Southeastern Colorado
Survey of Critical Biological Resources
2009

Addendum to the 2007 Survey

March 2010

Natural Heritage Program
COLORADO

Colorado State University

Southeastern Colorado
Survey of Critical Biological Resources 2009

Addendum to the 2007 Survey

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Cover photograph: Purgatoire River, by Renée Rondeau

EXECUTIVE SUMMARY

The Central Shortgrass Prairie (CSP) ecoregion covers some 56 million acres, extends into seven States, and has been highly altered through most of the region. The most intact portion is in southeast Colorado (Fig. 1; Neely et al. 2006). Numerous conservation groups and agencies have documented the quality and importance of southeast Colorado, yet little on-the-ground information was available prior to our surveys. In 2007 and 2009, landowners requested biological inventories of their properties by the Colorado Natural Heritage Program, so the landowners might obtain data pertinent to their stewardship, future management decisions, and ecosystem credit values. This study was made possible with support from Great Outdoors Colorado, Colorado Division of Wildlife, Colorado Cattlemen's Agricultural Land Trust, Colorado State Land Board, The Nature Conservancy, Natural Resource Conservation Service, and private landowners. The surveys confirmed that southeast Colorado is a biological hotspot; the Colorado Natural Heritage Program located 41 rare species of animals, 36 of rare plants, and 46 plant communities of conservation concern, with over 2400 mapped locations (Table 1, Fig. 3).

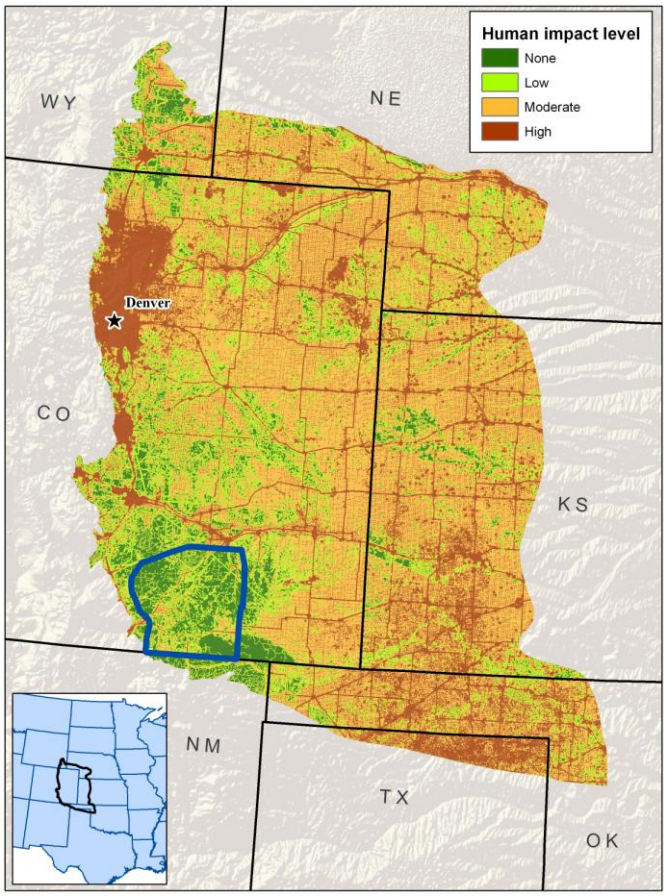

Figure 1. The human footprint or impacts on the Central Shortgrass Paraire ecoregion (modified from Neely et al. 2006). The blue polygon is the southeast Colorado study area (2.3 million acres).

The study area is a mosaic of grasslands, shrublands, rivers, canyonlands, shale hills, shale barrens, juniper savannas and woodlands, reflecting exceptional topographic diversity of this portion of the ecoregion. Grasslands are among the most highly altered of all ecosystems worldwide, and this is true of the CSP ecoregion as well (Neely et. al. 2006). Colorado has lost roughly 48% (CNHP and TNC 2008) of its historic native grasslands – a loss rate that is more than twice as high as that experienced by any other large-scale ecological system in the state. The remaining grasslands represent about 22% of Colorado (CNHP and TNC 2010), but are significantly under-represented in the state's portfolio of legally protected landscapes. Among upland habitats, grasslands support more than twice as many animal species of concern than any other habitat, including forests and shrublands, which each cover approximately the same percentage of Colorado as grasslands (roughly 19-21%). The study

area has several large blocks of intact grasslands, with all of the indicator species present, including swift fox, black-tailed prairie dog, mountain plover, burrowing owl, and ferruginous hawk.

Juniper breaks, shale barrens, and escarpments that provide topographic relief in the grasslands of southeast Colorado are prevalent in the northern portion of the study area, yet rare throughout Colorado (only 1% of Colorado (CNHP and TNC 2008)). These areas are critical for four of Colorado's endemic plants. The entire world-wide range of these four plants extends just slightly beyond the boundaries of the study area. Another important plant habitat within the study area is found within the canyonlands; the seeps and springs associated with the canyons are a hotspot for state rare ferns, with nearly all of Colorado's rare fern species making an appearance.

The rivers and streams of the Purgatoire basin are largely intact, with native plains river fishes still occupying the major drainages. The amphibians are also doing well, and Colorado's largest populations of plains leopard frogs is found here. The study area's canyonlands are unusual habitats for the Central Shortgrass region. In sharp contrast to the flat prairies, these tessellated canyons provide steep slopes dominated by woodlands and shrublands. These are ideal habitat for gray vireo and rufous-crowned sparrow (both declining birds). The canyons are a linkage to the Rocky Mountains and where we find large mammals normally associated with mountains rather than plains especially big horn sheep, elk, mountain lion, and black bear. That we associate such species only with mountain habitats reflects how few areas of prairie are as intact as is this area.

Southeastern Colorado is positioned at a crossroads of several different biogeographic units. Many species found in southeastern Colorado are more common to the Chihuahuan Desert. Here they are at the most northerly extension of their ranges. Species from the Southern Plains also occur here, though they are more common on the Edwards Plateau. As there are no sharp climatic boundaries between these biogeographic units, representatives from each of these zones mix here with central shortgrass prairie species.

The mosaic of largely intact systems for all of these major habitat types is one of the reasons the Colorado Natural Heritage Program was so successful at locating a plethora of species and habitats. Thirty-eight Potential Conservation Areas were delineated to depict the primary ecological boundaries that support the inventoried species and communities of conservation concern.

The vast majority of this study area is privately-owned (71%). With the loss of the prairie's most significant native grazer – the bison – cattle grazing has become a crucial ecological process for maintaining habitat condition in the prairie. The number of places supporting species and habitats of conservation concern is testament to the on-going stewardship of Colorado's ranching families. The future of this landscape rests in their hands.

ACKNOWLEDGMENTS

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 successful without the help of many dedicated individuals. Thanks to Chris West, Alyssa Street, 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 Beatty Canyon Ranch were wonderful partners to work with, and without whose help in acquiring funds, contacting local landowners, and contacting local organizations we would not have been successful. Other local participants who contributed in countless ways, including providing lodging, ranch tours, and additional funds include Jerry Wenger, Grady Grissom, Tony Haas, Corwin Brown, Mildy Roberts, Rebecca Goodwin, and Gary Hill. Additional thanks go to all of the Ranches and the landowners of Southeastern Colorado who participated in the survey, allowed us access to their land, and assisted us in making efficient use of our time, including:

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INTRODUCTION

The Central Shortgrass Prairie (CSP) ecoregion covers some 56 million acres across seven States and has been highly altered through most of the region. The one exception to this is southeast Colorado (Fig. 1, Neely et al. 2006). Numerous conservation groups and agencies have documented the intactness and importance of southeast Colorado, yet very little on-the-ground information was available. In 2007 and 2009, landowners initiated a request of the Colorado Natural heritage Program to conduct biological inventories on their properties so the landowners might have pertinent data regarding their stewardship, future management decisions, and ecosystem credit values. Financial support was provided by Great Outdoors Colorado, Colorado Division of Wildlife, Colorado Cattlemen's Agricultural Land Trust, Colorado State Land Board, The Nature Conservancy, Natural Resource Conservation Service, and private landowners. The study area is nearly 2.3 million acres in size; a total of 26 ranches were visited during the 2007 and 2009 study period. As previous analysis suggested, southeast Colorado is a biological hotspot; the Colorado Natural Heritage Program has documented 41 species of animals, 36 species of plants, and 46 plant communities of conservation concern, with over 2400 mapped locations (Table 1, Fig. 3). The mosaic of largely intact systems is one of the reasons we were so successful at locating a plethora of species and locations. Thirty-eight Potential Conservation Areas were delineated to depict the primary ecological boundaries that support the species and communities of conservation concern that were documented.

The majority of the area is privately owned (71%) and the primary land use is cattle ranching, so the future management and protection of this landscape lies in the hands of the private ranchers.

The 2009 Survey

In 2007, the Colorado Natural Heritage Program began a biological survey of southeastern Colorado, in partnership with local landowners, the Colorado Cattlemen's Agricultural Land Trust (CCALT), Great Outdoors Colorado (GOCO), Colorado Division of Wildlife, and the State Board of Land Commissioners. The focus of the 2007 inventory was primarily associated with the canyon country, with very little emphasis placed on the grasslands and shale hills. Due to continued interest in expanding their knowledge of the biological resources in this region, the local landowners, CCALT, and GOCO requested that CNHP conduct a second field season of inventory. The 2009 survey was primarily focused on the grasslands and shale hills. This report is the result of that effort, and constitutes an addendum to the 2008 report entitled *Southeastern Colorado Survey of Critical Biological Resources 2007* (Stevens et al. 2008), available for download at http://www.cnhp.colostate.edu/download/reports.asp.

Rather than repeat information contained in the previous report, this document focuses exclusively on new findings from the 2009 survey. It includes a map of 2009 survey sites, profiles and maps for new or revised Potential Conservation Areas, species profiles for newly documented species, summaries of the key findings for each ecological system, and a table summarizing impacts to the species and plant communities of concern. For details on the study area and survey methods, refer to Stevens et al. (2008). Areas targeted for survey during 2009 are shown in Figure 2.

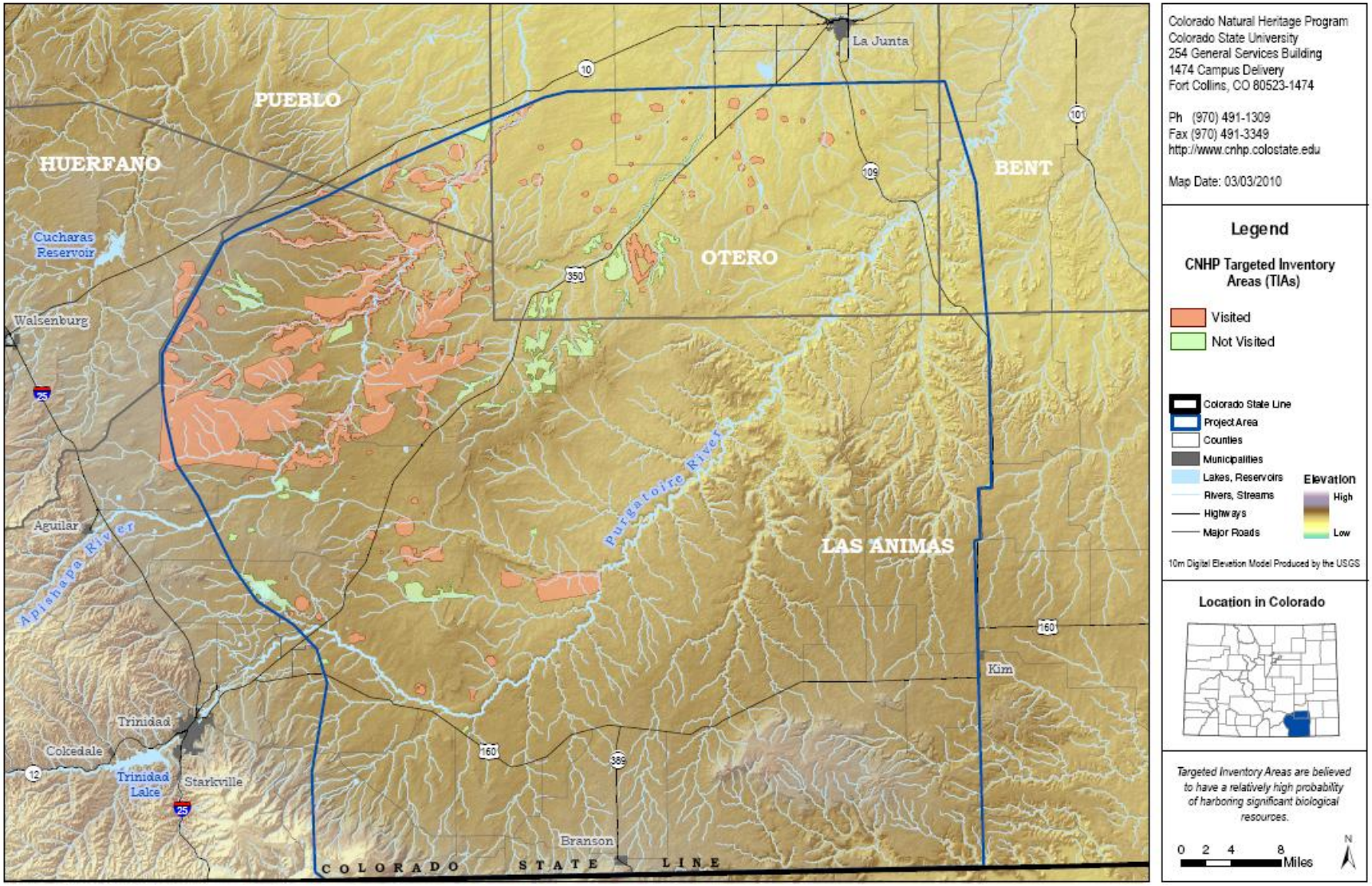


Figure 2. Targeted Inventory Areas for the 2009 survey.

RESULTS AND DISCUSSION

Southeast Colorado holds the largest, least fragmented, and topographically diverse landscape in the Central Shortgrass Prairie ecoregion. Ecological systems, as well as the ecological processes that maintain them, are still intact here. Due to the size, diversity and integrity of the landscape, southeastern Colorado supports a wealth of biological resources, including numerous species that were once common but have declined significantly due to the loss of habitat from grassland tillage, urban development, and other direct and indirect alterations to the native habitat.

The study area is a mosaic of grasslands, shrublands, rivers, canyonlands, shale hills, shale barrens, juniper woodlands, and savannas. Grasslands are the most imperiled and least protected ecosystem in North America (Neely et. al. 2006). Grassland birds have exhibited the most severe and extensive declines of any other class of North American species. This study area has several large blocks of intact grasslands with all of the indicator species present, including swift fox, black-tailed prairie dog, mountain plover, burrowing owl, and ferruginous hawk.

Nearly all of the rare plants within the ecoregion are associated with shale hills and barrens. These rare plants have a world-wide restricted range that is just slightly larger than the study area. The canyonlands in the area are biodiversity hotspots for state rare ferns, with nearly all of Colorado's rare species making an appearance.

