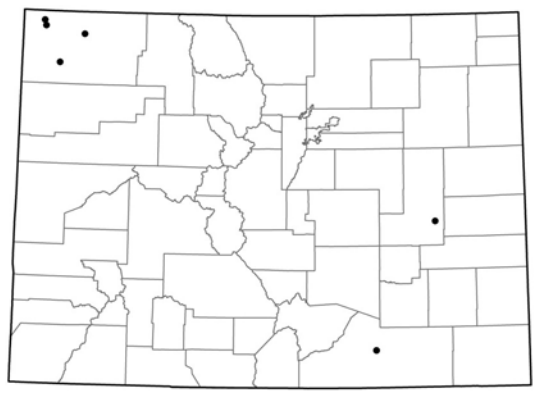
General Description: This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, Colorado Plateau, and the interior western United States and Canada at elevations from 600-3000 m. Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley floors and basins. *Pascopyrum smithii* strongly dominates the open to dense (15-100% cover) mixed grass herbaceous layer that grows 0.5-1 m tall. Other graminoids co-occur and may achieve local dominance. Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants may be present. Introduced species are common in some stands, especially where disturbed.

Vegetation: This association is characterized by an open to dense (15-100% cover) mixed grass herbaceous layer that grows 0.5-1 m tall and is strongly dominated by *Pascopyrum smithii*. Herbaceous cover may be significantly less on drier sites or after scarce cool-season precipitation. Other graminoids that co-occur and may achieve local dominance are *Bouteloua gracilis, Distichlis spicata, Eleocharis palustris, Koeleria macrantha*, and *Sporobolus airoides*. Many other species common in prairies and other grasslands are also found in this community, including *Achnatherum lettermanii, Achillea millefolium, Artemisia frigida, Artemisia ludoviciana, Bouteloua curtipendula, Carex* spp., *Eriogonum* spp., *Hesperostipa comata (= Stipa comata), Juncus balticus, Lupinus argenteus, Nassella viridula, Poa fendleriana, Poa secunda, Schizachyrium scoparium*, and *Solidago* sp. Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants, such as *Artemisia arbuscula ssp. longiloba, Artemisia tridentata, Ericameria nauseosa, Krascheninnikovia lanata, Rhus trilobata*, or *Symphoricarpos* spp., may be present.

Introduced species, such as *Agropyron cristatum, Cirsium arvense, Bromus japonicus, Bromus tectorum, Ceratocephala testiculata, Conyza canadensis, Iva axillaris, Lactuca serriola, Melilotus* spp., *Poa pratensis, Salsola kali, Sisymbrium altissimum*, and *Taraxacum officinale*, are common in some stands, especially where disturbed.

Similar Communities: This community is similar to several others that are dominated or codominated by *Pascopyrum smithii*. As currently defined, it represents a western Great Plains and foothills version of the western wheatgrass types in the central Great Plains. Further work needs to be done to refine the differences in composition and environmental characteristics.

Regional Distribution: This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, intermountain western United States and possibly Canada, ranging from North Dakota and possibly Saskatchewan, south to Nebraska and Colorado, west to northern Arizona, Utah and Idaho.



Colorado Distribution: This association is documented from Moffat, Lincoln and Las Animas Counties.

Elevation Range in Colorado: 4,620.00 - 6,920.00 ft / 1,408.18 - 2,109.22 m

Site Geomorphology: Stands are found on alluvial fans, swales, river terraces, floodplains, valley floors and basins.

Soil: The soils are typically clay, clay loam, and silt loam but may include sand or loamy sand. The soils are deep (40-100 cm) and well developed.

Successional and Ecological Processes: In semi-arid climates, this association is found in relatively mesic topographic positions such as swales, river terraces, floodplains and basins that may be temporarily or intermittently flooded, or in some classes, the fine-textured soil sometimes perches the water table (Hansen et al. 1995, Hall and Hansen 1997). In more mesic climates, it is found in extensive upland areas. A few stands occur at Dinosaur National Monument where fire removed the sagebrush overstory.

Adjacent Vegetation: -

Management: -

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior)* Woodland

State Common Name Plains Cottonwood Riparian Woodland

Global Scientific Name: *Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior)* Woodland

Global Common Name: Cottonwood - Peachleaf Willow Floodplain Woodland

Community Classification

System: International Vegetation Classification

Class: Woodland

Subclass: Deciduous woodland

Group: Cold-deciduous woodland

Subgroup: Natural/Semi-natural cold-deciduous woodland

Formation: Temporarily flooded cold-deciduous woodland

Alliance: Eastern Cottonwood Temporarily Flooded Woodland Alliance

Global Rank: G3G4
Global Rank Reasons: In the absence of regular flooding, many sites will undergo succession to later seral stages. Many sites are overgrazed and invaded by exotic woody and herbaceous species.

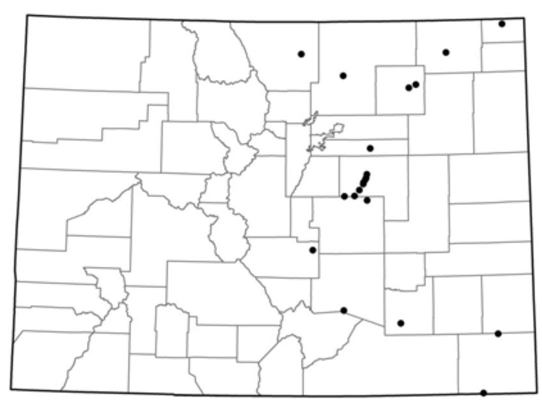
Subnational Rank: S3
Subnational Rank Reasons: This and similar associations are located throughout the western Great Plains. It was once a patchy type scattered along the South Platte and Platte Rivers. It is more abundant today than it was historically due to the altered hydrologic character of the river. It may decline as the Platte becomes more narrow and entrenched. Also, while this early-seral stage of cottonwoods is common, the late-seral, older cottonwood stands that occur as a result of channel migration, are becoming very rare due to hydrologic manipulation of stream flows. The presence of this early-seral association may be an indication of some resemblance to natural stream flow, but stands must be monitored if all stages of cottonwood riparian communities are to be protected along river corridors.

General Description: This community occurs on recently deposited alluvial material along rivers and streams. The soils are derived from alluvial sand, silt, and clay and are poorly developed. The water table fluctuates with the level of the adjacent river or stream. *Populus deltoides* is the dominant species in this community, although *Salix exigua* and/or *Salix interior* is generally more dominant in the initial stage following a major flood event. *Salix amygdaloides* is rare to codominant. The shrub/sapling layer is conspicuous, especially near the streambank, and consists mainly of *Salix exigua*, *Populus deltoides*, and *Salix amygdaloides*, or occasionally *Salix lutea*. On the older margins of this community *Fraxinus pennsylvanica* is often found as a sapling or small canopy tree. The herbaceous stratum is variable.

Vegetation: This association is characterized by seedling, sapling, and pole-sized

Populus deltoides, mixed with *Salix exigua* (sandbar willow) on sandbars, point bars, and other low, frequently flooded areas. Canopy cover of *Populus deltoides* ranges from 1-70%; cover of *Salix exigua* (sandbar willow) ranges from 2-85%. The total height of this association is often under 4 ft (1.5 m), but a few stands have near-mature sized cottonwood trees, and represent the last transition to older cottonwood types as the *Salix exigua* (sandbar willow) is shaded out by the overstory canopy of cottonwoods. Other sapling and seedling tree species may be present, including *Salix amygdaloides* (peachleaf willow), *Fraxinus pennsylvanica* (green ash), and *Ulmus pumila* (Siberian elm). Other shrubs that may be present include *Salix ligulifolia* (strapleaf willow) and *Vitis riparia* (riverbank grape). The herbaceous understory is relatively sparse with *Xanthium strumarium* (rough cocklebur), *Melilotus officinalis* (yellow sweetclover), *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), and *Bromus tectorum* (cheatgrass). If the stand is very moist, up to 22% cover may be *Carex* spp. (sedge) with some *Scirpus* spp. (bulrush) and *Eleocharis palustris* (common spikerush) present.

Similar Communities: There are three closely related communities to the Colorado association. The dominant cottonwood of the *Populus fremontii* / *Salix amygdaloides* / Mesic Shrub / Mesic Graminoid-forbs (Fremont's cottonwood / peachleaf willow / mesic shrub / mesic graminoid - forbs) plant association (Dick-Peddie 1993) is different from, but the co-dominant species and environmental setting are similar to, that of the Colorado association. Both the *Populus deltoides* / *Salix amygdaloides* - *Salix nigra* (eastern cottonwood / peachleaf willow - black willow) (Faber-Langendoen 1996) and the *Salix amygdaloides* - *Salix exigua* - *Salix lucida* ssp. *caudata* (peachleaf willow - coyote willow - greenleaf willow) plant associations (Bourgeron and Engelking 1994) are similar to the Colorado association but have different *Salix* (willow) species in the understory.



Regional Distribution: This cottonwood - willow woodland is found widely in the central Great Plains, especially Colorado, Nebraska, Kansas, and Oklahoma, and possibly both north and south of this region. It occurs along the Pecos in east-central New Mexico (Guadalupe County) and probably in other drainages of eastern New Mexico.

Colorado Distribution: This plant association occurs along streams and rivers throughout the South Platte River drainage in eastern Colorado and in southeastern Colorado in the Arkansas River drainage. Undocumented reports map this association in Moffat, Montezuma, Montrose and La Plata Counties in western Colorado.

Elevation Range in Colorado: 3,450.00 - 6,500.00 ft / 1,051.56 - 1,981.20 m

Site Geomorphology: This plant association occurs on young, alluvial surfaces such as point bars, low streambanks, and overflow areas. It occurs on immediate streambanks and low overflow areas near the main river channel, and on the floodplain of meandering, low to moderate gradient (0.5-3.0%) streams with silt and sand stream beds. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Channels are broad and braided (Rosgen's Channel Type: C5, D5). Along smaller washes and incised channels (*e.g.*, Kiowa and West Bijou Creeks), the plant association occurs on higher terraces, where periodic summer flash floods disturb the entire floodplain. The washes have flat-bottomed, sandy beds (Rosgen's Channel Type: F5).

Soil: Soils are typically fresh, alluvial material with little soil development. Textures are predominately loose, friable sands interspersed with narrow bands of clay loams and sandy clays.