The aquatic system is largely intact, with a native assemblage of plains river fishes still occupying the major drainages. The amphibians are also doing well; Colorado's largest population of plains leopard frogs is found here.

The canyonlands and their associated woodlands and savannas are ideal habitat for gray vireo and rufous-crowned sparrow (both declining birds), in addition to large mammals such as big horn sheep, elk, mountain lion, and black bear.

Forty-one animals, 36 plants, and 46 plant communities of conservation concern were documented within the study area (Table 1, Fig. 3). In order to depict the local geographic area necessary to maintain long-term persistence of these species and plant communities, we delineated 38 Potential Conservation Areas (Table 2, Figs. 4 and 5). Detailed profiles of the Potential Conservation Areas that are new (21) from the 2009 inventory, as well as those not highlighted in the 2007 report, can be found in Appendix A. Profiles for select species and communities newly documented in 2009 can be found in Appendix B.

Species and Plant Communities

The results of the 2009 Southeast Colorado survey corroborate the 2007 finding that the region is rich in biological diversity. Numerous rare plants, undocumented during 2007, were discovered during the 2009 survey. Additionally, black-tailed prairie dogs were found to occupy large areas within portions of the study site. Prairie dogs are important to the ecology of prairie grasslands as their alterations to the landscape are unique and provide forage, shelter, and nesting habitat for a suite of grassland animals. In addition to prairie dogs, 32 other animals as well as 36 plant species and 44 plant communities of conservation concern were documented from the study site (Table 1).

Table 1. Species and plant communities of conservation concern documented in the study area. The following list includes all of the species and plant communities that CNHP has in their database and does not reflect only the 2009 survey results. Refer to Stevens et al. (2009) for code definitions.

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			
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			
Athene cunicularia	Burrowing Owl	G4	S4B		BLM/USFS	LT
Buteo regalis	Ferruginous Hawk	G4	S3B,S 4N		BLM/USFS	SC
Calcarius mccownii	McCown's Longspur	G4	S2B		USFS	
Calcarius ornatus	Chestnut-collared Longspur	G5	S1B			
Charadrius montanus	Mountain Plover	G2	S2B		BLM/USFS	SC
Falco mexicanus	Prairie Falcon	G5	S4B,S 4N			
Falco peregrinus anatum	American Peregrine Falcon	G4T4	S2B		USFS	SC
Haliaeetus leucocephalus	Bald Eagle	G5	S1B,S 3N		USFS	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,S 4N			
Toxostoma curvirostre	Curve-billed Thrasher					

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Vireo vicinior	Gray Vireo	G4	S2B			
Fish						
Hybopsis gracilis	Flathead Chub	G5	S3		BLM/USFS	SC
Phenacobius mirabilis	Suckermouth minnow	G5	S2			SE
Insects						
Amblyscirtes simius	Simius Roadside Skipper	G4	S3			
Euphilotes rita coloradensis	Colorado Blue	G3G4T 2T3	S2			
Euristrymon favonius ontario	Northern Hairstreak	G4T4	S1			
Pygarctia neomexicana	A tiger moth	G3	S1			
Sagenosoma elsa	A Sphinx Moth	G4	S1?			
Mammals						
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			
Plecotus townsendii pallescens	Townsend's Big-eared Bat Subsp	G4T4	S2		BLM/USFS	SC
Vulpes velox	Swift Fox	G3	S3		USFS	SC
Reptiles						
Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2			SC
Leptotyphlops dissectus	New Mexico thread snake	G4G5	S1			SC
Phrynosoma cornutum	Texas Horned Lizard	G4G5	S3		BLM	SC
Phrynosoma hernandesi	Short-horned Lizard	G5	S5			
Sistrurus catenatus	Massasauga	G3G4	S2	PS:C	BLM/USFS	SC
Sonora semiannulata	Ground Snake	G5	S3			
Thamnophis cyrtopsis	Blackneck Garter Snake	G5	S2?			
Plants						
Adiantum capillus-veneris	southern maiden-hair	G5	S2			
Amorpha nana	dwarf wild indigo	G5	S2S3			
Aquilegia chrysantha var. *rydbergii*	golden columbine	G4T1Q	S1		BLM/USFS	
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	

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Asplenium platyneuron	ebony spleenwort	G5	S1			
Asplenium resiliens	black-stemmed spleenwort	G5	S1			
Asplenium trichomanes-ramosum	green spleenwort	G4	S1			
Bolophyta tetraneuris	Barneby's fever-few	G3	S3			
Bothriochloa springfieldii	Springfield bluestem	G5	S1			
Carex gravida var. *lunelliana*	Lunell's heavy-fruited sedge	G5T3T5Q	SU			
Cheilanthes eatonii	Eaton's lip fern	G5?	S1S2			
Cheilanthes standleyi	Standley's cloak fern	G4	S1			
Cheilanthes wootonii	Wooton's lip fern	G5	S1			
Chenopodium cycloides	sandhill goosefoot	G3G4	S1		USFS	
Draba smithii	Smith whitlow mustard	G2	S2		USFS	
Epipactis gigantea	helleborine	G4	S2S3		USFS	
Forsellesia planitierum	Texas greasebush	G4	S2			
Frasera coloradensis	Colorado green gentian	G2G3	S2S3			
Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3			
Lobelia cardinalis		G5	S2			
Nolina texana	Texas beargrass	G5	S1			
Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3		USFS	
Oonopsis foliosa var. *monocephala*	rayless goldenweed	G3G4T2	S2			
Oxybaphus rotundifolius	round-leaf four-o'clock	G2	S2			
Pellaea atropurpurea	purple cliff-brake	G5	S2S3			
Pellaea suksdorfiana	smooth cliff-brake	G5T4?	S2			
Pellaea wrightiana	Wright's cliff-brake	G5	S2			
Penstemon jamesii	James' beard-tongue	G4	S1			
Portulaca parvula	dwarf purslane	G5	S1			
Sapindus drummondii	soapberry	G5T5	S1			
Sarcostemma crispum	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	Xeric Tallgrass Prairie	G2?	S2			
Artemisia bigelovii / *Achnatherum hymenoides* Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3	S3			
Atriplex canescens / *Bouteloua gracilis* Shrubland	Shortgrass Prairie	G3G4	SU			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Atriplex canescens / *Pleuraphis jamesii* Shrubland	Great Plains Shrubland	G5?	SU			
Atriplex canescens / *Sporobolus airoides* Shrubland	Shortgrass Prairie	G3	S3			
Bouteloua eriopoda - *Bouteloua hirsuta* Herbaceous Vegetation	Shortgrass Prairie	G2	SU			
Bouteloua eriopoda - *Pleuraphis jamesii* Herbaceous Vegetation	Shortgrass Prairie	G3	SU			
Bouteloua gracilis - *Bouteloua curtipendula* Herbaceous Vegetation	Shortgrass Prairie	G5	SU			
Bouteloua gracilis - *Pleuraphis jamesii* Herbaceous Vegetation	Shortgrass Prairie	G2G4	S3			
Bouteloua gracilis Herbaceous Vegetation	Blue Grama Short Grass Prairie	G4Q	S4			
Cercocarpus montanus - *Rhus trilobata* / *Andropogon gerardii* Shrubland	Mountain Mahogany - Skunkbush / Big Bluestem Shrubland	G2G3	S2S3			
Cercocarpus montanus / *Hesperostipa comata* Shrubland	Mixed Foothill Shrublands	G2	S2			
Cercocarpus montanus / *Hesperostipa neomexicana* Shrubland	Foothills Shrubland	G2G3	S2S3			
Distichlis spicata Herbaceous Vegetation	Salt Meadows	G5	S3			
Eleocharis palustris Herbaceous Vegetation	Emergent Wetland	G5	S4			
Frankenia jamesii / *Achnatherum hymenoides* Shrubland	Foothills Shrubland	G2	S2			
Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3			
Juniperus monosperma / *Artemisia bigelovii* Woodland		G3?	S2			
Juniperus monosperma / *Bouteloua curtipendula* Woodland	Foothills Pinyon-Juniper Woodlands	G5	S3S4			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Juniperus monosperma / *Bouteloua eriopoda* Woodland	Juniper Woodland	GNR	S2S3			
Juniperus monosperma / *Bouteloua gracilis* Woodland	Foothills Pinyon-Juniper Woodlands	G5	S3S4			
Juniperus monosperma / *Cercocarpus montanus* Woodland		GNR	SU			
Juniperus monosperma / *Hesperostipa neomexicana* Woodland	Foothills Pinyon-Juniper Woodlands	G4	S3			
Juniperus monosperma / *Quercus* X *pauciloba* Woodland		G5	S1			
Juniperus scopulorum / *Cercocarpus montanus* Woodland	Foothills Pinyon-Juniper Woodlands/Scarp Woodlands	G2	S2			
Muhlenbergia asperifolia Herbaceous Vegetation	Great Plains Salt Meadows	GU	S3			
Nolina texana Shrubland	Desert Shrubland	GU	S1			
Opuntia imbricata Shrubland	Shortgrass Prairie	GNA	S3			
Panicum obtusum Herbaceous Vegetation		G3?	S2			
Pascopyrum smithii Herbaceous Vegetation	Western Slope Grasslands	G3G5Q	S2			
Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* Woodland	Mesic Western Slope Pinyon-Juniper Woodlands	G5	S4			
Pinus edulis / *Quercus* X *pauciloba* Woodland	Foothills Pinyon-Juniper Woodlands	G5	S2			
Pinus ponderosa / *Bouteloua gracilis* Woodland	Foothills Ponderosa Pine Savannas	G4	S4			
Populus deltoides - (*Salix amygdaloides*) / *Salix* (*exigua*, interior) Woodland	Plains Cottonwood Riparian Woodland	G3G4	S3			
Populus deltoides / *Panicum virgatum* - *Schizachyrium scoparium* Woodland	Plains Cottonwood Riparian Forests	G2	S2			
Populus deltoides / *Pascopyrum smithii* - *Panicum virgatum* Woodland		GNR	S2			

Scientific Name	Common Name	Global Rank	State Rank	US ESA	Federal Sensitive	State Sensitive
Populus deltoides / *Sporobolus airoides* Forest	Plains Cottonwood / Alkali Sacaton	G3	S2			
Populus deltoides ssp. *wislizeni* / Disturbed Understory Woodland		GNR	SNR			
Rhus trilobata - *Philadelphus microphyllus* Shrubland	Shrubland	GU	S1			
Salix exigua / Barren Shrubland	Coyote Willow/Bare Ground	G5	S5			
Salix exigua / Mesic Graminoids Shrubland	Coyote Willow/Mesic Graminoid	G5	S5			
Sarcobatus vermiculatus / *Bouteloua gracilis* Shrubland	Saline Bottomland Shrublands	G1Q	SU			
Schizachyrium scoparium - *Bouteloua curtipendula* Western Great Plains Herbaceous Vegetation	Great Plains Mixed Grass Prairies (Sandstone/Gravel Breaks)	G3	S2			
Schoenoplectus pungens Herbaceous Vegetation	Bulrush	G3G4	S3			

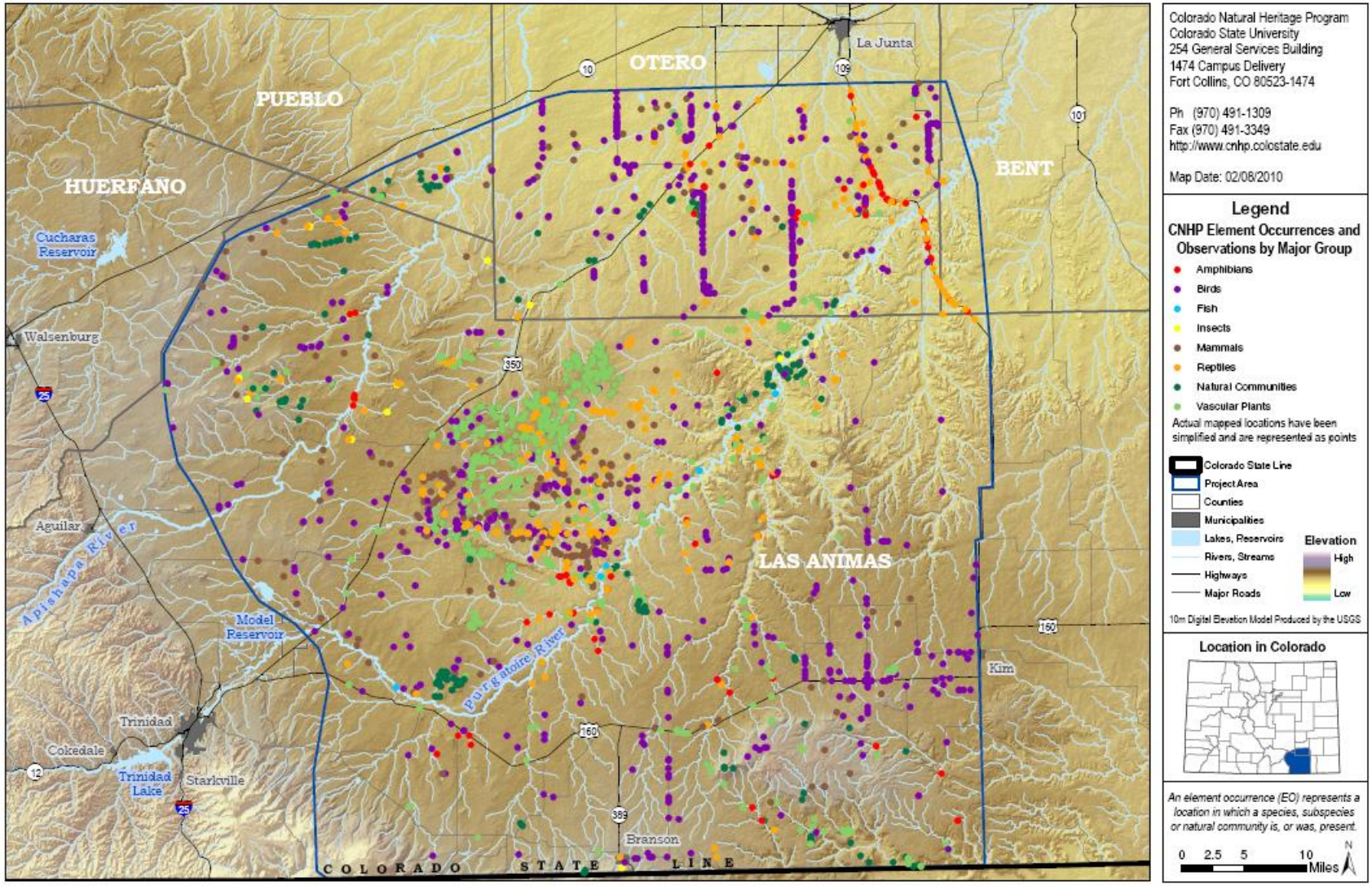


Figure 3. CNHP Element Occurrences and Observations in SE Colorado.