Successional and Ecological Processes: This community type is subject to, and maintained by, periodic flooding. In one study, it has been suggested that thirty years post-flood, this type will likely transition into a grassland type, as the cottonwood and willow species do not regenerate (Bellah and Hulbert 1974). The *Populus deltoides / Salix exigua* (broad-leaf cottonwood / sandbar willow) plant association is an early to mid-seral stage. With time and tree growth, *Salix exigua* (sandbar willow) is shaded by taller cottonwoods, and becomes less important. This vegetation type may be transitional between a *Salix exigua* (sandbar willow) dominated association and a *Populus deltoides* (cottonwood) dominated association. However, this plant association is thought to be a response to intermediate environmental conditions, especially intermediate soil moisture where *Salix exigua* dominates the wettest soils and *Populus deltoides* dominates the driest.

Adjacent Vegetation: -

Management: Because regeneration and establishment of new stands of *Populus deltoides* (eastern cottonwood) are dependent upon flooding events, any alterations to the natural flow regime of a river can affect the cottonwood ecosystem. Upstream dams stabilize stream flows by reducing the frequency and magnitude of floods. This results in fewer flood events that would allow for *Populus deltoides* stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities. These late-seral communities are dominated by more upland species, such as conifers in montane areas or other, more drought tolerant species in the foothill and plains environments. Riparian forage can be very productive and palatable to livestock. Cottonwood seedlings and saplings are frequently browsed by cattle. However, thick willow stands of this plant association may actually prevent livestock use. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. Cottonwood-dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This maintains high forage quality and quantity. Once established, *Salix amygdaloides* (peachleaf willow) is a very good streambank stabilizer and should be protected by managers (Hansen *et al*. 1995). *Salix exigua* (coyote willow) is also very useful in streambank stabilization in that it can rapidly colonize and spread on disturbed areas (Hansen *et al*. 1995). It is believed that fire in this type will result in the willow species vigorously sprouting afterward.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Populus deltoides / Pascopyrum smithii - Panicum obtusum Forest*
State Common Name Plains Cottonwood/Western Wheatgrass-Vine Mesquite

Global Scientific Name: *Populus deltoides / Pascopyrum smithii - Panicum obtusum Forest*
Global Common Name: Plains Cottonwood/Western Wheatgrass-Vine Mesquite

Community Classification

System: Terrestrial Community - Other Classification
Class: Not determined at this time.
Subclass: -
Group: -
Subgroup: -
Formation: -
Alliance: _

Global Rank: G2
Global Rank Reasons: Only documented from sandy floodplains on Colorado's eastern plains. Less than 10 occurrences are documented or reported, although it is expected to occur in neighboring states.

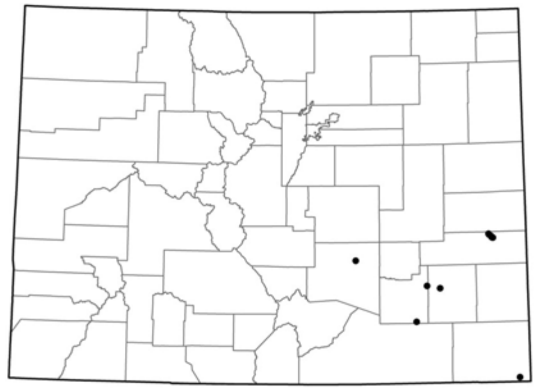
Subnational Rank: S2
Subnational Rank Reasons: Less than 10 documented and reported occurrences in Colorado. This association is threatened by alterations to the hydrological regime and over-grazing from cattle.

General Description: This riparian woodland occurs on silty clay soils along rivers and streams of the southeastern Colorado plains and along large rivers on the Western Slope. Mature *Populus deltoides* (cottonwood) provide a nearly continuous overhead canopy. High-quality stands have few shrubs, creating an open, park-like structure. Many stands in Colorado along the lower Arkansas and Purgatory Rivers have a thick subcanopy of *Tamarix ramosissima* (saltcedar), an invasive non-native shrub. This association occurs in wide valleys on floodplains and terraces. Stream channels are wide and meandering with sand and gravel beds, or wide and braided with sand beds.

Vegetation: *Populus deltoides* dominates the overstory canopy. *Salix amygdaloides* (peachleaf willow) may be present in small amounts. *Ericameria nauseosa* ssp. *nauseosa* var. *glabrata* (rubber rabbitbrush), when present, is the only native shrub. *Tamarix ramosissima* (saltcedar) was frequently abundant although plot selection attempted to avoid it. The herbaceous undergrowth is dominated by a mix of *Pascopyrum smithii* (western wheatgrass) and *Panicum obtusum* (vine mesquite). Other grass species that may be present include *Distichlis spicata* (inland saltgrass), *Panicum virgatum* (switchgrass), *Muhlenbergia asperifolia* (alkali muhly), *Sporobolus airoides* (alkali sacaton), *Sporobolus cryptandrus* (sand dropseed), *Elymus canadensis* (Canada wildrye), *Bouteloua gracilis* (blue grama), and *Bothriochloa laguroides* ssp. *torreyana* (silver beardgrass).

Similar Communities: -

Regional Distribution: This association is documented from eastern Colorado and also reported from the west slope. It is expected to occur in similar habitats in New Mexico, Oklahoma, Kansas, and Nebraska.



Colorado Distribution: Documented in Colorado in the Arkansas River drainage in southeastern Colorado. Undocumented occurrences are reported from Moffat (Yampa River drainage) and La Plata (San Juan River drainage) Counties.

Elevation Range in Colorado: 3,500.00 - 5,900.00 ft / 1,066.80 - 1,798.32 m

Site Geomorphology: This association occurs in wide valleys on floodplains and terraces. Stands are located 61-533 ft. (20-175 m) lateral distance from the active channel, although one plot occurred right at the channel edge. Stands are 2-3 ft (0.65-1.0 m) above the height of the average annual high water mark, with the exception of one stand, that occurred right at the active channel average high water level. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels are wide and meandering with sand and gravel-beds (Rosgen's Channel Type: C5, C4) or wide and braided with sand-beds (Rosgen's Channel Type: D5) .

Soil: Soils are deep silty clay and silty clay loams to over 30 inches (60 cm) deep. Some profiles have loamy sands and sands at depth.

Successional and Ecological Processes: The *Populus deltoides / Pascopyrum smithii - Panicum obtusum* (cottonwood / western wheatgrass - vine mesquite) riparian woodland is a late-seral community of active floodplains. This association occurs only on fine-textured soils in very subtle topographic swales on the floodplain. Large patches of *Sporobolus cryptandrus* (sand dropseed) occur underneath the same cottonwood stand, on the same terrace or floodplain, where pockets of very dry and sandy soils occur on subtle topographic ridges, forming the *Populus deltoides / Sporobolus cryptandrus* (cottonwood / sand dropseed) plant association.

Adjacent Vegetation: Adjacent riparian vegetation: *Populus deltoides / Sporobolus cryptandrus* (plains cottonwood / sand dropseed) woodlands, *Salix exigua* (coyote willow) and *Tamarix ramosissima* (tamarisk) shrublands, *Typha* spp. (cattail) and *Scirpus* spp. wetlands occur as part of the surrounding riparian mosaic. Adjacent upland vegetation: agricultural fields, *Pinus utahensis - Juniperus monosperma* (pinyon-juniper) woodlands, *Artemesia filifolia* (sand sage) shrublands, *Bouteloua gracilis - Buchloe dactylis* (Blue grama - buffalo grass) shortgrass prairies, and large patches of *Salsola collina* (slender Russian thistle) occur in the surrounding upland landscape.

Management: Because the regeneration and establishment of new stands of cottonwood is dependent upon flooding events, any alterations to the natural flow regime of a river can affect the cottonwood ecosystem. Riparian forage productivity can be high and very palatable to livestock. Cottonwood seedlings and saplings are frequently browsed by cattle. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. Cottonwood dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This maintains high forage quality and quantity. Winter-only grazing by livestock works very well in maintaining the native grass species vigor in cottonwood ecosystems of eastern plains rivers in Colorado. The native grass species are likely to remain if the current management of winter-only grazing is maintained and periodic fire is allowed to occur.

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Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Populus deltoides / Sporobolus airoides Forest*
State Common Name Plains Cottonwood / Alkali Sacaton

Global Scientific Name: *Populus deltoides (ssp. wislizeni, ssp. monilifera) / Sporobolus airoides Woodland*
Global Common Name: (Rio Grande Cottonwood, Plains Cottonwood) / Alkali Sacaton Woodland

Community Classification

System:	International Vegetation Classification
Class:	Woodland
Subclass:	Deciduous woodland
Group:	Cold-deciduous woodland
Subgroup:	Natural/Semi-natural cold-deciduous woodland
Formation:	Temporarily flooded cold-deciduous woodland
Alliance:	Eastern Cottonwood Temporarily Flooded Woodland Alliance

Global Rank: G3
Global Rank Reasons: Documented from New Mexico and Colorado. This community is still vulnerable throughout the range due to potential alterations to the riparian areas and stream flow, and overgrazing.

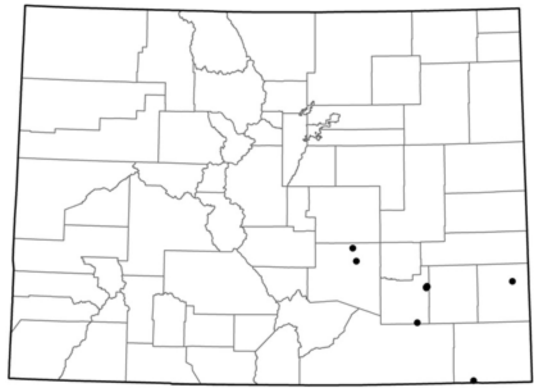
Subnational Rank: S2
Subnational Rank Reasons: Less than 10 occurrences in Colorado. Threats to this community include alterations to the hydrologic regime and improper grazing techniques.

General Description: This riparian woodland is a late-seral, mature cottonwood woodland on upper terraces. The woodland is very open with widely spaced trees. The distance between trees may be more than twice their canopy widths. Shrubs are few and far between. The ground is covered with thick grasses.