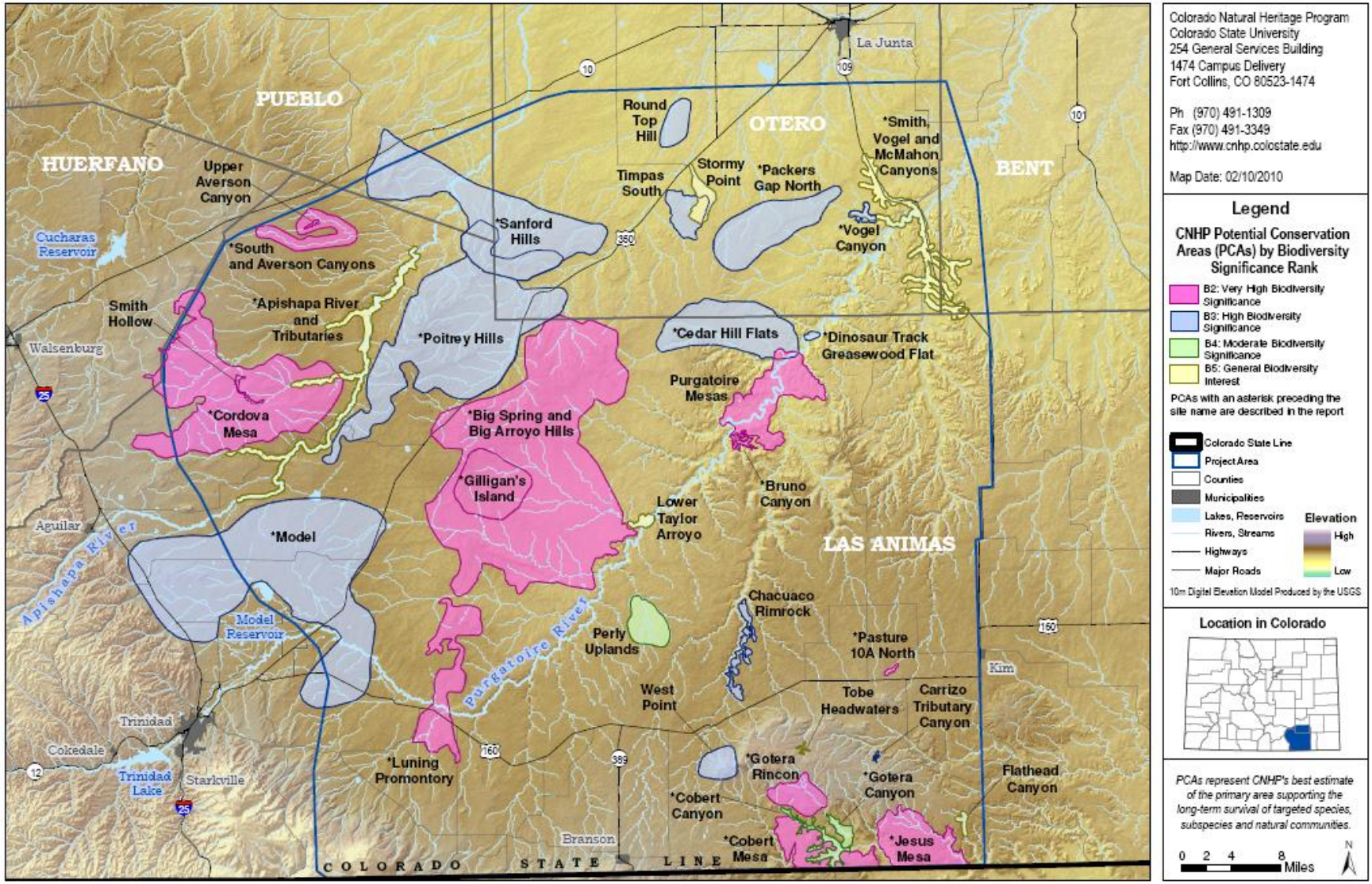


Figure 4. CNHP Potential Conservation Areas (PCAs) in Southeast Colorado. PCAs with asterisk are described in Appendix A (see Figure 5 for larger-sized PCAs).

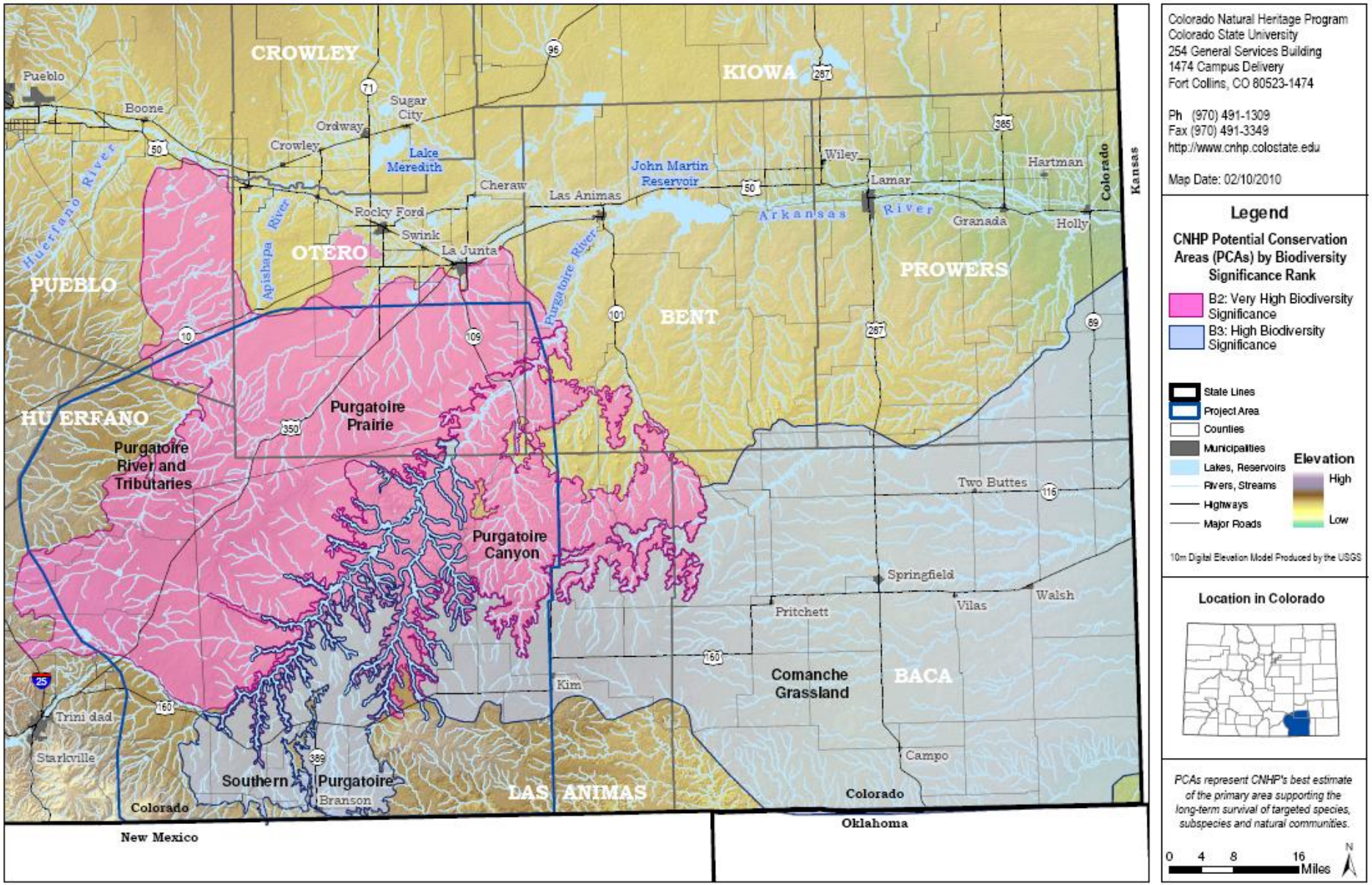


Figure 5. CNHP Potential Conservation Areas (PCAs) in Southeast Colorado (see Figure 4 for smaller-sized PCAs).

Potential Conservation Areas

A total of 38 Potential Conservation Areas are within or overlap the study area (Figs. 4 and 5). These areas are the most important places for conserving the rare biological resources identified within the study site. Biodiversity significance ranks (B-ranks) are applied to PCAs. These ranks are based upon the rarity of the biological resources being conserved at the site and the quality of those resources. Biodiversity ranks range from B1 (sites of outstanding biodiversity significance—irreplaceable) to B5 (sites that are of general or local biodiversity significance).

Table 2. Potential Conservation Areas of Southeast Colorado, arranged by Biodiversity Rank. Sites with asterisk are described in Appendix A. Refer to Stevens et al. (2008) for description of sites without an asterisk.

Site	Biodiversity Significance
Big Spring and Big Arroyo Hills*	B2: Very High Biodiversity Significance
Bruno Canyon*	B2: Very High Biodiversity Significance
Cobert Mesa*	B2: Very High Biodiversity Significance
Cordova Mesa*	B2: Very High Biodiversity Significance
Gilligan's Island*	B2: Very High Biodiversity Significance
Gotera Rincon*	B2: Very High Biodiversity Significance
Jesus Mesa*	B2: Very High Biodiversity Significance
Luning Promontory*	B2: Very High Biodiversity Significance
Pasture 10A North*	B2: Very High Biodiversity Significance
Purgatoire Canyon	B2: Very High Biodiversity Significance
Purgatoire Mesas	B2: Very High Biodiversity Significance
Purgatoire Prairie	B2: Very High Biodiversity Significance
Smith Hollow	B2: Very High Biodiversity Significance
South and Averson Canyons*	B2: Very High Biodiversity Significance
Upper Averson Canyon	B2: Very High Biodiversity Significance
Carrizo Tributary Canyon	B3: High Biodiversity Significance
Cedar Hill Flats*	B3: High Biodiversity Significance
Chacuaco Rimrock	B3: High Biodiversity Significance
Comanche Grassland	B3: High Biodiversity Significance
Dinosaur Track Greasewood Flat*	B3: High Biodiversity Significance
Model*	B3: High Biodiversity Significance
Packers Gap North*	B3: High Biodiversity Significance
Poitrey Hills*	B3: High Biodiversity Significance
Purgatoire River and Tributaries	B3: High Biodiversity Significance
Round Top Hill	B3: High Biodiversity Significance
Sanford Hills*	B3: High Biodiversity Significance
Southern Purgatoire	B3: High Biodiversity Significance
Timpas South	B3: High Biodiversity Significance
Vogel Canyon*	B3: High Biodiversity Significance
West Point	B3: High Biodiversity Significance

Cobert Canyon*	B4: Moderate Biodiversity Significance
Gotera Canyon*	B4: Moderate Biodiversity Significance
Perly Uplands	B4: Moderate Biodiversity Significance
Apishapa River and Tributaries*	B5: General Biodiversity Interest
Flathead Canyon	B5: General Biodiversity Interest
Lower Taylor Arroyo	B5: General Biodiversity Interest
Smith, Vogel and McMahon Canyons*	B5: General Biodiversity Interest
Stormy Point	B5: General Biodiversity Interest
Tobe Headwaters	B5: General Biodiversity Interest

Ecological Systems

Stevens et al. (2008) discussed the study area in terms of three broad ecological systems: canyon communities, woodland communities, and grassland/shrubland communities. To better document distinctions in biodiversity, ecological processes, impacts within these systems, this document splits the original three systems into six units:

1. grasslands,
2. woodlands, savannas, and foothill shrublands,
3. cliffs,
4. prairie shrublands,
5. shale hills, barrens, and escarpments, and
6. wetland, riparian, and aquatic systems.

Significant findings for each of these ecological units are discussed below.

Grassland System

The Central Shortgrass Prairie ecoregion gets its name from this dominant vegetation type (Fig 6). Grasslands are also prevalent within the study area, with 61% of the area classified as grassland (Fig.7). Shortgrass prairie is characterized by grasses that seldom reach above ankle height. Blue grama, the dominant grass (and the Colorado State grass), is an old-growth relictual species that thrives with low moisture and heavy grazing pressures, but seldom returns if the ground is plowed. This vegetation allowed bison, pronghorn,

Figure 6. Grassland system in southeast Colorado.
Photo by Renée Rondeau

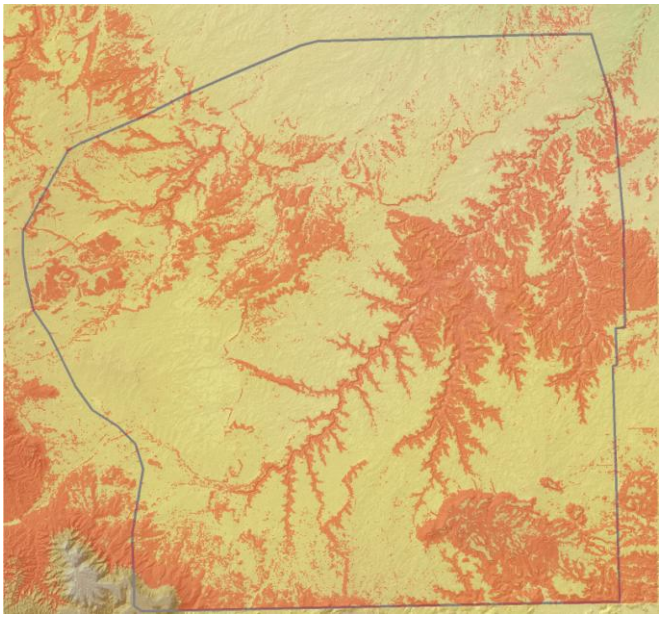


Figure 7. General distribution of the grassland system in the study area. Grasslands are depicted in yellow.

and prairie dogs to dominate the plains and Native American Plains cultures to thrive. This type is also critical to an economically viable ranching community. With only 50% (Neely et al. 2006) of the original shortgrass prairie remaining, all of the large patches of shortgrass prairie are of conservation significance. One of the largest of these remaining patches is in southeast Colorado (Fig. 7).

Species that once roamed the prairie in abundance have now become relatively uncommon or rare, and are now of conservation concern. Swift fox, mountain plover, burrowing owl, black-tailed prairie dog, ferruginous hawk, long-billed curlew, Texas horned lizard, and McCown's longspur are the most notable of these. Their presence indicates that a functional prairie still exists. All of these species were found in many locations throughout the study area's grasslands, thus supporting the importance of southeast Colorado in maintaining the ecoregion's biodiversity. Species and plant communities of conservation concern that rely primarily on grassland habitats are listed in Table 3; their distributions are depicted in Figure 8.

Although the shortgrass prairie is the dominant type in the grassland mosaic of southeast Colorado, it isn't the only grassland type. Large patches of high quality mid-grass prairie also occur in the study area. These prairies are characterized by grasses that are comparatively tall, reaching knee height during high moisture years. Unlike the shortgrass prairie, mid-grass species do not thrive with high grazing pressures, but they do exceptionally well when burned and lightly to moderately grazed. The occurrence of mid-grass prairie often indicates an area with a low impact grazing regime. New Mexico feather grass, needle-and-thread grass, and sideoats grama, all found within the study area, are excellent indicators of a functioning mid-grass prairie.

The grassland ecological unit, and the species within, evolved with herbivory, fire, and drought dominating the natural processes. Thus, this system is generally compatible with, and often benefitted by, ranching operations.

Ecological Processes and Impacts

Drought, fires, and herbivory are important driving factors for maintaining grasslands. In general, grasslands remain intact as long as the precipitation and temperature patterns do not drastically change. Relatively low annual precipitation, variable temperatures, and occasional **droughts** help to maintain the grassland structure by discouraging the growth of trees and shrubs. **Fires** can play an important role in maintaining grassland structure and species composition since several species of shrubs (e.g., cholla, and snakeweed) and trees (especially junipers), as well as some grasses (especially three-awn grass), are killed by fires. **Herbivory** (grazing) is the third important driving factor for grasslands. Grazing not only assists with maintaining the structure, but it also plays a key role in species composition. For example, blue grama is very resistant to intense grazing, while New Mexico feather grass is not. Thus, a grassland that experiences year-long continuous grazing appears very different than a grassland that has periodic short-term, deferred, or rotational grazing. The grassland mosaic that is expected in a functioning prairie is a result of the interaction between soil types, grazing regime, fire frequency, and precipitation.

It is the variability of habitats within the grasslands that helps to determine the presence, abundance, and health of grassland species, especially those that are of conservation concern. Species that inhabit grasslands are often associated with particular components of the grassland mosaic. For example, mountain plovers prefer grasslands that have greater than 30% bare ground and vegetation that is less than four inches tall. This requirement can be met by winter or spring burning, or by grazing the taller vegetation, or by a combination of both. Mountain plovers are known to have a close association with prairie dogs and cattle (Drietz et al. 2006) due to the fact that prairie dogs and cattle help create the vegetation structure that mountain plovers require. Mountain plovers are more likely to be present in areas that support both prairie dogs and cattle grazing, compared to areas that support only prairie dogs or grazing (Drietz et al. 2006).

Understanding the requirements, threats, and impacts to any given species of concern helps mangers maintain healthy viable populations. See Table 9 (impacts) and Appendix B (species profiles) for summaries of this information for each species and plant community of conservation concern. The greatest concerns for the grasslands and associated species are sod busting, incompatible grazing (either too much or too little), and climate change (conversion from grassland to shrubland or woodland).

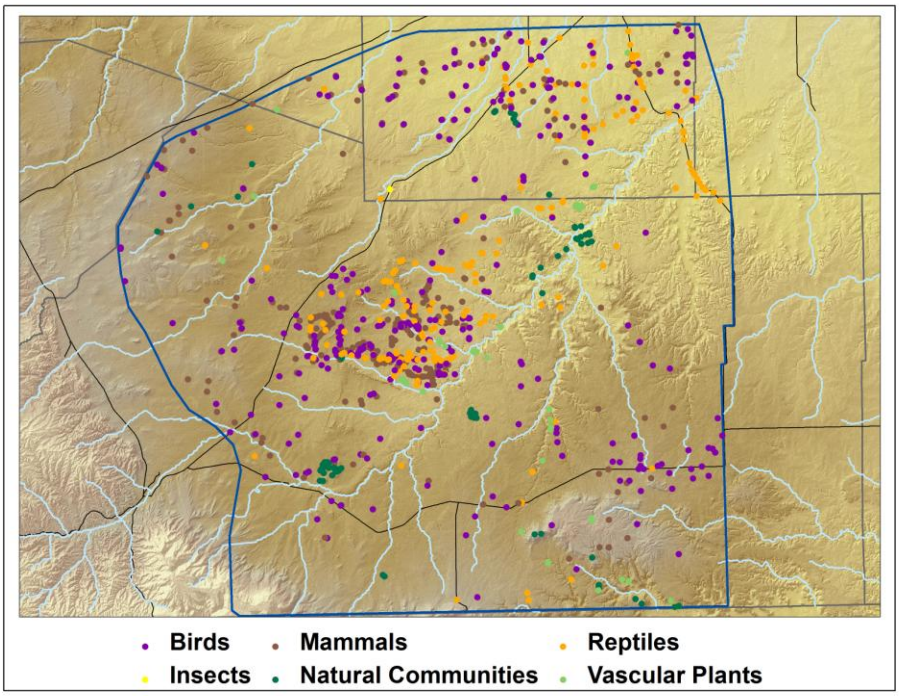


Figure 8. Occurrence locations for species and plant communities in the grassland system.

Blue grama tidbits: Blue grama, Colorado's most economically important grass, is full of nutrients, cures well, weathers drought, and is highly adapted to heavy grazing pressures yet extremely sensitive to some disturbances. The one thing that blue grama cannot usually withstand is being plowed. Although blue grama often produces seeds, it rarely regenerates from seed due to strict seed germination requirements and seedling sensitivity. Warm soils and at least ten days of wet soils are required for germination, while moist winters are required for seedling survival. This combination of conditions is seldom in Colorado; thus, blue grama seldom recolonizes an area once it has been eliminated. It is very common to hear ranchers who have lived in an area for many years note that blue grama has never regenerated in old fields or homesteads, and research supports their observations (Coffin et al. 1996).

Table 3. Species and plant communities of concern that rely primarily on grassland habitats.

Taxonomic Group	*Scientific Name*	Common Name
Birds	*Asio flammeus*	Short-eared Owl
	Athena cunicularia	Burrowing Owl
	Buteo regalis	Ferruginous Hawk
	Calcarius mccownii	McCown's Longspur
	Calcarius ornatus	Chestnut-collared Longspur
	Charadrius montanus	Mountain Plover
	Numenius americanus	Long-billed Curlew
Insects	*Amblyscirtes simius*	Simius Roadside Skipper
	Pygarctia neomexicana	A tiger moth
Mammals	*Cratogeomys castanops*	Yellow-faced pocket gopher
	Cynomys ludovicianus	Black-tailed Prairie Dog
	Mustela nigripes	Black-footed Ferret
	Vulpes velox	Swift Fox
Reptiles	*Phrynosoma cornutum*	Texas Horned Lizard
	Phrynosoma hernandesi	Short-horned Lizard
	Sistrurus catenatus	Massasauga
Vascular Plants	*Amorpha nana*	dwarf wild indigo
	Asclepias oenotheroides	zizotes milkweed
	Asclepias uncialis ssp. *uncialis*	dwarf milkweed
	Chenopodium cycloides	sandhill goosefoot
	Nolina texana	Texas beargrass
	Penstemon jamesii	James' beard-tongue
	Viola pedatifida	prairie violet
Natural Communities	*Andropogon gerardii - Schizachyrium scoparium* Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie
	Bouteloua eriopoda - Bouteloua hirsuta Herbaceous Vegetation	Shortgrass Prairie
	Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie
	Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation	Shortgrass Prairie
	Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie
	Bouteloua gracilis Herbaceous Vegetation	Blue Grama Short Grass Prairie
	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie
	Pascopyrum smithii Herbaceous Vegetation	Western Slope Grasslands
	Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Herbaceous Vegetation	Great Plains Mixed Grass Prairies (Sandstone/Gravel Breaks)
	Stipa comata - Bouteloua gracilis Herbaceous Vegetation	Montane Grasslands

Woodland, Savanna, and Foothills Shrubland System

When people conjure up visions of the of the eastern plains of Colorado, they seldom envision slopes teaming with dense juniper trees and mesa tops dotted with trees forming a savanna-like prairie, but this is exactly what can be found in southeast Colorado (Fig. 9). This ecological unit is not as widespread as the grasslands (Fig. 10), but because it supports a completely different suite of species, it is of great conservation interest. The juxtaposition of prairie and woodlands creates a landscape rich in biodiversity. Juniper trees may co-occur with pinyon pines in places, but the juniper is generally the dominant tree of this landscape.

Figure 9. Aerial view of the woodland, savanna, and foothills shrubland system. Photo by Chris West.

There are three primary areas where junipers are found: 1) canyon slopes, 2) rim-rock, and 3) mesa tops. Each of these environments creates a different suite of pinyon-juniper plant communities; these differences may be subtle to the human observer, but they are significant to wildlife. Canyon slopes often support the densest stands of pinyon-juniper, with a rich shrub layer that includes mountain mahogany, oaks, and skunkbush. These are the areas with the highest vegetation cover, or biomass, in the study area. This density of vegetation creates cover for wildlife, making these canyons crucial habitat for much of the megafauna (large, charismatic species) that can be found in this area. These include species that are normally associated with the Rocky Mountain region rather than the Great Plains: black bear, big horn sheep, elk, mountain lion, and mule deer. These areas also support gray vireo, rufous-crowned sparrow, and summer tanagers, all birds of conservation concern and tightly associated with the juniper trees. The triploid checkered whiptail and the Texas

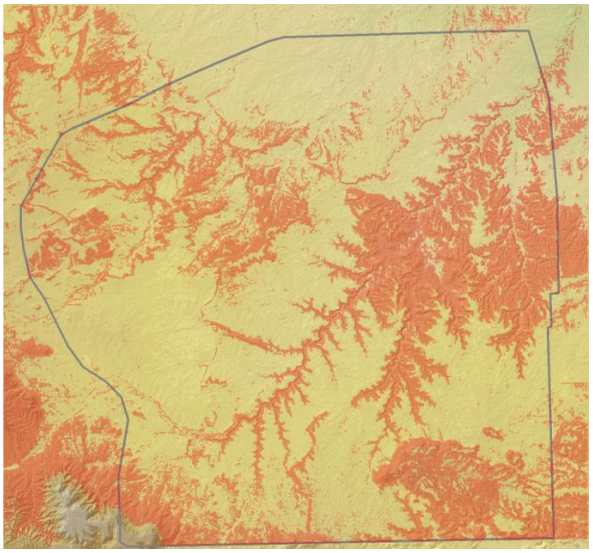


Figure 10. General distribution of woodlands, savannas, and foothills shrublands in the study area (orange color).

Table 4. Species and plant communities of concern that rely primarily on woodland, savanna, and foothills shrubland habitats.

Taxonomic Group	*Scientific Name*	Common Name
Birds	*Aimophila ruficeps*	Rufous-crowned Sparrow
	Melanerpes lewis	Lewis's Woodpecker
	Vireo vicinior	Gray Vireo
Insects	*Euphilotes rita coloradensis*	Colorado Blue
	Euristrymon favonius ontario	Northern Hairstreak
	Pygarctia neomexicana	A tiger moth
Reptiles	*Aspidoscelis neotesselata*	Triploid Colorado Checkered Whiptail
	Leptotyphlops dissectus	New Mexico thread snake
	Phrynosoma cornutum	Texas Horned Lizard
	Phrynosoma hernandesi	Short-horned Lizard
	Sonora semiannulata	Ground Snake
Vascular Plants	*Asclepias macrotis*	long-hood milkweed
	Asclepias uncialis ssp. *uncialis*	dwarf milkweed
	Bothriochloa springfieldii	Springfield bluestem
	Nolina texana	Texas beargrass
	Portulaca parvula	dwarf purslane
	Sarcostemma crispum	twinevine
	Viola pedatifida	prairie violet
Natural Communities	*Cercocarpus montanus - Rhus trilobata* / *Andropogon gerardii* Shrubland	Mountain Mahogany - Skunkbush / Big Bluestem Shrubland
	Cercocarpus montanus / *Hesperostipa comata* Shrubland	Mixed Foothill Shrublands
	Cercocarpus montanus / *Hesperostipa neomexicana* Shrubland	Foothills Shrubland
	Juniperus monosperma / *Bouteloua curtipendula* Woodland	Foothills Pinyon-Juniper Woodlands
	Juniperus monosperma / *Bouteloua eriopoda* Woodland	Juniper Woodland
	Juniperus monosperma / *Bouteloua gracilis* Woodland	Foothills Pinyon-Juniper Woodlands
	Juniperus monosperma / *Cercocarpus montanus* Woodland	
	Juniperus monosperma / *Hesperostipa neomexicana* Woodland	Foothills Pinyon-Juniper Woodlands
	Juniperus monosperma / *Quercus* X *pauciloba* Woodland	
	Juniperus scopulorum / *Cercocarpus montanus* Woodland	Foothills Pinyon-Juniper Woodlands/Scarp Woodlands
	Nolina texana Shrubland	Desert Shrubland
	Pinus edulis - Juniperus spp. / *Cercocarpus montanus* Woodland	Mesic Western Slope Pinyon-Juniper Woodlands
	Pinus edulis / *Quercus* X *pauciloba* Woodland	Foothills Pinyon-Juniper Woodlands
	Pinus ponderosa / *Bouteloua gracilis* Woodland	Foothills Ponderosa Pine Savannas
	Rhus trilobata - Philadelphus microphyllus Shrubland	Shrubland

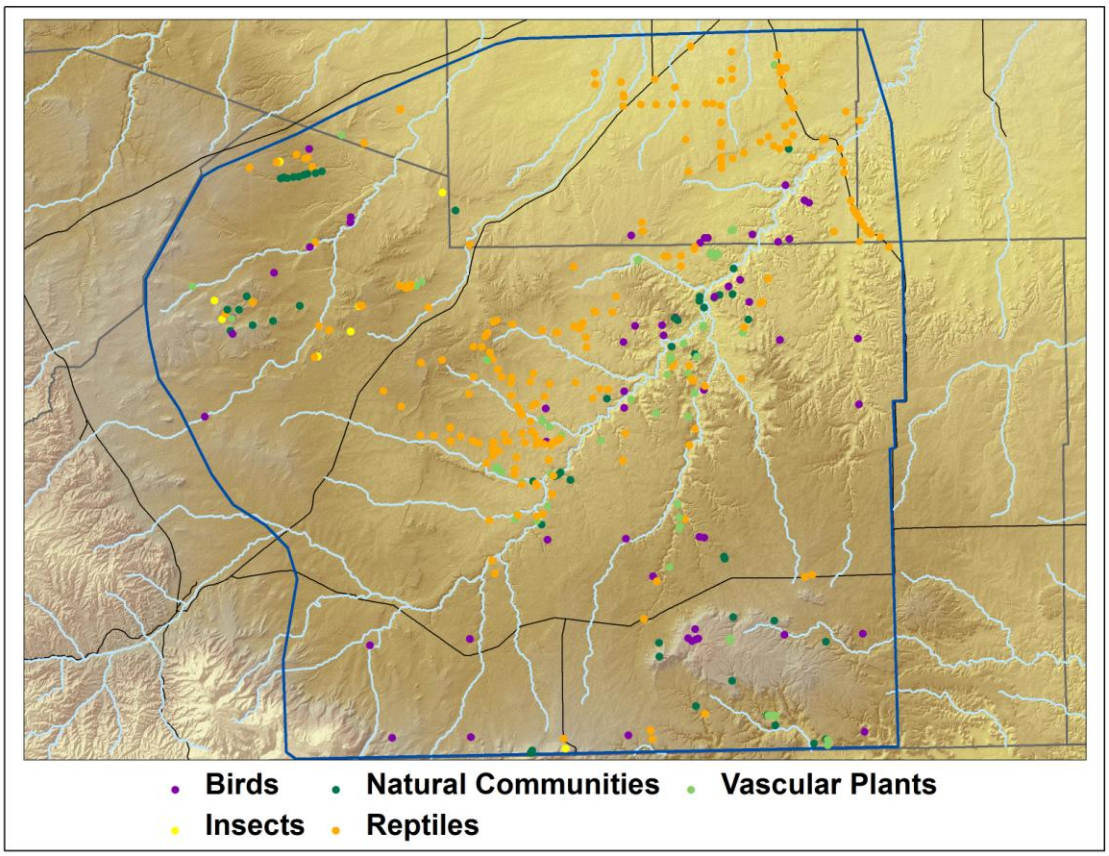


Figure 11. Species and community occurrences in woodlands, savannas, and foothills shrublands.

horned lizard, both reptiles of conservation concern, are frequently found in this ecological unit (though they are not restricted to this area).