Vegetation: Large, widely spaced *Populus deltoides* (plains cottonwood) characterize this association. Shrubs form a minor component of this type. The introduced *Tamarix ramosissima* (saltcedar) occurs at all sampled sites. *Chrysothamnus viscidiflorus* (yellow rabbitbrush) is fairly abundant at the Green River site. The herbaceous undergrowth is dominated by *Sporobolus airoides* (alkali sacaton). Other herbaceous species that may be present include *Kochia scoparia* (kochia), *Panicum obtusum* (vine mesquite), *Bouteloua gracilis* (blue grama), *Aristida purpurea* (purple threeawn), *Helianthus annuus* (common sunflower), and *Ambrosia artemisiifolia* (annual ragweed).

Similar Communities: An association with similar herbaceous composition and habitat occurs in New Mexico, the *Sporobolus airoides -Distichlis spicata* Herbaceous Vegetation plant association described by Muldavin and Melhop (1992). It is intermittenly flooded, but has no cottonwood overstory component.

Regional Distribution: Documented in Colorado and New Mexico. This association is common in the Pecos basin in southeastern New Mexico and occasional in the middle and lower Rio Grande.



Colorado Distribution: Documented in southeastern Colorado in Pueblo, Otero, Prowers and Baca Counties. Undocumented occurrence reported in northwestern Moffat County.

Elevation Range in Colorado: 3,400.00 - 6,300.00 ft / 1,036.32 - 1,920.24 m

Site Geomorphology: This association occurs on upper terraces. It is located 120-1,000 ft (37-300 m) lateral distance from the active channel, and 3.6-4.1 ft (1.1-1.25 m) above the channel high water mark. Stream channels are wide and meandering with distinct point-bars and cut-banks at curves. The stream gradient is < 1%. Predominant bed material is gravel and sand.

Soil: Soils are deep loamy sands with silt loam and silty clay textures in the upper layers 2-6 inches (5-15 cm). One profile had distinct mottles starting at 2 inches (5 cm) depth.

Successional and Ecological Processes: The *Populus deltoides / Sporobolus airoides* (plains cottonwood / alkali sacaton) riparian woodland is a late-seral community of active floodplains. *Sporobolus airoides* (alkali sacaton) is a salt tolerant plant and is commonly found in low-lying alkaline bottoms and wash banks. Pockets of *Panicum obtusum* (vine mesquite), *Pascopyrum smithii* (western wheatgrass), and *Distichlis spicata* (saltgrass) can also occur on the same terrace, under the same stand of cottonwood trees, but on finer textured soils in very subtle topographic swales. Pockets of *Sporobolus cryptandrus* (sand dropseed) can also occur on drier, sandy soils on minor ridges on the same floodplain surface. It would appear that the graminoid species in the undergrowth of these cottonwood communities are responding to soil texture, moisture holding capacities and degree of soil salinity, while the cottonwoods are well established with much deeper, phreatophytic roots. Subsequent to cottonwood establishment, successive flooding events have unevenly deposited different sediments on the floodplain surface, creating a micro-mosaic of different habitats underneath the cottonwood canopy.

Adjacent Vegetation: Adjacent riparian vegetation: *Populus deltoides / Pascopyron smithii - Panicum obtusum* (plains cottonwood / western wheatgrass - vine mesquite) woodlands, *Salix exigua* (coyote willow) and *Tamarix ramosissima* (tamarisk) shrublands, *Typha* spp. (cattail) wetlands occur as part of the surrounding riparian mosaic. Adjacent upland vegetation: agricultural fields, *Pinus utahensis - Juniperus monosperma* (pinyon-juniper) woodlands, *Artemesia filifolia* (sand sage) shrublands, *Bouteloua gracilis - Buchloe dactylis* (Blue grama - buffalo grass) shortgrass prairies, and large patches of *Salsola collina* (slender Russian thistle) occur in the surrounding upland landscape

Management: *Sporobolus airoides* (alkali sacaton) can become an important forage grass in habitats where higher quality grasses are not available. Because the regeneration and establishment of new stands of cottonwood is dependent upon flooding events, any alterations to the natural flow regime of a river can affect the cottonwood ecosystem. Upstream dams stabilize stream flows and reduce flooding frequency and magnitude. This results in fewer flood events that would allow for cottonwood stand regeneration. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities. These late-seral communities are dominated by more upland species, such as conifers in montane areas or other, more drought tolerant species in the foothill and plains environments. Riparian forage productivity can be high and very palatable to livestock. Cottonwood seedlings and saplings are frequently browsed by cattle. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. Cottonwood dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This maintains high forage quality and quantity. Winter-only grazing by livestock works very well in maintaining the native grass species vigor in cottonwood ecosystems of eastern plains rivers in Colorado. The native grass species are likely to remain if the current management of winter-only grazing is maintained and periodic fire is allowed to occur.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Populus deltoides / Sporobolus cryptandrus Forest*
State Common Name Plains Cottonwood/Sand Dropseed

Global Scientific Name: *Populus deltoides / Sporobolus cryptandrus Forest*
Global Common Name: Plains Cottonwood/Sand Dropseed

Community Classification

System: Terrestrial Community - Other Classification
Class: Not determined at this time.
Subclass: -
Group: -
Subgroup: -
Formation: -
Alliance: _

Global Rank: G1G2Q
Global Rank Reasons: Known only from sandy floodplains on Colorado's eastern plains rivers. It is expected to occur in neighboring states but more information is needed. Alterations to the hydrologic regime and overgrazing are potential threats to the community throughout its range.

Subnational Rank: S1S2
Subnational Rank Reasons: Less than 5 occurrences are documented in the state. This and other riparian communities are threatened by any alterations to the hydrologic regime and from over grazing by cattle.

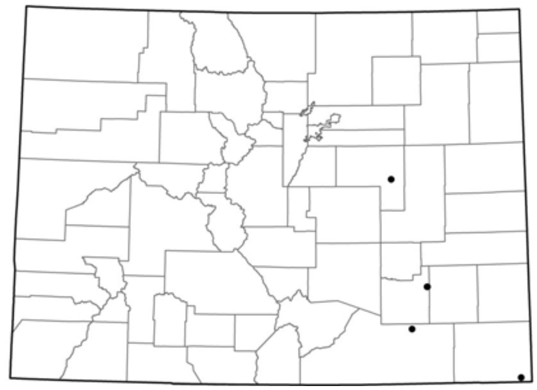
General Description: In Colorado, this community occurs on sandy floodplain soils within the Arkansas River basin. A nearly continuous overhead canopy is provided by mature *Populus deltoides* ssp. *monilifera* (plains cottonwood). There are few native shrubs, which often leads to an open, park-like structure; however, *Tamarix ramosissima* (saltcedar), a non-native, introduced invasive shrub has become a thick subcanopy in many stands along the lower Arkansas River in Colorado. Stands occur in wide valley bottoms on active floodplains. Soils are deep, silty and sandy clay loams over sand to loamy sands over sand.

Vegetation: *Populus deltoides* creates a distinct overstory gallery canopy. *Salix amygdaloides* (peach leaf willow) may be present in small amounts. Native shrubs are not present or are very scattered, and include *Artemisia filifolia* (sand sage). The introduced *Tamarix ramosissima* (saltcedar) is thick on the floodplains of perennial rivers. The herbaceous understory is dominated by *Sporobolus cryptandrus* (sand dropseed). Other grass species that may be present include *Pascopyrum smithii* (western wheatgrass), *Sporobolus airoides* (alkali sacaton), *Panicum obtusum* (vine mesquite), *Elymus canadensis* (Canada wildrye), *Andropogon hallii* (sand bluestem), and *Hesperostipa comata* (needle and thread grass).

Similar Communities: This plant association may be part of the more broadly defined

Populus deltoides / *Distichlis spicata* (eastern cottonwood/inland saltgrass) plant association described from the South Platte and Arkansas Rivers in Colorado by Lindauer (1970), Christy (1973), and Crouch (1979a, 1979b). Even though stands of *Populus deltoides* / *Sporobolus cryptandrus* (eastern cottonwood / sand dropseed) did not contain any *Distichlis spicata* (inland saltgrass), they did occur adjacent to similar age stands of the *Populus deltoides* / *Pascopyrum smithii* - *Panicum obtusum* (eastern cottonwood / western wheatgrass - obtuse panicgrass) plant association containing *Distichlis spicata*.

Regional Distribution: This association is documented in eastern Colorado and is expected to occur in similar habitats in New Mexico, Kansas, and Oklahoma.



Colorado Distribution: This community is known from Bijou Creek, a tributary to the South Platte River; from the Arkansas, Purgatory, and Big Sandy Rivers; and a small canyon tributary (Sand Canyon) on the southeastern Colorado plains.

Elevation Range in Colorado: 3,900.00 - 5,800.00 ft / 1,188.72 - 1,767.84 m

Site Geomorphology: Stands occur in wide valley bottoms on active floodplains, located 144-570 ft (44-173 m) laterally away from the active stream channel and 2-5 ft (0.6-1.5 m) above the annual high water mark. Streams ranged from wide, meandering cobble or sand-bed channels to broad, braided sandbed ephemeral washes.

Soil: Soils are deep 19-31 inches (49-80 + cm). Textures ranged from silty and sandy clay loams over sand on the larger, perennial river floodplains, to loamy sands over sand on the dry wash floodplains. Soils were very dry, sometimes cemented sand, with no mottles.

Successional and Ecological Processes: This riparian woodland is a late-seral community of active floodplains. It appears to develop only on very dry and sandy soils, on higher terraces that are less frequently flooded. *Sporobolus cryptandrus* (sand dropseed) is limited to sandy soils, but can be an indicator of disturbed sites.

Adjacent Vegetation: Adjacent riparian vegetation: *Populus deltoides* / *Pascopyrum smithii* - *Panicum obtusum* (eastern cottonwood / western wheatgrass - obtuse panicgrass) woodlands; *Salix exigua* (coyote willow) and *Tamarix ramosissima* (saltcedar) shrublands; and *Typha* spp. (cattail) wetlands occur as part of the surrounding riparian mosaic. Adjacent upland vegetation: agricultural fields, *Pinus edulis* - *Juniperus* spp. (two needle pinyon - juniper) woodlands; *Artemisia filifolia* (sand sage) shrublands; *Bouteloua gracilis* - *Buchloe dactyloides* (Blue grama - buffalograss) shortgrass prairies, and large patches of *Salsola collina* (slender Russian thistle) occur in the surrounding upland landscape.

Management: Regeneration and establishment of new stands of cottonwood are dependent upon flooding events, and any alterations to the natural flow regime of a river can affect the cottonwood ecosystem. Without periodic disturbance by flooding, riparian areas become dominated by late-seral communities. These late-seral communities are dominated by more upland species, such as conifers in montane areas or other, more drought tolerant species in the foothill and plains environments. Cottonwood seedlings and saplings are frequently browsed by cattle. Excessive grazing and browsing will reduce plant vigor and allow non-native plant species to gain a competitive advantage. Cottonwood-dominated riparian areas in Colorado are best grazed moderately for short periods during the growing season or solely during the winter season. This maintains high forage quality and quantity. Winter-only grazing by livestock works very well in maintaining the native grass species vigor in cottonwood ecosystems of eastern plains rivers in Colorado.

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Sarcobatus vermiculatus / Bouteloua gracilis* Shrubland
State Common Name Saline Bottomland Shrublands

Global Scientific Name: *Sarcobatus vermiculatus / Bouteloua gracilis* Shrubland
Global Common Name: Black Greasewood / Blue Grama

Community Classification

System:	International Vegetation Classification
Class:	Shrubland
Subclass:	Deciduous shrubland
Group:	Extremely xeromorphic deciduous shrubland
Subgroup:	Natural/Semi-natural extremely xeromorphic deciduous shrubland
Formation:	Extremely xeromorphic deciduous subdesert shrubland without succulents
Alliance:	Black Greasewood Shrubland Alliance

Global Rank: G1Q
Global Rank Reasons: This association is currently known from a small region of north-central New Mexico and from another occurrence in southeastern Colorado - with less than 1000 acres documented. Most stands of *Sarcobatus*-dominated vegetation have been severely degraded by livestock use, and lowered water tables due to severe erosion. This association may be closely related to other *Sarcobatus* or *Atriplex canescens* vegetation types in the western United States.

Subnational Rank: SU
Subnational Rank Reasons: Only one documented occurrence in Colorado. This large occurrence is in fair condition and subject to reacreational impacts. More survey information is needed on this community type to further assign an element rank.

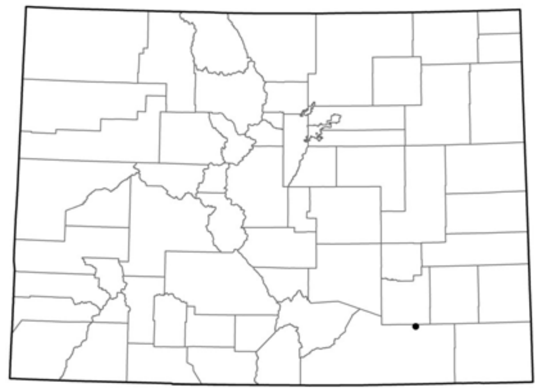
General Description: This poorly documented association has been described only from north-central New Mexico, along the Rio Chama, a tributary of the Rio Grande. This is a semi-arid region, with annual precipitation of 25-35 cm. Most occurs as the result of high intensity, short duration, convective thundershowers during the summer months. Summers are typically hot, and winters are moderately cold, with some snowfall. This association is found on alluvial fans and river terraces. Slopes are gentle. This is a subdesert shrubland, with a moderately dense layer of deciduous and semideciduous shrubs. *Sarcobatus vermiculatus* and *Atriplex canescens* dominate this layer. A shorter shrub layer is dominated by *Gutierrezia sarothrae*. The herbaceous layer is composed of perennial grasses. *Bouteloua gracilis* has the highest percent occurrence, followed by *Pleuraphis jamesii (= Hilaria jamesii)* and *Sporobolus cryptandrus*.

Vegetation: This is a poorly described association. It is a subdesert shrubland, with a moderately dense layer of deciduous and semi-deciduous shrubs, about 0.5 m in height. *Sarcobatus vermiculatus* and *Atriplex canescens* dominate this layer. A lower shrub layer (20 cm tall) is dominated by *Gutierrezia sarothrae*. The herbaceous layer is composed of perennial grasses, with total cover up to 50%. *Bouteloua gracilis* has the highest percent occurrence, followed by *Pleuraphis jamesii (= Hilaria jamesii)* and *Sporobolus cryptandrus*. Few other species occur and much bare ground may be exposed.

Similar Communities: -

Regional Distribution: This association has been described from north-central New Mexico, along the Rio Chama, a tributary of the Rio Grande and also from southeastern Colorado in Las Animas County.

Colorado Distribution: Documented from one occurrence in Las Animas County. This occurrence in southeastern Colorado covers less than 100 acres.



Elevation Range in Colorado: ? - ? ft / ? - ? m

Site Geomorphology: Slopes are gentle. Topography of these sites is such that water tends to spread out and flow slowly, causing sheet erosion.

Soil: Soils are likely to be finely textured and alkaline.

Successional and Ecological Processes: -

Adjacent Vegetation: This occurrence in Las Animas County occurred in a mosaic with a *Sarcobatus vermiculatus*/*Sporobolus airoides* community.

Management: -

Literature Cited

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Herbaceous Vegetation

State Common Name Great Plains Mixed Grass Prairies (Sandstone/Gravel Breaks)

Global Scientific Name: *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Herbaceous Vegetation

Global Common Name: Western Great Plains Little Bluestem Mixedgrass Prairie

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Medium-tall sod temperate or subpolar grassland
Alliance:	Little Bluestem - Sideoats Grama Herbaceous Alliance

Global Rank: G3
Global Rank Reasons: Colorado has 9 documented occurrences. The number of occurrences is unknown elsewhere, but is reported from Oklahoma (where it is ranked S4), Kansas (S?), and possibly New Mexico (SP). It is found in seven southwestern Great Plains ecoregional sections.

Subnational Rank: S2
Subnational Rank Reasons: It is estimated that there are less than twenty occurrences (of moderate or better size) in the state, most of which have had some historic or current impact from livestock grazing.

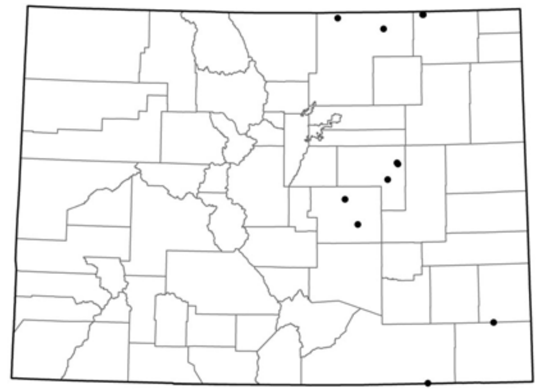
General Description: This little bluestem grassland community is found on the plains of eastern Colorado. Stands occur on shallow sandy or rocky soil, usually on level or gently sloping terrain. The vegetation of this community is dominated by mid grasses with tall and short grasses present to abundant. The vegetation cover is moderate to dense. *Schizachyrium scoparium* and *Bouteloua curtipendula* are the dominant species, with many other are common grasses present. Forbs do not make up a large amount of the canopy. Woody plants, such as short shrubs, are uncommon but usually present.

Vegetation: This is a mid grass dominated community. Short and tall grass species are also present and may even be abundant within the community. Most of the plants in this community are 0.5 m or less, but the tallest species grow to approximately 1 m (Weaver and Albertson 1956). *Schizachyrium scoparium* and *Bouteloua curtipendula* are the dominant species. *Andropogon hallii, Bouteloua gracilis, Bouteloua hirsuta, Koeleria macrantha, Panicum virgatum, Sorghastrum nutans, Hesperostipa neomexicana (= Stipa neomexicana), Sporobolus compositus var. compositus*, and *Sporobolus cryptandrus* are also common grasses. Forbs do not make up a large portion of the canopy, but *Eriogonum* spp. and *Dalea purpurea* are typically present. Woody plants, such as the short shrubs

Gutierrezia sarothrae and *Yucca glauca*, are uncommon but usually present.

Similar Communities: The descriptions of communities by Weaver and Albertson (1956) are short and general. Their relationship to this type is not verified.

Regional Distribution: This little bluestem grassland community is found in the southwestern Great Plains of the United States, ranging from Kansas and Colorado south to Oklahoma and possibly New Mexico.



Colorado Distribution: This community is found in eastern Colorado in Logan, Weld, Elbert, El Paso, Baca and Las Animas Counties.

Elevation Range in Colorado: 4,200.00 - 6,080.00 ft / 1,280.16 - 1,853.18 m

Site Geomorphology: Stands typically occur on level or gently sloping terrain, although it has also been documented on more moderate slopes.

Soil: Soils are shallow and may be sandy or rocky.

Successional and Ecological Processes: -

Adjacent Vegetation: -

Management: -

Literature Cited

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Schoenoplectus pungens* Herbaceous Vegetation
State Common Name Bulrush

Global Scientific Name: *Schoenoplectus pungens* Herbaceous Vegetation
Global Common Name: Bulrush Wet Meadow

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Semipermanently flooded temperate or subpolar grassland
Alliance:	Threesquare Semipermanently Flooded Herbaceous Alliance

Global Rank: G3G4
Global Rank Reasons: This association has a wide distribution, but few stands have been documented.

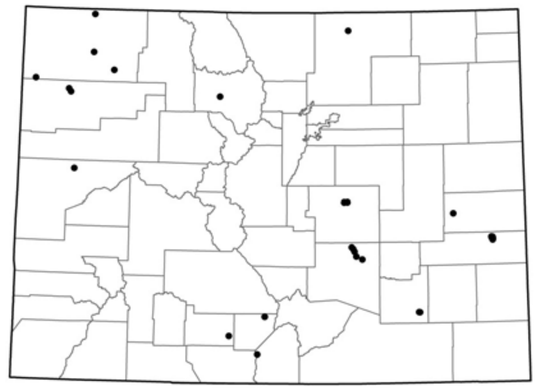
Subnational Rank: S3
Subnational Rank Reasons: In Colorado more than 20 stands are documented. However, few of these are large or in pristine condition.

General Description: The *Schoenoplectus pungens (=Scirpus pungens)* (threesquare bulrush) plant association forms small low stature (1-3 ft, 0.3-1 m) marshes in low-lying swales, abandoned channels, and overflow channels where soils remain saturated. This association is characterized by pure stands of *Schoenoplectus pungens,* occasionally associated with a few other graminoid species. This association also occurs on silt and sand bars within the active channel where the water velocity is lowest.