Sandstone rimrock and mesa tops occur above the canyon slopes. The rimrock area has very little soil development, and therefore supports lower vegetation biomass. Thus, fires are unusual in rimrock and mesa areas. Due to the lack of fires, old growth junipers are fairly common and may approach 300 – 400 years of age. One of the rare plants – the long-hood milkweed (*Asclepias macrotis)* – thrives in this community. Further away from the rimrock and on to the mesa tops, the trees thin out and grasses begin to dominate. These savannas are heavily influenced by fire, or lack thereof. Grazing regimes have a large impact on the species composition of savannas.

Ecological Processes and Impacts

As noted above, **fires** play a very large role in this ecological unit, especially on the canyon slopes and mesa tops, while **grazing** plays a large role on the mesa tops. The mesa tops are the areas where "juniper invasion" is occurring. The concept of juniper invasion refers to the process where mesa-top grasslands become juniper savannas due to the infiltration of relatively young junipers populating the mesa tops. Fires kill juniper trees, so the lack of

fire allows junipers to invade the grasslands that are adjacent to the region's major juniper source – the canyons. It is unclear what this system would look like in the absence of fire suppression by humans, but it is highly likely that lightning strikes would occasionally start large-scale fires that would kill many of the junipers. Currently, the junipers on the mesa tops are relatively young, and old growth junipers are seldom found. We expect that some kind of natural cycle (i.e., without human interference) would support periodic expansion and contraction of junipers at the prairie interface, but what that cyclical frequency is (or was) is unknown. Currently, the ranching community is managing the junipers on the mesa tops with controlled burns, bull dozing, ―tipping" and cutting to increase forage. The largest impact from the bulldozing, tipping, and cutting techniques is an increase in weeds. Grazing regimes on the mesa tops have a direct connection to the species composition. Areas with low to moderate grazing regimes often support New Mexico feather grass and black grama. Excellent examples of the juniper/New Mexico feathergrass community occur on OV Mesa and the benches of Bruno Canyon and Beatty Canyon. A more intense grazing regime on the mesa tops often results in blue grama dominating. Continuous grazing or heavy stocking rates in these areas can lead to snakeweed invasion, especially after droughts.

Understanding the requirements, threats, and impacts to any given species of concern helps mangers maintain healthy viable populations. See Table 9 (impacts) and Appendix B (species profiles) for summaries of this information for each species and plant community of conservation concern. The greatest concerns for the woodlands, savannas, and foothills shrublands are altered fire regime, invasive species, and problematic native species, and altered grazing regime.

Cliff System

Striking and often hidden beauty may be found in the canyon lands of the prairie, along the Purgatoire River and its tributaries. Many of these canyons are difficult to access and are seldom visited by humans, while others have been occupied by humans for centuries. Native American rock art, grinding holes, and rock tools attest to the importance of these canyons to past civilizations.

Figure 12. Cliff system in southeast Colorado. Photo by George Mentz

Today the canyons provide important habitat for rare plants (especially ferns), nesting peregrine falcons, and bats. Many of the canyons have seeps fed by groundwater, which are crucial for most of the rare ferns found in this region (Fig. 13). Eleven rare ferns grow in these canyons—making this area one of Colorado's "fern hotspots." At least one of these canyons supports a fern species that may be new to science (taxonomic studies are ongoing) – at the very least, it is newly recorded in Colorado. Sixteen species of conservation concern that rely primarily or exclusively on cliff habitats have been documented in the study area (Table 5, Fig. 14).

Ecological processes and impacts

Perhaps the most important ecological process to manage for species of conservation concern in the cliff system is **groundwater**. Adequate groundwater is needed to sustain the seeps, which in turn sustain the ferns. Our knowledge of the groundwater system in southeast Colorado is limited, but altered surface flows and groundwater pumping are known to change groundwater systems. There are no large-scale surface flow modifications on the side canyons, but there are numerous stock ponds on the upper reaches of the small drainages which are altering the natural quantity and timing of in-stream flow in these tributaries. It is unclear what positive or negative impact(s) this has on maintaining seeps and springs. A geologic study in the area reported that the juniper invasion may also be causing groundwater depletion (S. Wooten, pers. comm.). The landowners mentioned the following statements: "We speculate that there was significantly more ground water in the form of springs and seeps during the homestead period and before as evidenced by the location of so many homestead and Native American sites that today do not have a water source for many miles. One hundred years of fire suppression by humans as well as new sources of energy, i.e.,

Figure 13. Rare canyon ferns are dependent upon an intact hydrological system.
Photo by Renée Rondeau.

fossil fuel, to heat homes, and cook has resulted in extensive juniper density. When Juniper encroaches into fertile soils and dominates the soil water consumption, there is very little water that percolates through the surface and into the ground for the recharge of springs and seeps. Where juniper density has been reduced via fire, cutting or mechanical removal, spring and seep flows have increased and dry spring sites become active again. Examples of such sites are found in Cherry Canyon and side canyons of Smith Canyon. Pictures of this area taken prior to the 1950's show very little Juniper in the grass dominated region and most of the juniper contained to shallow, rocky soils along the rims and slopes of the canyons. Even there the density was remarkably less than can be seen today."

Today numerous wells have been placed into the aquifer which may have an impact (more research would be required to understand this potential impact, as groundwater movement can be very complicated.) In general, the current condition of this ecological unit is good, and the presence of seeps and ferns is an excellent indicator that the system is healthy and functioning. A thorough map of seeps/springs, and fern locations could be useful as a future monitoring tool.

See Table 9 for impacts to cliff species.

Table 5. Species of conservation concern that rely primarily on cliff habitats.

Taxonomic Group	*Scientific Name*	Common Name
Birds	*Falco mexicanus*	Prairie Falcon
	Falco peregrinus anatum	American Peregrine Falcon
Mammals	*Plecotus townsendii pallescens*	Townsend's Big-eared Bat Subsp
Vascular Plants	*Adiantum capillus-veneris*	southern maiden-hair
	Argyrochosma fendleri	Fendler cloak-fern
	Asplenium platyneuron	ebony spleenwort
	Asplenium resiliens	black-stemmed spleenwort
	Asplenium trichomanes-ramosum	green spleenwort
	Cheilanthes eatonii	Eaton's lip fern
	Cheilanthes standleyi	Standley's cloak fern
	Cheilanthes wootonii	Wooton's lip fern
	Draba smithii	Smith whitlow mustard
	Pellaea atropurpurea	purple cliff-brake
	Pellaea suksdorfiana	smooth cliff-brake
	Pellaea wrightiana	Wright's cliff-brake
	Woodsia neomexicana	New Mexico cliff fern

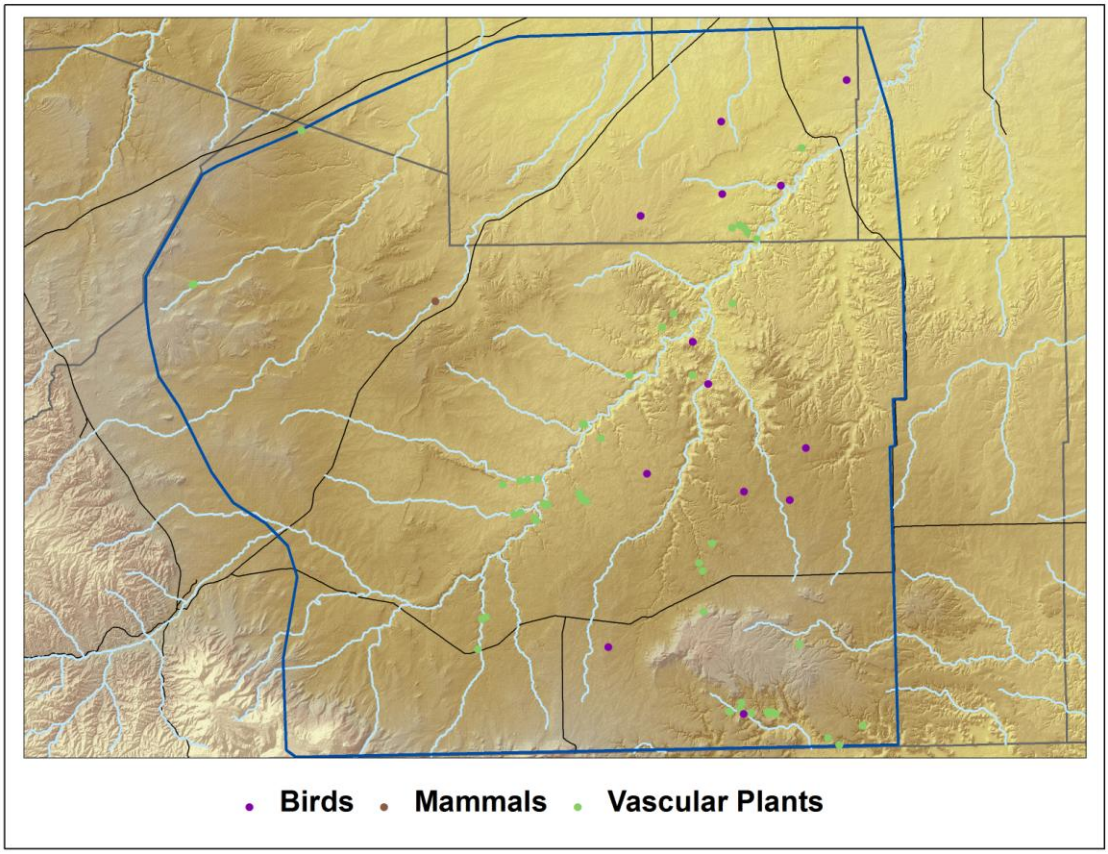


Figure 14. Species occurrences in the cliff system.

Prairie Shrubland System

Prairie shrublands are imbedded within the shortgrass prairie matrix (Figs. 15 and 16), and often reflect a change in soils from the sandy-clay loam of the grasslands to deep silty clay loams. Cholla dominates in the driest areas in the region, but where slight depressions or shallow drainages occur, fourwing saltbush or greasewood becomes the dominant shrub. The cholla shrublands provide excellent nesting habitat for Cassin's sparrow, a declining grassland bird, as well as the curve-billed thrasher and rare plains woodrat. The fourwing saltbush is also good habitat for the Cassin's sparrow. Greasewood flats indicate that the soils are fairly alkaline, especially compared to the cholla and fourwing saltbush communities. Eleven species and plant communities that rely primarily on prairie shrubland habitats have been documented in the study area (Table 6, Fig. 18).

Figure 15. Prairie shrubland in the study area. Photo by Renée Rondeau

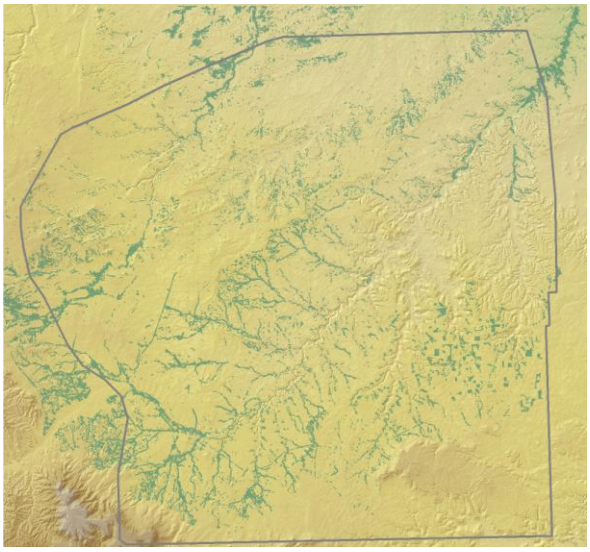


Figure 16. General distribution of prairie shrublands.

Ecological processes and impacts

Subtle differences in ground and surface water levels affect species composition of these shrublands. When groundwater is relatively close to the surface, either fourwing saltbush or greasewood will be the dominant shrub, depending on the soil type. When groundwater is deeper, cholla will be the dominant shrub. Grazing also influences the species composition of these shrub communities. Fourwing saltbush is the most sensitive to heavy grazing pressures, and may be eliminated from pastures that experience heavy

stocking rates or continuous grazing. Fires generally kill all of these shrubs; thus, the presence of these shrubs indicates a lack of fire (this system probably has a naturally low-frequency fire regime). Fourwing saltbush often occurs in drainages that receive periodic flash floods. When shrubs and understory grasses are in good condition, they provide a vegetation buffer that slows surface water movement, assists with infiltratrion, and prevents excessive erosion. In areas where the condition of the vegetation is compromised and erosion is accelerated, intensive storm events can lead to the creation of gulleys, which are very difficult to restore (Fig. 17).

Figure 17. Past poor management of fragile areas in portions of the the study area has created places with serious erosion issues. Photo by Renée Rondeau

Shale Hills, Barrens, and Escarpment System

Figure 19. Shale hills in the study area. Photo by Renée Rondeau

Some 87-92 million years ago (Cretaceous Period) a shallow ocean covered eastern Colorado (Kauffman 1977). Most of the sediments left behind by this ocean eroded away, however the shale hills, barrens, and escarpments of eastern Colorado are the remnants of this ancient ocean (Figs. 19 and 20). The Cretaceous period was a relatively warm climate with changing sea levels, mostly increasing. The oceans and seas were populated with now extinct marine reptiles, ammonites, and bivalves. The abundant ocean life can still be viewed today in the form of fossils.

In addition to fossils the area is rich in geologic oddities, such as geodes (aka turtle rocks), concretions, and cones in cones. The sedimentary units that comprise the hills are Carlisle shale, Greenhorn limestone and Graneros shale, (Johnson 1969 geologic map).