Vegetation: This plant association can be pure stands of *Schoenoplectus pungens* (threesquare bulrush). Some stands include other graminoids such as *Juncus balticus* var. *montanus* (mountain rush), *Hordeum jubatum* (foxtail barley), *Phragmites australis* (common reed), *Spartina gracilis* (alkali cordgrass), *Muhlenbergia asperifolia* (alkali muhly), and *Eleocharis palustris* (common spikerush). On alkaline soils, *Distichlis spicata* (inland saltgrass) is a common associate.

Similar Communities: Closely related communities that have different associated species include: the *Scirpus americanus* / *Carex* spp. (chairmaker's bulrush/sedge) community from Saskatchewan, Montana, Wyoming, Utah, Colorado, Kansas, and Nebraska (Johnston 1987) and the *Scirpus* spp. / *Distichlis spicata* (bulrush/inland saltgrass) from Utah, Kansas, Nebraska, and North Dakota (Johnston 1987).

Regional Distribution: This community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains, from east-central Alberta, Canada, and Montana south to Colorado, and west into Nevada, Utah, and Wyoming.



Colorado Distribution: This plant association occurs in western Colorado in the Yampa, White, Colorado and Rio Grande River basins. It also if found in eastern Colorado in the South Platte and Arkansas River Basins.

Elevation Range in Colorado: 3,800.00 - 7,800.00 ft / 1,158.24 - 2,377.44 m

Site Geomorphology: The *Scirpus pungens* (threesquare bulrush) plant association occurs in low-lying swales, abandoned channels, and overflow channels. The water table is generally at or near the surface. This association also occurs on silt and sandbars within the active channel where the water velocity is lowest. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Streams are low gradient, meandering, alluvial channels with broad, well defined floodplains (Rosgen Channel Types: C6) or very wide, braided channels with eroding banks (Rosgen Channel Types: D5).

Soil: Soils from the Colorado River Basin are black, anoxic, organic soils and gleyed, clay-loam, alkaline soils. The alkaline soils are classified as loamy typic Cryaquents.

Successional and Ecological Processes: *Schoenoplectus pungens* (threesquare bulrush) is an early colonizer and is adapted to saturated conditions on streamsides, sandy shores, marshes, and reservoir margins. Because of the wet soil conditions and aggressive growth of *Schoenoplectus pungens*, most other species are precluded from the sites. Disturbance can cause the establishment of increaser species such as *Juncus balticus* var. *montanus* (mountain rush) and *Hordeum jubatum* (foxtail barley). Lowering the water table may dry the site and result in decreased cover of *Schoenoplectus pungens*. An increase in salinity may increase alkaline tolerant species.

Adjacent Vegetation: Adjacent riparian vegetation: *Salix exigua* (coyote willow) shrublands and *Eleocharis palustris* (common spikerush) wetlands occur in similar low-lying areas. *Populus* (cottonwood) species and *Acer negundo* (box elder) forests and *Sarcobatus vermiculatus* (greasewood) shrublands occur on higher terraces. Adjacent upland vegetation: *Pinus edulis* (pinyon pine) and *Juniperus osteosperma* (Utah juniper) woodlands and *Artemisia tridentata* (big sagebrush) shrublands occur on adjacent hill slopes.

Management: *Scirpus pungens* (=*Schoenoplectus pungens*) (threesquare bulrush) has low to moderate palatability to livestock and is seldom grazed. However, if water levels drop or upland forage is limited, livestock may heavily utilize this plant association (Hansen *et al*. 1995). *Scirpus pungens* (=*Schoenoplectus pungens*) (threesquare bulrush) helps filter sediments to build streambanks. This species is a prolific seed producer but seeds require moist, bare soil for germination. Its rhizomes spread quickly into exposed areas, rapidly colonizing mudflats and drawdown areas (Hansen *et al*. 1995).

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Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Sporobolus airoides* Southern Plains Herbaceous Vegetation
State Common Name Great Plains Salt Meadows

Global Scientific Name: *Sporobolus airoides* Southern Plains Herbaceous Vegetation
Global Common Name: Alkali Sacaton Southern Plains Grassland

Community Classification

System:	International Vegetation Classification
Class:	Herbaceous Vegetation
Subclass:	Perennial graminoid vegetation
Group:	Temperate or subpolar grassland
Subgroup:	Natural/Semi-natural temperate or subpolar grassland
Formation:	Medium-tall bunch temperate or subpolar grassland
Alliance:	Alkali Sacaton Herbaceous Alliance

Global Rank: G3Q
Global Rank Reasons: The number of occurrences is unknown. The community is reported from Arizona, Colorado (S3), Kansas, New Mexico (S2), Texas, Utah, and Mexico and may occur in California. The community is found on slightly to moderately saline, nearly level bottomland and terraces with alluvial silty clay soils.

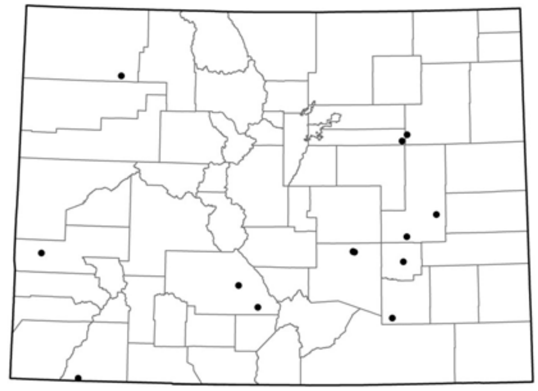
Subnational Rank: S3
Subnational Rank Reasons: This community is reported from over 10 counties in Colorado, but documented occurrences are small and patchy. The community is highly threatened by improper livestock grazing and stream flow alterations.

General Description: This plant association occurs on alkaline or saline soils in floodplain depressions and on sandy stream banks. *Sporobolus airoides* (alkali sacaton) dominates the vegetative cover with a few woody species also present. The association occurs in small but frequent patches on the eastern plains and Western Slope of Colorado.

Vegetation: This plant association is characterized by a dense, narrow stand of *Sporobolus airoides* (alkali sacaton) lining and overhanging the stream bank or by a monotypic stand in playa lakes. Other grass species that may be present include *Panicum obtusum* (vine mesquite), *Bouteloua gracilis* (blue grama), S*chizachyrium scoparium* (little bluestem), and *Sporobolus cryptandrus* (sand dropseed). Woody species which can be present along streams and rivers, include *Populus angustifolia* (narrowleaf cottonwood), *Fraxinus anomala* (singleleaf ash), *Rhus trilobata* (skunkbush sumac), *Amelanchier alnifolia* (Saskatoon serviceberry), and *Salix exigua* (sandbar willow). Forb cover is minimal.

Similar Communities: -

Regional Distribution: This alkali sacaton mesic grassland community is found in the southwestern Great Plains, Colorado Plateau and elsewhere in the southwestern United States and Mexico, ranging from Kansas and Colorado south to Texas, New Mexico and west to Arizona, Utah, and possibly California.



Colorado Distribution: This association occurs in small but frequent patches on the eastern plains of Colorado, as well as on the Western Slope.

Elevation Range in Colorado: 4,900.00 - 9,000.00 ft / 1,493.52 - 2,743.20 m

Site Geomorphology: This plant association occurs in floodplain depressions and on sandy stream banks.

Soil: Soils are alkaline (basic) or saline (contain a high concentration of soluble salts).

Successional and Ecological Processes: This is an early-seral community that occurs on floodplains and depressions with moderately alkaline or saline soils. Stands may be flooded infrequently, or have high water tables. The intermittent flood regime affects soil moisture and salinity which can alter species composition. Sudden increases in salinity will result in a decrease in cover of *Sporobolus airoides* (alkali sacaton). With no change in salinity, this plant association will form hummocks that accumulate sand. Gradually the sites will decrease in salinity and moisture and invasion by other grasses will follow.

Adjacent Vegetation: Adjacent Riparian Vegetation: *Populus angustifolia* (narrowleaf cottonwood) forests and *Salix exigua* (coyote willow) shrublands occur in adjacent riparian areas. Adjacent Upland Vegetation: *Pinus edulis-Juniperus* spp. (pinyon pine-juniper) woodlands occur on adjacent hill slopes.

Management: Very little management information is available. However, *Sporobolus airoides* (alkali sacaton) is considered to be of poor to good forage value for livestock (Stubbendieck 1981). *Distichlis spicata* var. *spicata* (inland saltgrass) often increases in this association with heavy grazing or with an increase in soil salinity.

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State Name: *Asclepias uncialis* ssp. *uncialis* (dwarf milkweed)
Global Name: *Asclepias uncialis* ssp. *uncialis* (Greene's Milkweed)

Taxonomy
Class: Dicotyledoneae
Order: Gentianales
Family: Asclepiadaceae

Taxonomic Comments: *A. uncialis* ssp. *uncialis* in the Kartesz (1994) sense is the same entity as *A. uncialis* sensu stricto (excluding *A. uncialis* ssp. *ruthiae*).

Ranks and Status
Global Rank: G3G4T2T3
State Rank: S2
Federal Protection Status: BLM and USFS Sensitive Species
State Protection Status: None

Description and Phenology
A small, herbaceous perennial with several to many stems 1 to 2.5 inches high. Stems have milky sap. Leaves are primarily opposite, and are of two different forms - lower leaves are oval to lanced shaped, while upper leaves are much narrower. Flowers have five reflexed petals with attendant hoods and horns. Flowers of *A. uncialis* ssp. *uncialis* are rose-purple, appearing in clusters at the tips of the stems, and are reported to have a strong fragrance (Zimmerman 1993).

Diagnostic Characteristics: Small stature, early blooming period, and heterophyllous leaves are diagnostic field characteristics.

Look Alikes: The small stature, early blooming period, and heterophyllous leaves distinguish *Asclepias uncialis* ssp. *uncialis* from the sympatric and similarly small-sized *A. pumila*, which has white flowers, blooms from July to September, and has only filiform leaves (Locklear 1991). The low-growing *A. involucrata* may also be found in the southern portion of the range of *A. uncialis* ssp. *uncialis*. It has greenish-white flowers, blooms later than *A. uncialis* ssp. *uncialis*, and has longer leaves that are uniformly lanceolate (Locklear 1996).