The vegetation of the hills is tightly associated with the geology and is noticeably different than the surrounding prairie in that it is dominated by junipers and occasional pinyon pines and generally has very little soil build up thus giving a white hue to the hills. The understory varies from sparse to dense vegetation depending on slope, aspect, and grazing regime. The outwash areas are at the base of the hills and are comprised of colluvial soils derived from the eroding shale hills. These outwash areas are generally dominated by grasses and occasional shrubs, especially cholla (*Cylindropuntia imbricata*) and four-winged saltbush (*Atriplex canescens*). Typical grasses throughout the site are blue grama (*Bouteloua gracilis*), New Mexico feather grass (*Hesperostipa neomexicana*), galleta grass (*Pleuraphis*

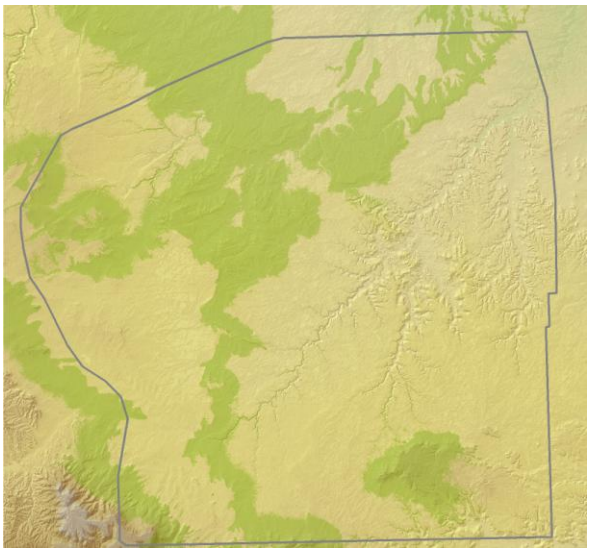


Figure 20. General distribution of shale hills, barrens, and escarpments in the study area (CNHP 2007).

Shale Hills, Barrens, and Escarpment System

Figure 19. Shale hills in the study area. Photo by Renée Rondeau

Some 87-92 million years ago (Cretaceous Period) a shallow ocean covered eastern Colorado (Kauffman 1977). Most of the sediments left behind by this ocean eroded away, however the shale hills, barrens, and escarpments of eastern Colorado are the remnants of this ancient ocean (Figs. 19 and 20). The Cretaceous period was a relatively warm climate with changing sea levels, mostly increasing. The oceans and seas were populated with now extinct marine reptiles, ammonites, and bivalves. The abundant ocean life can still be viewed today in the form of fossils.

In addition to fossils the area is rich in geologic oddities, such as geodes (aka turtle rocks), concretions, and cones in cones. The sedimentary units that comprise the hills are Carlisle shale, Greenhorn limestone and Graneros shale, (Johnson 1969 geologic map).

The vegetation of the hills is tightly associated with the geology and is noticeably different than the surrounding prairie in that it is dominated by junipers and occasional pinyon pines and generally has very little soil build up thus giving a white hue to the hills. The understory varies from sparse to dense vegetation depending on slope, aspect, and grazing regime. The outwash areas are at the base of the hills and are comprised of colluvial soils derived from the eroding shale hills. These outwash areas are generally dominated by grasses and occasional shrubs, especially cholla (*Cylindropuntia imbricata*) and four-winged saltbush (*Atriplex canescens*). Typical grasses throughout the site are blue grama (*Bouteloua gracilis*), New Mexico feather grass (*Hesperostipa neomexicana*), galleta grass (*Pleuraphis*

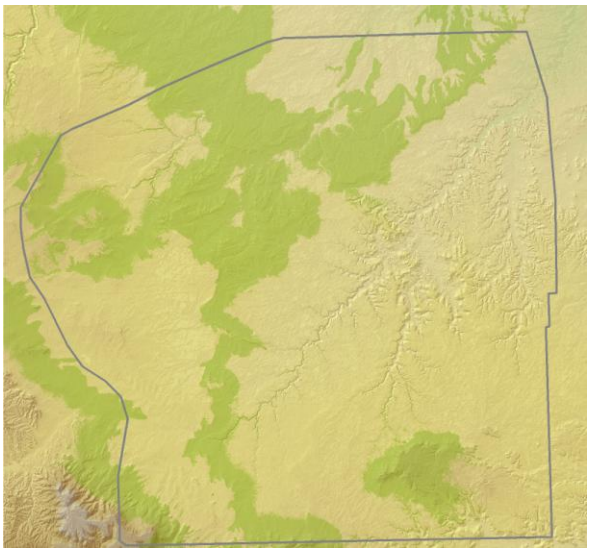


Figure 20. General distribution of shale hills, barrens, and escarpments in the study area, from CNHP (2007).

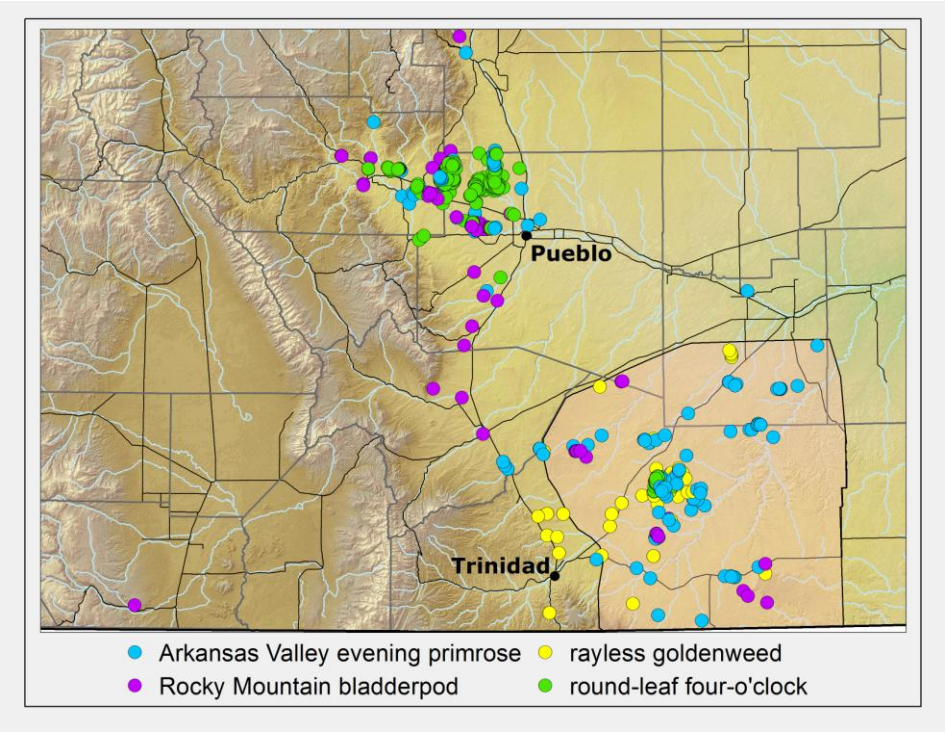


Figure 21. World-wide distribution of rare plants that rely primarily or exclusively on shale-derived habitats. The study area is also depicted.

jamesii), and threeawn grass (*Aristida purpurea*). Many of the sparsely vegetated slopes (barrens) are dominated by *Frankenia jamesii*, a species that is the only representative of its family (the Frankenia Family, or *Frankeniaceae*) in Colorado and relatively uncommon in Colorado. The shale breaks and associated colluvial outwash areas are particularly important because they support significant plants and plant communities. Several Colorado endemic plants that are globally rare are only associated with this habitat, specifically, Arkansas Valley evening primrose (*Oenothera harringtonii*), and rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), both tightly associated with the colluvial outwash while Rocky Mountain bladder pod (*Lesquerella calcicola*) is located on the tops as well as the outwash.

These hills are so prominent within the prairie landscape that nearly all of them have been named: Cordova Mesa, Sanford Hills, Big Springs Hills, Big Arroyo Hills, Poitrey Hills, and Rattlesnake Hills, among others. The majority of Colorado's rarest plants are associated with unusual bedrock. Because of this fact, nearly all of the hills and escarpments within the study area were targeted for inventory, and subsequently have been recognized as Potential Conservation Areas. Although we were unable to survey all of the targeted areas, every field trip that included this ecological unit resulted in new documented occurrences of rare plants and plant communities, and often resulted in new occurrence records for rare lizards (whiptails and horned lizards). This system has the highest endemism rate of any of the systems in southeast Colorado. For a species to be called —endemic" to a place or area means that it is found only in that place and nowhere else in the world. Arkansas Valley evening primrose, Rocky Mountain bladderpod, round-leaf four o'clock, Barneby's feverfew, rayless goldenweed , and Colorado green gentian are endemic to shale outcrops and outwashes.

Their worldwide distribution is limited to southeast Colorado, including this study area and west to Canon City, Fremont County (Fig. 21**).** Prior to this survey, many of these plants were considered quite rare (G2), but the 2009 inventory identified so many new locations for these species that their status ranks were adjusted to reflect a lower degree of imperilment, specifically Arkansas Valley evening primrose went from G2G3 to G3 and Rocky Mountain bladderpod went from G2 to G3. Several of Colorado's rare insects, including the Colorado blue butterfly and a rare tiger moth (*Pygarctia neomexicana*), are also closely tied (although not restricted) to this system, and rely on these cushion plants as a place to lay their eggs.

Eighteen species and plant communities of conservation concern that rely primarily on barren habitats have been documented in the study area (Table 7, Figure 22).

Ecological processes and impacts

The most significant ecological processes driving this system are drought, wind, and grazing. Due to the sparse vegetation cover, fires are seldom an issue. Most of the plants that occur on shale hills are highly evolved to cope with drought conditions by surviving underground via the root system or by long-lived seeds that wait to germinate until there is adequate precipitation. Many of the rare plants are seldom seen during droughts, but grow prolifically when wetter conditions return, especially when abundant precipitation occurs in spring. Because most of these hills can also be classified as escarpments, they are also subject to high winds – another habitat condition that favors short-statured plants. These escarpments are targets for future wind energy development. Although none of the hills currently have wind turbines, many of them are leased to wind companies and have wind metering towers. Grazing is another important factor for influencing which plant species will be present and which will be dominant. This is especially true for grass composition. Shallow and well-drained soils are normal for this system, which are perfect for supporting juniper trees and bunch grasses, especially Indian rice grass and New Mexico feather grass. The abundance of these grasses indicates a light to moderate grazing regime. Heavy grazing often eliminates these two grasses. We found areas that represented all the different grazing regimes.

Table 7. Species and plant communities of conservation concern that rely primarily or exclusively on barrens habitats.

Taxonomic Group	*Scientific Name*	Common Name
Insects	*Euphilotes rita coloradensis*	Colorado Blue
	Pygarctia neomexicana	A tiger moth
Reptiles	*Aspidoscelis neotesselata*	Triploid Colorado Checkered Whiptail
	Phrynosoma cornutum	Texas Horned Lizard
	Phrynosoma hernandesi	Short-horned Lizard
Vascular Plants	*Asclepias macrotis*	long-hood milkweed
	Asclepias uncialis ssp. *uncialis*	dwarf milkweed
	Bolophyta tetraneuris	Barneby's fever-few
	Forsellesia planitierum	Texas greasebush
	Frasera coloradensis	Colorado green gentian
	Lesquerella calcicola	Rocky Mountain bladderpod
	Oenothera harringtonii	Arkansas Valley evening primrose
	Oonopsis foliosa var. *monocephala*	rayless goldenweed
Natural Communities	*Artemisia bigelovii* / *Achnatherum hymenoides* Shrubland	Plains Escarpment Prairies (Limestone Breaks)
	Frankenia jamesii / *Achnatherum hymenoides* Shrubland	Foothills Shrubland
	Juniperus monosperma / *Artemisia bigelovii* Woodland	
	Juniperus monosperma / *Hesperostipa neomexicana* Woodland	Foothills Pinyon-Juniper Woodlands

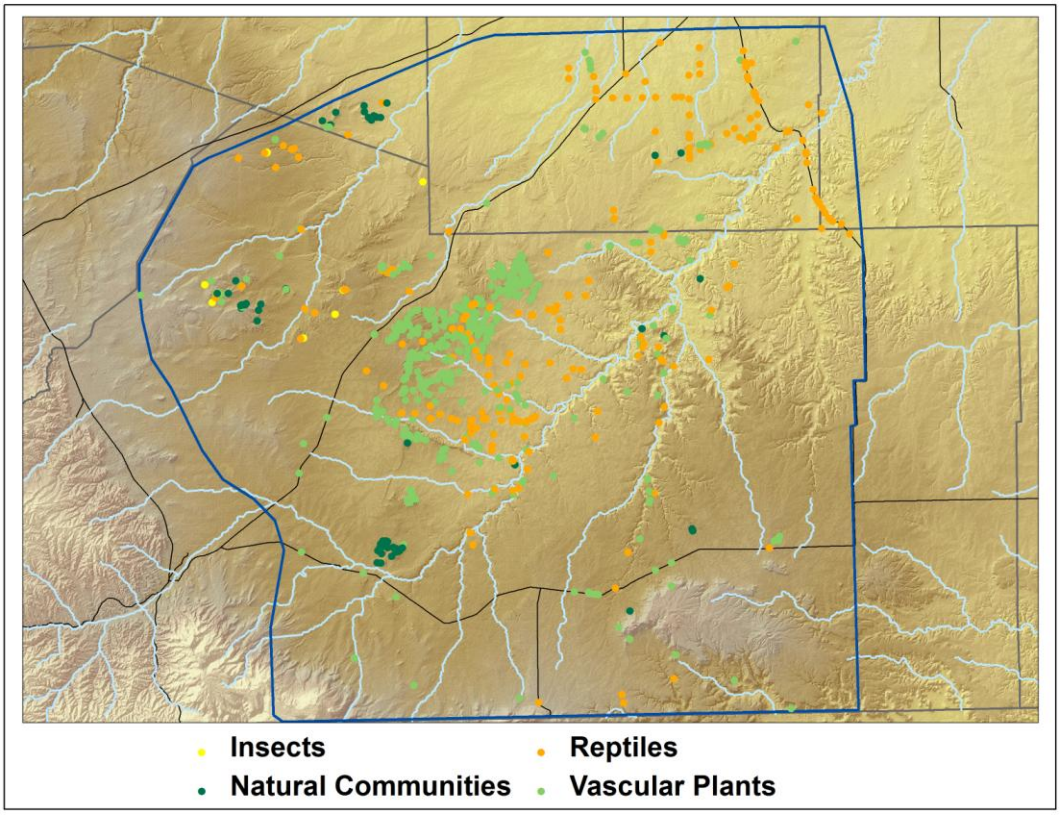


Figure 22. Distribution of species and plant communities of conservation concern that rely primarily or exclusively on barrens habitats.

Riparian, Wetland, and Aquatic System

This is the water system of southeast Colorado (Figs. 23 and 24). It includes the rivers and associated riparian areas, seeps, springs, ephemeral ponds, and playas. The primary rivers within the study area are the Purgatoire, Apishapa, Cimarron, and Timpas. All of these rivers can run dry during extreme drought years, but most have perennial stretches during average and wet years. Numerous narrow tributary canyons dissect the mesas and plateaus, and extend out away from the main canyons.