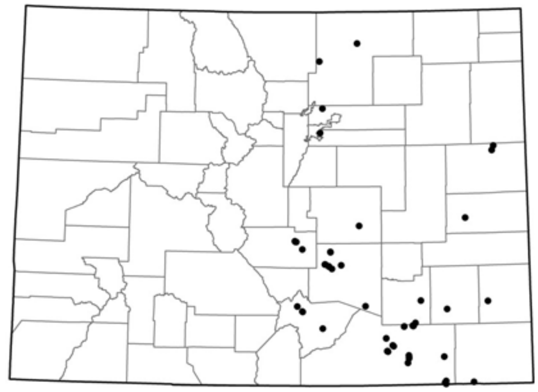
Phenology: *Asclepias uncialis* ssp. *uncialis* is the earliest blooming milkweed in the Great Plains (Great Plains Flora Association 1986) although its flowering period can potentially overlap those of a few other species in its range (e.g., *A. asperula*, *A. speciosa*, and *A. involucrata*). In Colorado, flowering begins in late April and extends to the end of May. The small population in Weld County, Colorado, that did not flower in the dry spring of 2006 was observed flowering in early August of the same year after some substantial summer rains.

Habitat
Typical habitat for *Asclepias uncialis* ssp. *uncialis* is level to gently sloping terrain without notable micro-topographic features. Although plants are often found at the base of escarpments or mesas, the species does not occur on rock ledges or outcroppings, and is absent from highly disturbed habitats such as sand dunes, erosion channels, wash slopes, and badlands. Elevations of extant occurrences in Colorado range from 3,920-7,640 feet (1,190-2,330 m). Soils in the range of *A. uncialis* ssp. *uncialis* belong to orders characterized by dry, warm soils (Mollisols, Entisols, Aridisols, and Alfisols). *Asclepias uncialis* ssp. *uncialis* does not appear to have highly specific microsite requirements, and there is no evidence that *A. uncialis* ssp. *uncialis* is restricted to a particular soil type. Occurrences are known from soils derived from a variety of substrates, including sandstone, limestone, and shale, but are most often found in sandy loam soils. It does not occur in pure sand. *Asclepias uncialis* ssp. *uncialis* is primarily associated with species typical of shortgrass prairie. Associated vegetation is comprised mostly of grasses, with forbs, shrubs, and trees typically comprising less than 15% of the total vegetation cover. Plants are typically found growing in open spaces between bunch grasses. Associated forbs are variable throughout the range, since many species found with *A. uncialis* ssp. *uncialis* in southeastern Colorado (e.g., *Melampodium leucanthum*) are near the northern edge of their distribution in that area (Locklear 1996). Although *A. uncialis* ssp. *uncialis* is often associated with Juniper Woodland and Savanna ecological systems, it is always found in the prairie or grassland components of these systems.

Elevation Range Feet: 3,920 - 7,640
Elevation Range Meters: 1,194 - 1,194

Distribution
Global Range: Historically, this species appears to have been known from two or three disjunct geographical areas: 1) the western Great Plains of eastern Colorado, northeastern New Mexico, and the adjacent Oklahoma panhandle; 2) central to southwestern New Mexico and scattered locations in Arizona; and 3) Sweetwater County in southwestern Wyoming. Some botanists consider the location of the Wyoming collection (*C.C. Parry #246*) to be an error in labeling and speculate that it may have come from northeastern Colorado (Fertig 2000, Fishbein personal communication 2004). Recent observations (i.e., those less than 20 years old) are confined to the first two areas mentioned plus a few observations in central New Mexico. Based on collection location and frequency, the range of the species appears to have contracted in northeastern Colorado since the mid to late 1800's.

Colorado State Range: Estimated range is 71,964 square kilometers (27,785 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences. There is potentially about 40,000 square miles of habitat in eastern Colorado (although perhaps as much as 50% of this area is no longer suitable habitat), roughly 45% of the total potential range of the species. The current known distribution of *Asclepias uncialis* ssp. *uncialis* forms an arc along the flank of the Southern Rocky Mountains from northeastern Colorado to southwestern New Mexico and adjacent southeastern Arizona. Currently known from nine Colorado counties (Las Animas, Weld, Kit Carson, Huerfano, Pueblo, Otero, Prowers, Fremont, and El Paso), and historically known from at least eight additional counties (Arapaho, Adams, Baca, Bent, Cheyenne, Larimer, Denver and Washington). Occurrences are primarily in southeastern Colorado.

Threats and Management Issues

The primary threat at this time is considered to be agricultural development. It is not known if all of the occurrences are or are not threatened by these activities. In general, *A. uncialis* ssp. *uncialis* habitat, shortgrass prairie, is threatened by extensive human alterations for agricultural, residential, and recreational uses. Specific threats to extant occurrences include: recreational use, agricultural use, and military tank traffic. Based on available information, there are several threats to the persistence of *A. uncialis* ssp. *uncialis*. In order of decreasing priority, other threats are population limitation by unknown biological requirements, altered disturbance regime, habitat loss, spread of exotic species, and global climate change. A lack of understanding of population trends and habitat conditions for *A. uncialis* ssp. *uncialis* , and the lack of knowledge about its life cycle, population extent, and demographics also contribute to the possibility that one or more of these factors will threaten the long-term persistence of the species (Decker 2006). Locklear (1996) identified several patterns exhibited by *Asclepias uncialis* ssp. *uncialis* that are of concern: 1) *A. uncialis* ssp. *uncialis* is often not found at historical sites that retain native vegetation. In these cases, absence of *A.uncialis* ssp. *uncialis* may be due to causes peculiar to the biology of *A.uncialis* ssp. *uncialis*, instead of habitat degradation, 2) Most of the known populations are small, discrete, and isolated from each other. Large areas of intervening, apparently suitable habitat are not occupied. Gene flow between these isolated populations is unlikely, and may lead to a decline in species viability over time, and 3) *A.uncialis* ssp. *uncialis* exhibits extremely low rates of sexual reproduction, perhaps even lower than is characteristic of the genus. Although known populations are exposed to grazing, potential recreational use and development, and military training maneuvers, the degree of threat from these disturbances is not known.

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Version Date: 05/13/2008

State Name: *Bolophyta tetraneuris* (Barneby's fever-few)
Global Name: *Parthenium tetraneuris* (Barneby's Feverfew)

Taxonomy
Class: Dicotyledoneae
Order: Asterales
Family: Asteraceae

Taxonomic Comments: Synonym is *Bolophyta tetraneuris* (Barneby) W.A. Weber. *Parthenium tetraneuris* has been published as a tetraploid race of *P. alpinum* (FNA 21:21).

Ranks and Status
Global Rank: G3
State Rank: S3
Federal Protection Status: None
State Protection Status: None

Description and Phenology
Parthenium tetraneuris is an inconspicuous perennial that forms low mounds of leaves, 2-5 cm tall. White disk flowers bloom in May.

Look Alikes: This species is not likely to be confused with any other species in its habitat when they are in flower. However, in its vegetative state it is difficult to distinguish from *Eriogonum lachnogynum* and *Tetraneuris acaulis*.

Phenology: Flowers in May, fruit in late May and June.

Habitat
Found on tops of limestone and shale cliffs and bluffs, and in open pinon-juniper stands with very sparse ground-vegetation. Soils are derived from white shale (Peterson 1983). Grows on limestone and shale derived from the Niobrara Formation in communities composed of various mixtures of *Pinus edulis, Juniperus osteosperma, Cercocarpus* sp., *Artemisia* sp., *and Frankenia.* A disjunct population near Salida (Chaffee County) grows on alluvium of the Dry Union Formation (O'Kane 1988). The population in Costilla County grows on volcanic-derived soils (pers. comm. Jennings 1995).

Elevation Range Feet: 5,400 - 5,750
Elevation Range Meters: 1,645 - 1,645

Distribution
Global Range: Abruptly confined to exposures of gypseous shale (5,400 to 5,750 feet); it occurs in Pueblo, Fremont, Chaffee, Las Animas and Costilla counties; most occurrences are from Pueblo and Fremont county sites (ca. 179,000 individuals).

Colorado State Range: Currently known from 6 counties in Colorado (Chaffee, Conejos, Costilla, Fremont, Las Animas, and Pueblo).

 

Threats and Management Issues
Threatened by housing and recreational development, mining for cement products, and off road vehicle use; effects of grazing not known (O'Kane 1988); road development and the expansion of the city of Pueblo are also significant threats (Peterson 1983).

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Version Date: 12/18/2007

State Name: *Chenopodium cycloides* (sandhill goosefoot)
Global Name: *Chenopodium cycloides* (Sandhill Goosefoot)

Taxonomy
Class: Dicotyledoneae
Order: Caryophyllales
Family: Chenopodiaceae

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Ranks and Status
Global Rank: G3G4
State Rank: S1
Federal Protection Status: USFS Sensitive Species
State Protection Status: None

Description and Phenology
An herbaceous annual is found on sandy soils. The plant has branched stems 12-25 inches high. Stems are smooth to somewhat waxy coated. Leaves are linear, one veined, entire and slightly fleshy. Flowers are in dense or interrupted panicles of spikes. Partially fused sepals spread at maturity to reveal reddish-purple fruit in August through September.

Look Alikes: Distinguished from *C. berlandieri*, *C. incanum*, and *C. pratericola*, with which it often occurs in mixed populations, by its linear leaves with a single vein, partially fused sepals which spread at maturity revealing the reddish-purple fruit, and larger fruits.

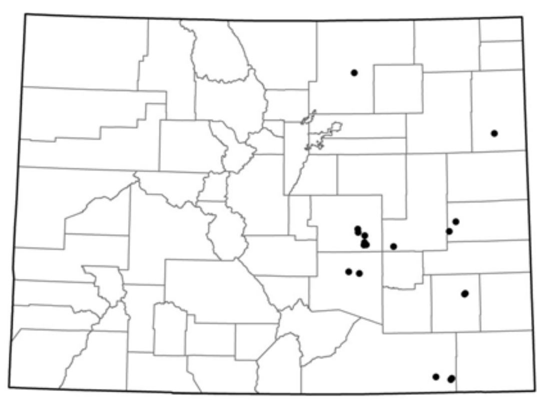
Phenology: Annual; Flowers July through August, fruits in August through September (Ryke et al. 1994).

Habitat
The plant can be found on grasslands in sandy soils on dunes and stabilized sand in blowouts (Ryke et al. 1994).