Figure 23. Ephemeral wetland in the study area. Photo by Renée Rondeau

While the main valleys 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 bedrock that support seasonally flooded pools, which house numerous populations of the plains leopard frog. This species is widely distributed within the project area, with over 20 occurrences recorded from multiple canyons. This area supports one of the highest concentrations of plains leopard frogs in all of Colorado, which indicates that the hydrologic integrity of the canyons is still intact. The state rare canyon tree frog is known to occur in one canyon off of Mesa de Maya, but we anticipate that other occurrences would be located in the area with future surveys.

A surprising discovery in our 2007 survey was the intact fish community. All of the fish found during the survey were native species, with the exception of the largemouth bass, which was 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. The Flathead chub and

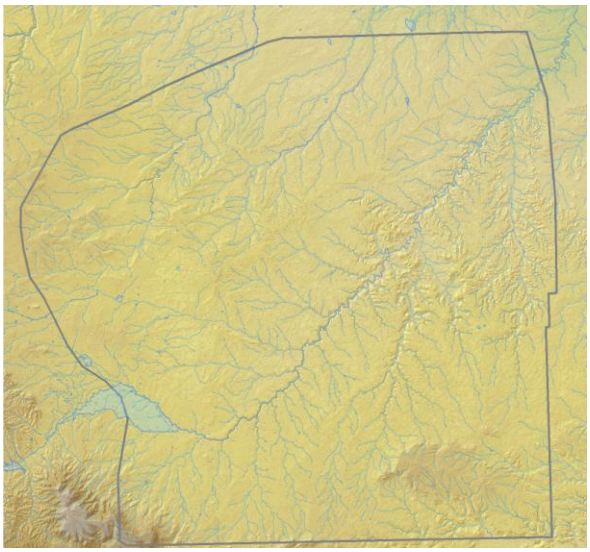


Figure 24. General distribution of riparian, wetland, and aquatic systems.

Figure 25. Riparian system. Photo by Renée Rondeau

Suckermouth minnow were only found on the main stem of the Purgatoire River and are species of conservation concern as they have been declining in eastern Colorado.

Some important finds of the 2009 field season included the first known occurrence east of I-25 for two plant species: helleborine (an orchid) and golden columbine. The golden columbine (G4T1Q) is a subspecies that is endemic to Colorado, with less than five populations known in the world (see species profile in Appendix B). All of these populations are in the Pikes Peak region except the one newly documented occurrence in southeast Colorado. The only known occurrence of helleborine in eastern Colorado is in the study area (see species profile in Appendix B). The Cardinal flower was also new to the area. All three of these plants are indicators of healthy, functioning seep and spring areas. The orchid and columbine were unexpected since all of the previously known locations are in the Rocky Mountains.

The green toad and Couch's spadefoot toad are associated with seasonal wetlands. These areas are often dry, but large summer rainstorms transform the ephemeral wetlands, which then come alive with many species of toads. Their chorus transforms the quiet night into a symphony of sounds that can be heard from miles away. The riparian areas (Figs. 25 and 27), especially in the side canyons, are often dominated by cottonwood tree communities. Plains cottonwoods regenerate primarily by seed, and are known to have excellent germination success following large flooding events, especially in the early part of summer when their "cotton" is flying. These trees provide excellent habitat for neotropical migratory song birds, bald eagles, and Lewis's woodpeckers. Seedlings are palatable to cattle.

See Table 8 and Fig. 26 for list and map of species and plant communities.

Table 8. Species and plant communities of conservation concern that rely primarily on riparian, wetlands, and aquatic habitats.

Taxonomic Group	*Scientific Name*	Common Name
Amphibians	*Bufo debilis*	Green Toad
	Hyla arenicolor	Canyon Treefrog
	Rana blairi	Plains Leopard Frog
	Rana pipiens	Northern Leopard Frog
	Scaphiopus couchii	Couch's Spadefoot
Birds	*Asio flammeus*	Short-eared Owl
	Haliaeetus leucocephalus	Bald Eagle
	Melanerpes lewis	Lewis's Woodpecker
	Phalaropus tricolor	Wilson's Phalarope
Fish	*Hybopsis gracilis*	Flathead Chub
	Phenacobius mirabilis	Suckermouth Minnow
Reptiles	*Thamnophis cyrtopsis*	Blackneck Garter Snake
Vascular Plants	*Aquilegia chrysantha* var. *rydbergii*	golden columbine
	Carex gravida var. *lunelliana*	Lunell's heavy-fruited sedge
	Epipactis gigantea	helleborine
	Lobelia cardinalis	
	Sapindus drummondii	soapberry
Natural Communities	*Distichlis spicata* Herbaceous Vegetation	Salt Meadows
	Eleocharis palustris Herbaceous Vegetation	Emergent Wetland
	Muhlenbergia asperifolia Herbaceous Vegetation	Great Plains Salt Meadows
	Panicum obtusum Herbaceous Vegetation	
	Populus deltoides - (*Salix amygdaloides*) / *Salix* (*exigua*, interior) Woodland	Plains Cottonwood Riparian Woodland
	Populus deltoides / *Panicum virgatum* - *Schizachyrium scoparium* Woodland	Plains Cottonwood Riparian Forests
	Populus deltoides / *Pascopyrum smithii* - *Panicum virgatum* Woodland	
	Populus deltoides / *Sporobolus airoides* Forest	Plains Cottonwood / Alkali Sacaton
	Populus deltoides ssp. *wislizeni* / Disturbed Understory Woodland	
	Salix exigua / Barren Shrubland	Coyote Willow/Bare Ground
	Salix exigua / Mesic Graminoids Shrubland	Coyote Willow/Mesic Graminoid
	Schoenoplectus pungens Herbaceous Vegetation	Bulrush
	Sporobolus airoides Southern Plains Herbaceous Vegetation	Great Plains Salt Meadows

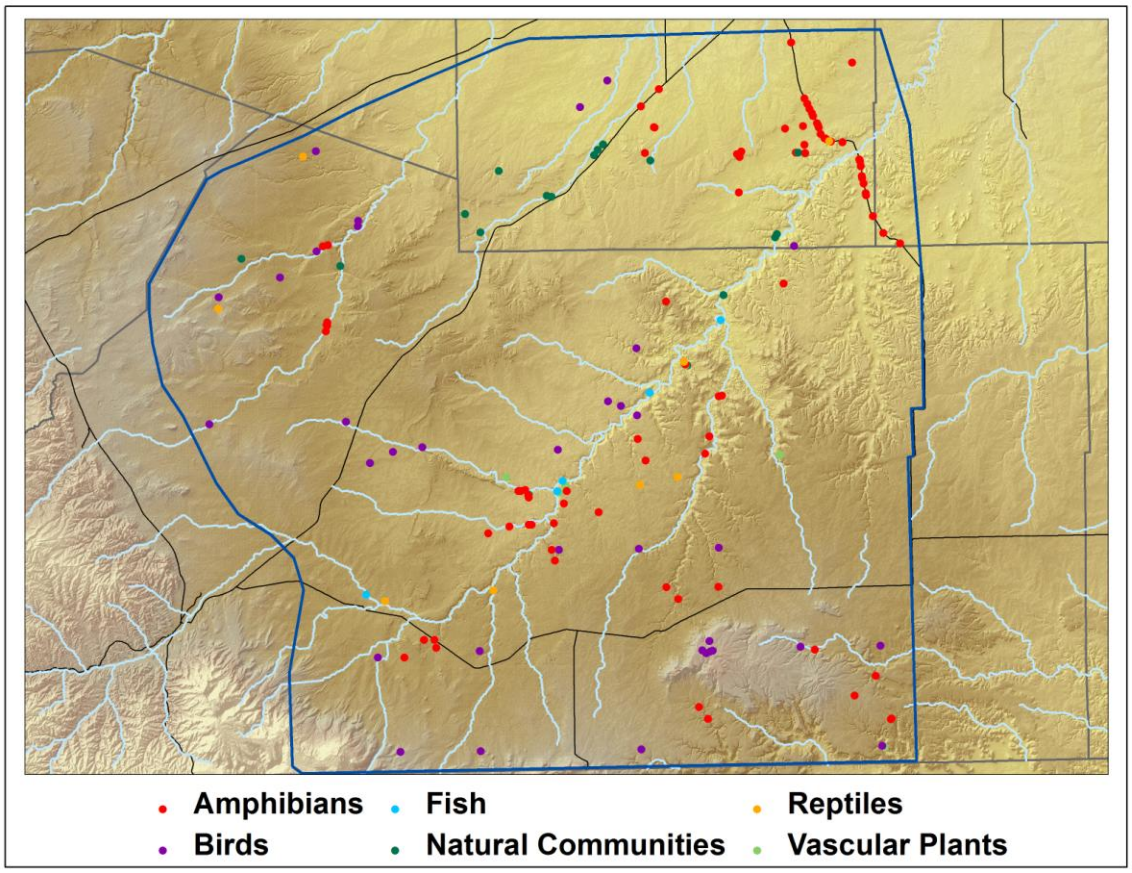


Figure 26. Species and community occurrences in riparian, wetland, and aquatic areas.

Ecological processes and impacts

This system relies on a combination of surface and ground water flows in a hydrologic regime complete with periodic large floods and cycles of drought. Both the quality and the quantity of water quality are important for fish and amphibians. Increased siltation, water diversion and nutrient enrichment has a negative impact on the suckermouth minnow (Propst 1982). Flathead chubs are sensitive to altered timing and quantity of water, and are threatened by the construction of dams and reservoirs since these alter the natural hydrologic regime. There are no large-scale hydrological modifications within the study area, but the Purgatoire River has been dammed upstream at the Trinidad Reservoir. We do not know what effect this change in hydrology has had on native flora and fauna in the study area, but the area still experiences flash-flood events. The fact that the fish survey documented all the native species that would historically have been present indicates that the overall hydrologic regime is still intact.

The only hydrological modifications observed within the study area are watering ponds on the tops of the side canyons. These ponds 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

Figure 27. Example of an ephemeral creek. These waterways hold water when precipitation levels are high, and dry up when drought conditions prevail. Photo by Renée Rondeau.

subpopulations of plains leopard frogs. The fact that plains leopard frogs still remain in most of the area's canyons seems to indicate that the overall population genetics and viability is in good condition. Groundwater wells are scattered throughout the ranches, and are critical to managing a successful cattle operation. Although we did not detect any indication that these wells are having an impact, it is nonetheless a change to the groundwater system. Introduced species are one of the most significant impacts to this ecological unit and include both plants and animals. In general, the more inaccessible canyons are relatively free of exotic plants and animals, and represent excellent examples of the canyon riparian and wetland system. However, the presence of bullfrogs in Lunning Arroyo, Trementina Canyon, and one of the Trinchera Creek side canyons is a significant concern for the native leopard frogs in those areas. Bullfrogs are not native to Colorado and are larger than most of Colorado's native amphibians. They adversely impact native species through intense predation as well as competition for resources. The ephemeral nature of most side canyons is probably a benefit for the plains leopard frog since bullfrogs cannot survive in short-lived ponds.

The introduced large mouth bass also has a negative impact. This introduced predator can have an impact on native fish diversity and abundance, particularly impacting smaller fishes like minnows (Bunnell and Zampella. 2008). Numerous invasive plant species are found throughout the study area. Tamarisk is the most significant of these, and was found on the

larger streams. Cheatgrass is also prevalent in some areas. Both of these species outcompete the native vegetation and have the ability to homogenize the species compostion.

Table 9. Impacts to species and plant communities of conservation concern. The impacts noted in this table are those that are currently operating in the study area. Impacts that are not marked in this table may be relevant for these same species/communities elsewhere. Impact codes: H = high (significant negative impact); M = moderate negative impact; L = low negative impact; P = positive impact; * = potential future impact. Species/communities highlighted in bold font are considered indicators for the ecological system unit.

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
GRASSLAND SPECIES and PLANT COMMUNITIES																												
Short-eared Owl																												
Burrowing Owl			L ?																									
Ferruginous Hawk			L											M *		L								L ?				
McCown's Longspur			L											M *				M						L ?				
Chestnut-collared Longspur			L											M *				M						L ?				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Mountain Plover			M											M *		M		H		L		L	L		L ?				
Long-billed Curlew			L											M *											L ?				
Simius Roadside Skipper			L			L												L							L ?				
A tiger moth																						L							M
Yellow-faced pocket gopher			L																										
Black-tailed Prairie Dog			L												L	H								H	L ?				
Swift Fox			L						L					L *	L	M									L ?				
Texas Horned Lizard			L						H					L *											M ?				
Short-horned Lizard			L															L		L									

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Massasauga			L						H					L *	M										L ?				
dwarf wild indigo																		x				?				L	M		
zizotes milkweed																									L				
dwarf milkweed																						L							L
sandhill goosefoot																													
Texas beargrass																						?				L	M		
James' beard-tongue																		?				?				L	M		
prairie violet																		x				?				L	M		
Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation														L *				M				L	L		L ?				
Bouteloua eriopoda - Bouteloua hirsuta Herbaceous Vegetation									L									M				L	M		L ?				
Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation																		M				L	M		L ?				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
***Bouteloua gracilis - Bouteloua curtipendula* Herbaceous Vegetation**																						L	M		L ?				
***Bouteloua gracilis - Pleuraphis jamesii* Herbaceous Vegetation**																		L				L	M		L ?				
***Bouteloua gracilis* Herbaceous Vegetation**																		M				M	M		L ?				
***Hesperostipa neomexicana* Herbaceous Vegetation**																		M				L	M		L ?				
Pascopyrum smithii Herbaceous Vegetation																		M				L	M		L ?				
Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Herbaceous Vegetation																						L	M		L ?				
Stipa comata - Bouteloua gracilis Herbaceous Vegetation																		M				M	M		L ?				
WOODLAND, SAVANNA, and FOOTHILLS SHRUBLAND SPECIES and COMMUNITIES																													

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Rufous-crowned Sparrow														L														
Lewis's Woodpecker						L																						
Gray Vireo							M																					
Colorado Blue																		P						?				
Northern Hairstreak														L ? *										L ?				
A tiger moth																						L						M
Triploid Colorado Checkered Whiptail			L ?				P																					
New Mexico thread snake																		?										?
Texas Horned Lizard			L						H					L *										M ?				
Short-horned Lizard			L															L		L								
Ground Snake			L						M																			
long-hood milkweed								L																L				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
dwarf milkweed																						L							L
Springfield bluestem																									L				
Texas beargrass																						?				L	M		
dwarf purslane																						?				L	M	?	
twinevine																													
prairie violet																		x				?				L	M		
Cercocarpus montanus - Rhus trilobata / Andropogon gerardii Shrubland																													
Cercocarpus montanus / Hesperostipa comata Shrubland																													
Cercocarpus montanus / Hesperostipa neomexicana Shrubland																													
***Juniperus monosperma / Bouteloua curtipendula* Woodland**							M		L									M				M	M						
***Juniperus monosperma / Bouteloua eriopoda* Woodland**							M		L									M				M	M						