Elevation Range Feet: 3,860 - 5,820
Elevation Range Meters: 1,176 - 1,176

Distribution
Global Range: Six counties in southwest Kansas. Also in southeast Colorado, Texas, Nebraska, Oklahoma and southcentral New Mexico.

Colorado State Range: Known from Bent, Cheyenne, El Paso, Las Animas, Lincoln, Pueblo, Weld and Yuma counties in eastern Colorado.



Threats and Management Issues
Residential development and agricultural use of land represent tangible threats to this species. Currently, no known occurrences are imminently threatened.

References

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Version Date: 05/15/2008

State Name: *Frasera coloradensis* (Colorado green gentian)
Global Name: *Frasera coloradensis* (Colorado Gentian)

Taxonomy
Class: Dicotyledoneae
Order: Gentianales
Family: Gentianaceae

Ranks and Status
Global Rank: G3
State Rank: S3
Federal Protection Status: None
State Protection Status: None

Description and Phenology
A perennial herb with several branched flowering stems up to 3 dm tall bearing white or greenish-white flowers with purple dots. The plants exist for several years as a vegetative rosette before flowering, and they may bloom only once before dying. The narrow, white-margined leaves are distinctive.

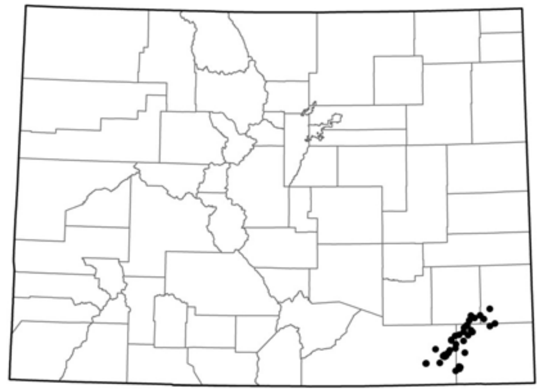
Look Alikes: It is quite distinctive and is unlikely to be confused with other taxa. (Naumann 1991) However, leaves look superficially like the young leaves of Yucca glauca, but on close inspection, Yucca leaves are thicker and more fibrous, with fibers peeling off at the margins (pers. comm. Coles 1994).

Phenology: Flowers in mid-June to mid-July (Naumann 1991). Produces fruits in July after flowering (Ryke 1994).

Habitat
Low sandy/sandstone breaks in grasslands, northerly aspects in between rocks or just below them; shallow slopes. Associated with surface outcrops or shallow-to-bedrock occurrences of Cretaceous rock formations, including Greenhorn limestone, Graneros shale and Dakota sandstone. Plant community generally shortgrass prairie or mixed prairie breaks. Substrate best indicator for locations of this species (Naumann 1991).

Elevation Range Feet: 4,000 - 5,500
Elevation Range Meters: 1,219 - 1,219

Distribution
Global Range: Colorado endemic; documented habitat less than 300 acres; potential undocumented habitat is estimated at about 1,000 acres (Naumann 1991). Total range is about 25 miles x 75 miles.



Threats and Management Issues

Moderately threatened by agricultural and road management practices such as herbicide application; grazing may suppress reproduction, but probably doesn't frequently kill established plants except in cases of overgrazing; primary threat is inadvertant loss or alteration of naturally limited habitat (Naumann 1991).

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Version Date: 05/15/2008

State Name: *Herrickia horrida* (Canadian River spiny aster)
Global Name: *Herrickia horrida* (Horrid Herrickia)

Taxonomy
Class: Dicotyledoneae
Order: Asterales
Family: Asteraceae

Taxonomic Comments: Treated as Eurybia horrida by Kartesz (1999); has also been treated as Herrickia horrida (e.g., by Kartesz, 1994). USFWS misspelled as 'Herricka' in Federal Register (9/93).

Ranks and Status
Global Rank: G2?
State Rank: S1
Federal Protection Status: None
State Protection Status: None

Description and Phenology
A low growing, perrenial shrub with numerous slender, branched stems extending from a somewhat wood root; stems 30 cm high or less (Wooten and Standley 1913). Thick, oblong, leathery leaves 2-5 cm long, coarsly toothed with spines on the teeth. The flowers are composed of violet rays and yellow discs (Weber et al 1979).

Diagnostic Characteristics: Purple composite with spinulose, oblong, thick-leathery leaves; spinulose involucre bracts (Weber et al. 1979).

Look Alikes: Easily recognized by its holly-like leaves (Weber 1990).

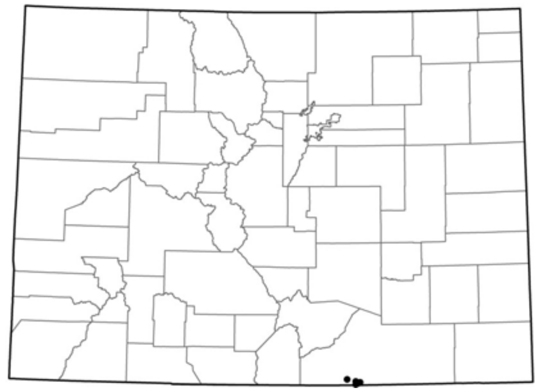
Phenology: [In New Mexico] Flowers July to Oct. (unknown source in EMF) and Aug. (Wooten and Standley 1913). Usually in prime flower in mid-August (pers. comm. Jennings 1995).

Habitat
Rocky hillsides, steep narrow canyon bottoms (Fletcher 1984).

Elevation Range Feet: 6,900 - 8,700
Elevation Range Meters: 2,103 - 2,103

Distribution
Global Range: South Las Animas County, Colorado and along the Canadian River drainage in Colfax, Harding, and Mora Counties, New Mexico. It only occurs in the canyon for a 25-30 mile stretch (Knight pers. comm. 1996).

Colorado State Range: Known from Las Animas County in Colorado. Estimated range in Colorado is 48 square kilometers (19 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues
Threats are not documented. Plant occurs on private land and on James M. John State Wildlife Area near Interstate 25 and the New Mexico border. Preferred habitat of species not suitable for development and very inaccessible. Some oil and gas drilling occurs within the vicinity of the occurrences with unknown impacts.

References

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Version Date: 05/15/2008

State Name: *Lesquerella calcicola* (Rocky Mountain bladderpod)
Global Name: *Lesquerella calcicola* (Rocky Mountain Bladderpod)

Taxonomy
Class: Dicotyledoneae
Order: Capparales
Family: Brassicaceae

Ranks and Status
Global Rank: G2
State Rank: S2
Federal Protection Status: None
State Protection Status: None

Description and Phenology
This perennial is silvery-stellate throughout. The caudex is simple or closely branched. Stems are 10-30 cm long with radial basal leaves. Leaves are oblanceolate to linear. The racemes do not elongate in fruit, the fruit are crowded at the top. Fruit is 5-9 mm long. Pedicel forms a sigmoid shape. Flowers are yellow (Harrington 1954, Weber and Wittmann 2001).

Diagnostic Characteristics: Most easily identified with fruit and flowers present. Flowers are yellow. The fruit are pubescent and on a sigmoid pedicel.

Look Alikes: *Lesquerella fendleri* co-occurs and is vegetatively indistinguishable from *L. calcicola*. *Lesquerella calcicola* has pubescent fruit while *L. fendleri* fruit are glabrous (Weber and Wittmann 2001).

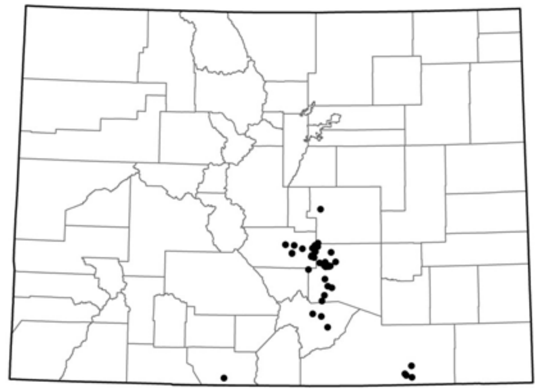
Phenology: Colorado Natural Heritage Program occurrence records suggest that this species flowers in May and June, and produces fruit in June-September, or even later in the calendar year.

Habitat
Shale barrens within grassland and pinyon-juniper mosaic. Other commonly associated species include *Cercocarpus montanus, Frankenia jamesii, Gutierrezia sarothrae, Oryzopsis hymenoides, Hilaria jamesii, Melampodium leucanthum, Oonopsis foliosa* ssp. *foliosa, Tetraneuris acaulis, Eriogonum* spp., as well as other globally rare shale barren species such as *Mirabilis rotundifolia* and *Oonopsis puebloensis*.

Elevation Range Feet: 4,800 - 6,700
Elevation Range Meters: 1,463 - 1,463

Distribution
Global Range: Colorado (Arkansas River Valley) and northern New Mexico.

Colorado State Range: Known from Conejos, El Paso, Fremont, Huerfano, Las Animas, and Pueblo counties in Colorado. Estimated range in Colorado is 22,758 square kilometers (8787 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues
The primary threat at this time is considered to be housing/urban development. The species may also be threatened by military maneuvers (on military lands), recreational uses, and noxious weed invasions. This species occurs in areas that are experiencing rapid development pressures.

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Version Date: 03/21/2007

State Name: *Oenothera harringtonii* (Arkansas Valley evening primrose)
Global Name: *Oenothera harringtonii* (Arkansas Valley Evening-primrose)

Taxonomy
Class: Dicotyledoneae
Order: Myrtales
Family: Onagraceae

Ranks and Status
Global Rank: G2G3
State Rank: S2S3
Federal Protection Status: USFS Sensitive Species
State Protection Status: None

Description and Phenology
Oenothera harringtonii is an annual or biennial, perhaps occasionally a short-lived perennial. Plants have a stout taproot with one to five stems rising from a basal rosette. Plants stand 15-40 cm tall and support large white flowers with petals that are 2-2.6 cm long. The stems are yellowish-fawn color, usually with reddish-purple splotches. Plants flower from mid-May to June, with five to ten flowers per stem opening each day. Petals are white, fading to pink, and flowers have a heavy fragrance.

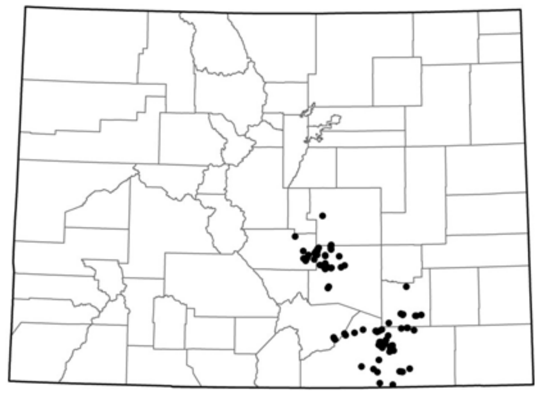
Look Alikes: Similar to *O. caespitosa* ssp. *macroglottis* whose range overlaps that of *O. harringtonii* in Fremont county. Because of their greatly different habitats they are rarely found growing together. One exception is along the Arkansas River between Parkdale and Canon City, where *O. caespitosa* ssp. *macroglottis* atypically occurs in a nonmontane habitat along the river. Intermediates have not been observed. The perennial *O. caespitosa* ssp. *macroglottis* has all basal leaves, notched corolla lobes, lower numbers of capsules per stem, and lower seed production. *O. caespitosa* ssp. *macroglottis* has a sweet fragrance as opposed to the strong "gardenia-like" fragrance of *O. harringtonii* (Wagner et al. 1995).

Phenology: Flowering mid May through June. Though *O. harringtonii* is typically annual, some individuals, especially from the southern part of the range, appear to overwinter and flower for at least a second season (Wagner et al. 1985).

Habitat
Oenothera harringtonii habitat is typically flat or gentle slopes in open shortgrass or saltbush communities. Plants are often found on compacted, silty clay soil, but may also grow on rocky, sandy, and silty loam soils. Substrates are often derived from shale and limestone formations, including the Niobrara formation, Carlile shale, Greenhorn limestone, Graneros shale, and Pierre shale formations.

Elevation Range Feet: 4,600 - 6,100
Elevation Range Meters: 1,402 - 1,402

Distribution
Global Range: Colorado endemic (El Paso, Fremont, Huerfano, Las Animas, Otero, and Pueblo counties). Estimated range is 15,693 square kilometers (6,059 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences. Probably in adjacent New Mexico (Wagner et al. 1985).



Threats and Management Issues
Residential development is considered to be the primary threat to the species at this time. Habitat loss due to urbanization, road development projects, and resource extraction activities, especially quarrying and surface mining, is a substantial threat to *Oenothera harringtonii*. Since several known occurrences are near highways, roadside maintenance activities, such as herbicide use, may impact the several known occurrences that are near highways. Recreational use of habitat is a threat to at least one occurrence at a Colorado state park. Invasion of habitat by non-native plant species is a potential threat throughout the range of this non-competitive species. Two classes of weeds pose substantial problems. Noxious weeds, such as field bindweed (*Convolvulus arvensis*) and jointed goatgrass (*Aegilops cylindrica*), and escaped non-native species used for agriculture and restoration, such as sweetclover (*Melilotus* spp.) and Mexican-fireweed (*Kochia scoparia*), have both been recorded at current occurrences. Livestock grazing, especially during flowering and fruiting periods, is likely to reduce the reproductive output of this species. This is a significant threat because *O. harringtonii* relies on seed production rather than vegetative reproduction to maintain its populations. Long-term sustainability of *O. harringtonii* populations is also jeopardized by declines in pollinator populations. The small size of many populations confers susceptibility to local extirpation from genetic, demographic, and environmental stochasticities (Ladyman 2005).

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Version Date: 05/15/2008

State Name: ***Oonopsis foliosa*** **var.** ***monocephala*** **(rayless goldenweed)**
Global Name: ***Oonopsis foliosa*** **var.** ***monocephala*** **(Single-head Goldenweed)**

Taxonomy
Class: Dicotyledoneae
Order: Asterales
Family: Asteraceae

Taxonomic Comments: Synonyms include *Haplopappus fremontii* ssp.*monocephalus* (used by USFWS 9/93), and *Oonopsis foliosa.*

Ranks and Status
Global Rank: G3G4T2
State Rank: S2
Federal Protection Status: None
State Protection Status: None

Description and Phenology
A perennial herb generally 10-40 cm tall, arising from a woody taproot. Vegetative reproduction via one or two horizontal, spreading, sprouting branch roots is common. The erect stems are glabrous or very sparsely hairy, with numerous entire, alternate, oblanceolate leaves of 5-15 cm in width. Involucre up to 35 mm wide and 25 mm tall. Phyllaries obtuse to acute, in 2 or more series, subequal or imbricate, ray flowers are absent.

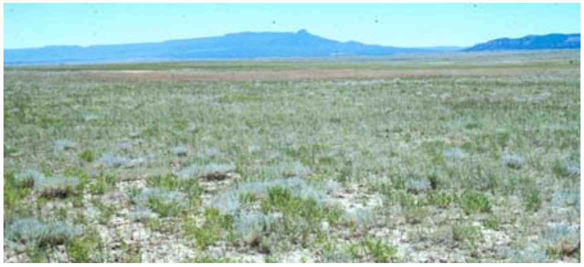
Diagnostic Characteristics: The lack of ray flowers distinguishes this species from sympatric *Oönopsis* species, although hybrids between var. *monocephala* and var. *foliosa* may exhibit a gradual transition from discoid to radiate morphology (Hughes and Brown 1994).

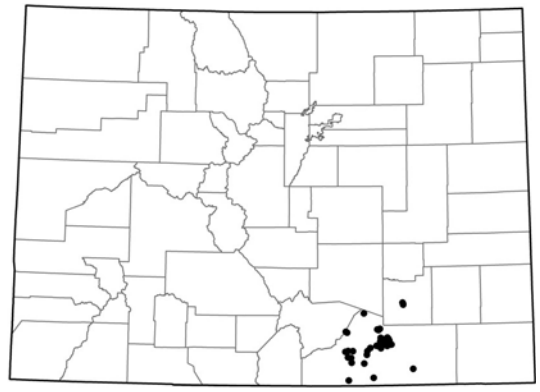
Phenology: Flowers June-July.

Habitat
This species is most often found in sparsely vegetated areas on or near highly eroded shale and clay slopes, including disturbed areas such as two-tracks. Soils are typically dry, fine-grained and clayey. Within the shortgrass prairie matrix, it may be associated with a variety of semi-arid grassland and shrubland associations, including those dominated by *Bouteloua gracilis, Frankenia jamesii, Krascheninnikovia lanata, Sarcobatus vermiculatus,* and *Yucca glauca.*

Elevation Range Feet: 4,000 - 6,000
Elevation Range Meters: 1,219 - 1,219

Distribution
Global Range: Colorado endemic (Las Animas County). Estimated range is 2,182 square kilometers (842 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.





Threats and Management Issues
Road construction and maintenance are considered to be the primary threats to the species at this time. Most of the individuals occur on private cattle ranches and on the DoD's Pinyon Canyon Maneuver Site. There are several highways, roads, and telephone lines throughout the occurrences. Although the species seems to tolerate a moderate level of disturbance, maintenance or further developments may adversely disturb or destroy individuals. Housing or commercial development may be a threat in the future.

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Version Date: 05/15/2008

State Name: *Oxybaphus rotundifolius* (round-leaf four-o'clock)
Global Name: *Mirabilis rotundifolia* (Round-leaf Four-o'clock)

Taxonomy
Class: Dicotyledoneae
Order: Caryophyllales
Family: Nyctaginaceae

Ranks and Status
Global Rank: G2
State Rank: S2
Federal Protection Status: None
State Protection Status: None

Description and Phenology
A perennial herb with round, densely soft-hairy, opposite leaves and trumpet-shaped magenta flowers in bloom in the summer (the flowers close by mid-morning). *Mirabilis rotundifolia* may be nearly glabrous to stiffly, densely hirsute.

Look Alikes: *M. multiflora* is sympatric but is much larger, has glabrous and glaucous leaves. *Oxybaphus rotundifolius* generally has round leaves while *O. hirsutus* generally has oblong-ovate leaves (pers. comm. Minton 94-11-09). *O. rotundifolius* may be nearly glabrous to stiffly, densely hirsute. *O. hirsutus* is a buffalo wallow plant on the plains; it is not sympatric with *O. rotundifolius*. In vegetative state, *O. rotundifolius* is superficially similar to local species of *Penstemon* with glaucous, pointed leaves (pers. comm. Coles 1994).

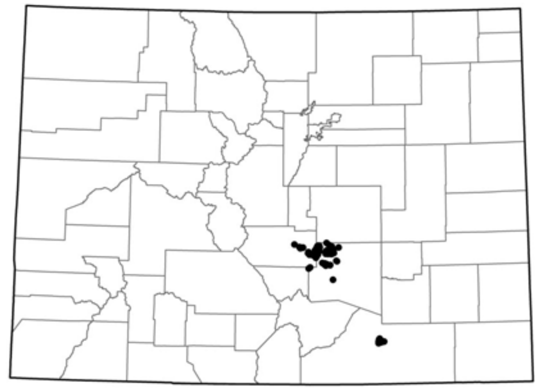
Phenology: Flowering occurs from early to mid-June and the flowers open before dawn and remain open until approximately 9 a.m.). In 1990 the plants had not emerged by April 15, and were just greening up by mid-May. In 1989 they were too dry to be seen readily by mid-July (Naumann 1990).

Habitat
Mirabilis rotundifolia (Oxybaphus rotundifolius) is generally restricted to outcrops of the lower shale unit of the Smoky Hill member of the Cretaceous Niobrara Formation. The plant community is sparse shrubland or woodland with a barren aspect. Frequent associates are James' frankenia *(Frankenia jamesii)* and oneseed juniper *(Juniperus monosperma)*.

Elevation Range Feet: 4,790 - 5,610
Elevation Range Meters: 1,459 - 1,459

Distribution
Global Range: Endemic to Colorado; known from Fremont, Las Animas, and Pueblo

counties. Estimated range is 3,732 square kilometers (1,441 square miles), calculated in GIS by drawing a minimum convex polygon around the known occurrences.



Threats and Management Issues

Residential development is considered to be the primary threat to the species at this time. Highly threatened by residential and recreational development (Naumann 1990). Three sites are bisected by state highways and may be impacted by road use and maintenance. Predation by Hawk Moth Caterpillars (horn worms) may be a problem (pers. comm. Kelso 1996).

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Version Date:05/15/2008