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
***Juniperus monosperma* / *Cercocarpus montanus* Woodland**							M															M	M						
***Juniperus monosperma* / *Hesperostipa neomexicana* Woodland**							M		L									M				M	M						
***Juniperus monosperma* / *Quercus* X *pauciloba* Woodland**							M		L													M	M						
***Juniperus scopulorum* / *Cercocarpus montanus* Woodland**							M		L																				
Nolina texana Shrubland																													
Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* Woodland							M		L									L				M	M						
Pinus edulis / *Quercus* X *pauciloba* Woodland							M		L									L				M	M						
Pinus ponderosa / *Bouteloua gracilis* Woodland																													

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Rhus trilobata - Philadelphus microphyllus Shrubland																												
CLIFF SPECIES																												
Prairie Falcon														L														
American Peregrine Falcon														L														
Townsend's Big-eared Bat Subsp						H *							H	L						M								
southern maiden-hair								L																	L	M		
Fendler cloak-fern								L																	L	M		
ebony spleenwort								L																	L	M		
black-stemmed spleenwort								L																	L	M		
green spleenwort								L																	L	M		
Eaton's lip fern								L																	L	M		
Standley's cloak fern								L																	L	M		
Wooton's lip fern								L																	L	M		

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Smith whitlow-grass					L			M																		H ?		
purple cliff-brake																									L	M		
smooth cliff-brake																									L	M		
Wright's cliff-brake																									L	M		
New Mexico cliff fern								L																	L	M		
PRAIRIE SHRUBLAND SPECIES AND NATURAL COMMUNITIES																												
Sage Sparrow																		L ?										
Cassin's Sparrow																		L ? P						P ?				
Curve-billed Thrasher																		P						P ?				
Southern Plains Woodrat			M																					P ?				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Short-horned Lizard			L															L		L									
sandhill goosefoot																													
***Atriplex canescens* / *Bouteloua gracilis* Shrubland**							L	M										H											
***Atriplex canescens* / *Pleuraphis jamesii* Shrubland**							L	M										H											
***Atriplex canescens* / *Sporobolus airoides* Shrubland**							L	M										H											
Opuntia imbricata Shrubland							L	M										H											
Sarcobatus vermiculatus / *Bouteloua gracilis* Shrubland								M										M				L							
SHALE HILL, BARREN, and ESCARPMENT SPECIES and NATURAL COMMUNITIES																													
Colorado Blue																		P							?				
A tiger moth																						L							M
Triploid Colorado Checkered Whiptail			L ?				P																						

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Texas Horned Lizard			L						H					L *											M ?				
Short-horned Lizard			L															L		L								
long-hood milkweed								L																L				
dwarf milkweed																						L						L
Barneby's fever-few														M *										?			H	
Texas greasebush																								?				
Colorado green gentian				?					L		L			L				M				?			L	M		
Rocky Mountain bladderpod														M *				L				L		?				
Arkansas Valley evening primrose									L									?				L		?				L
rayless goldenweed									?									?				L		?				L
round-leaf four-o'clock														M *								L		?				M

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Artemisia bigelovii / *Achnatherum hymenoides* Shrubland														M *				M				L							
Frankenia jamesii / *Achnatherum hymenoides* Shrubland									L					M *				M				L			?				
Juniperus monosperma / *Artemisia bigelovii* Woodland														M *				M				L							
***Juniperus monosperma* / *Hesperostipa neomexicana* Woodland**							M		L									M				M	M						
RIPARIAN, WETLAND, and AQUATIC SPECIES and NATURAL COMMUNITIES																													
Green Toad			L		P			M	L									M		M	M	H		?	M ?				
Canyon Treefrog																									M ?			L	
Plains Leopard Frog			L					M	L									M		M	M	H		?	M ?				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Northern Leopard Frog			L					M	L									M		M	M	H		?	M ?				
Couch's Spadefoot			L					M												L					H ?				
Short-eared Owl																													
Bald Eagle								L ?																					
Lewis's Woodpecker						L																							
Wilson's Phalarope					P																				L ?				
Flathead Chub																									L ? M ?				

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Suckermouth Minnow																									L ? M ?				
Blackneck Garter Snake								M	L									M			M				M ?				
golden columbine								L													L				M ?				
Lunell's heavy-fruited sedge																		?				H				L	M		
helleborine								L													L				M ?				
cardinal flower								L													L				M ?				
soapberry																		?			?					L	M		
Distichlis spicata Herbaceous Vegetation					L			M										M			H								

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Eleocharis palustris Herbaceous Vegetation					L			M										M				H							
Muhlenbergia asperifolia Herbaceous Vegetation					L			M										M				H							
Panicum obtusum Herbaceous Vegetation					L			M										M				H							
Populus deltoides - (*Salix amygdaloides*) / *Salix* (*exigua*, interior) Woodland					L			M										M				H							
Populus deltoides / *Panicum virgatum* - *Schizachyrium scoparium* Woodland					L			M										M				L							
Populus deltoides / *Pascopyrum smithii* - *Panicum virgatum* Woodland					L			M										M				s							
Populus deltoides / *Sporobolus airoides* Forest					L			M										M				s							
Populus deltoides ssp. *wislizeni* / Disturbed Understory Woodland					L			M										M				s							
Salix exigua / Barren Shrubland					L			M										M				s							
Salix exigua / Mesic Graminoids Shrubland					L			M										M				s							

Impacts	Habitat Conversion					Habitat Degradation			Transportation & Infrastructure			Energy & Mining			Harvesting of Biological Resources					Pollu -tion		Invasive Species			Climate Change			Other	
Species/Community	**Residential development**	**Commercial and Industrial development**	**Conversion to cropland**	**Recreation areas**	**Reservoirs**	**Natural system modification**	**Altered fire regime**	**Altered hydrological regime**	**Roads and ROW**	**Railroads**	**Utility lines**	**Oil and gas drilling**	**Mining**	**Wind energy**	**Hunting, trapping (fishing not applicable)**	**Poisoning**	**Gathering**	**Incompatible grazing management**	**Haying**	**Chemicals and toxins (incl. pesticides, herbicides)**	**Nutrient loads**	**Invasive species**	**Problematic native species**	**Diseases**	**Habitat shifting and alteration**	**Climate variability**	**Increased drought**	**Intrinsic factors**	**Military training (mechanized)**
Schoenoplectus pungens Herbaceous Vegetation					L			M										M				s							
Sporobolus airoides Southern Plains Herbaceous Vegetation					L			M										M				s							

LITERATURE CITED

Colorado Natural Heritage Program [CNHP]. 2007. Shale Barrens Plants probability surface for the CSP. Raster digital dataset. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Colorado Natural Heritage Program and The Nature Conservancy. 2008. A Biodiversity Scorecard for Colorado. Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado, and The Nature Conservancy, Boulder, Colorado. Unpublished report to The Nature Conservancy, draft of October 20, 2008.

Colorado Natural Heritage Program and The Nature Conservancy. In prep (2010). Colorado's Biodiversity: A State of the State.

Coffin, D. P., W. K. Lauenroth, and I. C. Burke. 1996. Recovery of vegetation in a semiarid grassland 53 years after disturbance. Ecological Applications 6:538-555.

Drietz, V. J., P. M. Lukacs, and F. L. Knopf. 2006. Monitoring low density avian populations: an example using Mountain Plovers. The Condor 108:700-706.

Bunnell, J. F.and R. A. Zampella. 2008. Native fish and anuran assemblages differ between impoundments with and without non-native centrarchids and Bullfrogs. Copeia 4:931–939.

Belew, F. Pusateri, B. Rosenlund, D. Runner, K. Sochi, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative. The Nature Conservancy of Colorado and the Shortgrass Prairie Partnership. 124 pp. and Appendices.

Kauffman, E.G. 1977. Geological and biological overview: Western interior Cretaceous basin. The Mountain Geologist, v. 14, nos. 3-4; p. 75-99.

Neely, B., S. Kettler, J. Horsman, C. Pague, R. Rondeau, R. Smith, L. Grunau, P. Comer, G. Belew, F. Pusateri, B. Rosenlund, D. Runner, K. Sochi, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative. The Nature Conservancy of Colorado and the Shortgrass Prairie Partnership. 124 pp.and Appendices.

Propst, D. L. 1982. Warmwater fishes of the Platte River Basin, Colorado: distribution, ecology, and community dynamics. Ph.D. dissertation, Department of Fishery and Wildlife Biology, Colorado State Univ., Fort Collins, Colorado.

Stevens, J., J. Sovell, D. Culver, K. Decker, L. Grunau, A. Lavender, C. Gaughan. 2008. Southeastern Colorado Survey of Critical Biological Resources 2007. Colorado Natural Heritage Program, Colorado State University, Fort Collins.

APPENDIX A: POTENTIAL CONSERVATION AREAS

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 biological resources highlighted within these PCAs are not restricted to the site boundary; rather the highest quality occurrences of these resources and the area estimated by CNHP biologists required to support the long-term survival of the targeted species or natural communities are defined by the boundaries. The species and communities being conserved at the location, and the physical features and/or ecological processes required to sustain them, dictate the size and configuration of a PCA. Human activities are not precluded from PCAs, but a PCAs ability to function naturally may be greatly influenced by them. PCAs at all scales may require ecological management or restoration to maintain their functionality and the long term persistence of the species and communities they contain.

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.

Big Spring and Big Arroyo Hills

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 150,365 acres (60,851 ha) **Elevation:** 4,790 - 5,915 ft. (1,460 - 1,803 m)

General Description: This site is characterized by shale hills, escarpments, mesas, and outwash prairies embedded in the shortgrass prairie. The sedimentary units that comprise the hills are Carlile shale, Greenhorn limestone and Graneros shale, dark-gray shale, gray limestone, and gray shale (Johnson 1969 geologic map). The vegetation of the hills is tightly associated with the geology and is noticeably different than the surrounding prairie in that it is dominated by junipers and occasional pinons and generally has very little soil build up thus giving a white hue to the hills. The whiteness of the hills is due to the white-gray shale and limestone substrate. Dominant vegetation types include shortgrass prairie and scattered juniper woodlands (*Juniperus monosperma*). The prairie is in good to excellent condition despite military tank traffic. The understory varies from sparse to dense vegetation depending on slope, aspect, and grazing regime. The outwash areas are the bajadas of the hills and are comprised of colluvial soils derived from the eroding shale hills. These outwash areas are generally dominated by grasses and occasional shrubs, especially cholla (*Cylindropuntia imbricata*) and four-winged saltbush (*Atriplex canescens*). Typical grasses throughout the site are blue grama (*Bouteloua gracilis*), New Mexico feathergrass (*Hesperostipa neomexicana*), galleta grass (*Pleuraphis jamesii*), and threeawn grass (*Aristida purpurea*). Many of the sparsely vegetated slopes (barrens) are dominated by *Frankenia jamesii*, a species that is the only representative of its family (the Frankenia Family, or *Frankeniaceae*) in Colorado and relatively uncommon in Colorado. The shale breaks and associated colluvial outwash areas are particularly important because they support significant plants and plant communities. Several Colorado endemic plants that are globally rare are only associated with this habitat, specifically, Arkansas Valley evening primrose (*Oenothera harringtonii*), and rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), both tightly associated with the colluvial outwash while Rocky Mountain bladder pod (*Lesquerella calcicola*) is more commonly found on the shale slopes and mesa tops. The juniper / New Mexico feathergrass (*Juniperus monosperma / Hesperostipa neomexicana)* community occurs on the mesa tops and is a rare community of interest that is tightly associated with grazing regimes. Additional dominant plant species include: *Gutierrezia sarothrae, Echinocereus reichenbachii, Melampodium leucanthum, Piptatherum micranthum, Achnatherum scribneri, Acnatherum hymenoides,* and *Bouteloua curtipendula*. Several animal species of concern also utilize this habitat, especially the triploid checkered whiptail and Texas horned lizard.

Land Use History: Area was grazed until 1983 and eliminated once it became a military base. Military training, especially with tanks, is the primary use today.

Biodiversity Significance Rank Comments (B2): This site supports three high quality occurrences of the globally imperiled (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*). These are amongst the best known locations for this taxon in the world. The site also supports three excellent (A-ranked) occurrences of a globally vulnerable (G3G4T2T3/S2) plant subspecies, dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*). There are few known excellent occurrences of this species in Colorado. The globally imperiled (G2/S2) *Frankenia jamesii / Achnatherum hymenoides* plant community is abundant and in excellent (A-ranked) condition and there are excellent (A-ranked) and good (B-ranked) occurrences of the globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*), as well as several high quality occurrences of globally rare and state rare natural communities.

Natural Heritage element occurrences at the Big Spring and Big Arroyo Hills 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	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	G2	S2				A	2009-05-07
Natural Communities	Artemisia bigelovii / Achnatherum hymenoides Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3	S3				A	2009-05-25
Natural Communities	Juniperus monosperma / Artemisia bigelovii Woodland	Juniper / Sagebrush Woodland	G3?	S2				B	2009-05-25
Natural Communities	Pascopyrum smithii Herbaceous Vegetation	Western Slope Grasslands	G3G5Q	S2				B	1998-10-02
Vascular Plants	Bolophyta tetraneuris	Barneby's fever - few	G3	S3				C	2009-05-25
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				C	2009-05-25
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	A	2007-06-30
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	2007-06-29
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	2007-05-18
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	CD	2007-06-28
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	2009-06-23
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	D	2007-05-18
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	A	2009-05-25

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	G3	S3			USFS	E	2007-05-19
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2009-05-25
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				A	2006-06-30
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2007-06-29
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2006-06-29
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/USFS	A	2007-05-18
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/USFS	A	2007-05-19
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/USFS	A	2007-05-20
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				B	2009-06-23
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				A	2006-06-28
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				B	2009-06-24
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				E	1997-05-28
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				A	2009-06-23

** 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 include the known occurrences of rare plants in this area, and to provide additional potential habitat where individuals can become established over time. Boundary also includes examples of the mosaic of plant communities in this area. The boundary was digitized while referencing a one meter digital color orthophoto quad, a 1:100,000 digital quad, and a GIS model developed by CNHP that shows the probability of the presence of shale barren plants.

Protection Urgency Rank Comments (P4): The site is mostly contained in the Pinon Canon Maneuver Site, and also includes private lands, and public lands managed by

Comanche National Grassland and the State of Colorado. Future plans are unknown. At present, most of the area is used as a military training ground.

Management Urgency Rank Comments (M3): The area shows some signs of degradation from tank maneuvers, but is still in relatively good condition. Although there are a few patches of exotic plants, no state-listed noxious weeds were noted. However, sixteen noxious weeds are known from the Pinon Canyon Maneuver Site (Spackman Panjabi and Decker 2007) and have the potential to infest areas within the site, especially in areas with periodic ground disturbances. Protection from military maneuvers, including indirect impacts such as the generation of dust, would benefit the occurrences.

Land Use Comments: Most of this site is currently a U.S. Army training area. Twice a year for 21 days about 1,500 tanks and other vehicles practice military activities here. A small fence exclosure was erected in 1995 to keep traffic off of a portion of one of the occurrences of *Asclepias uncialis* ssp. *uncialis*. The exclosure is about 1/2 acre or less.

References

Johnson, R.B. 1969. Geologic map of the Trinidad quadrangle south-central Colorado. Miscellaneous Geologic Investigations. Map 1-558. USGS.

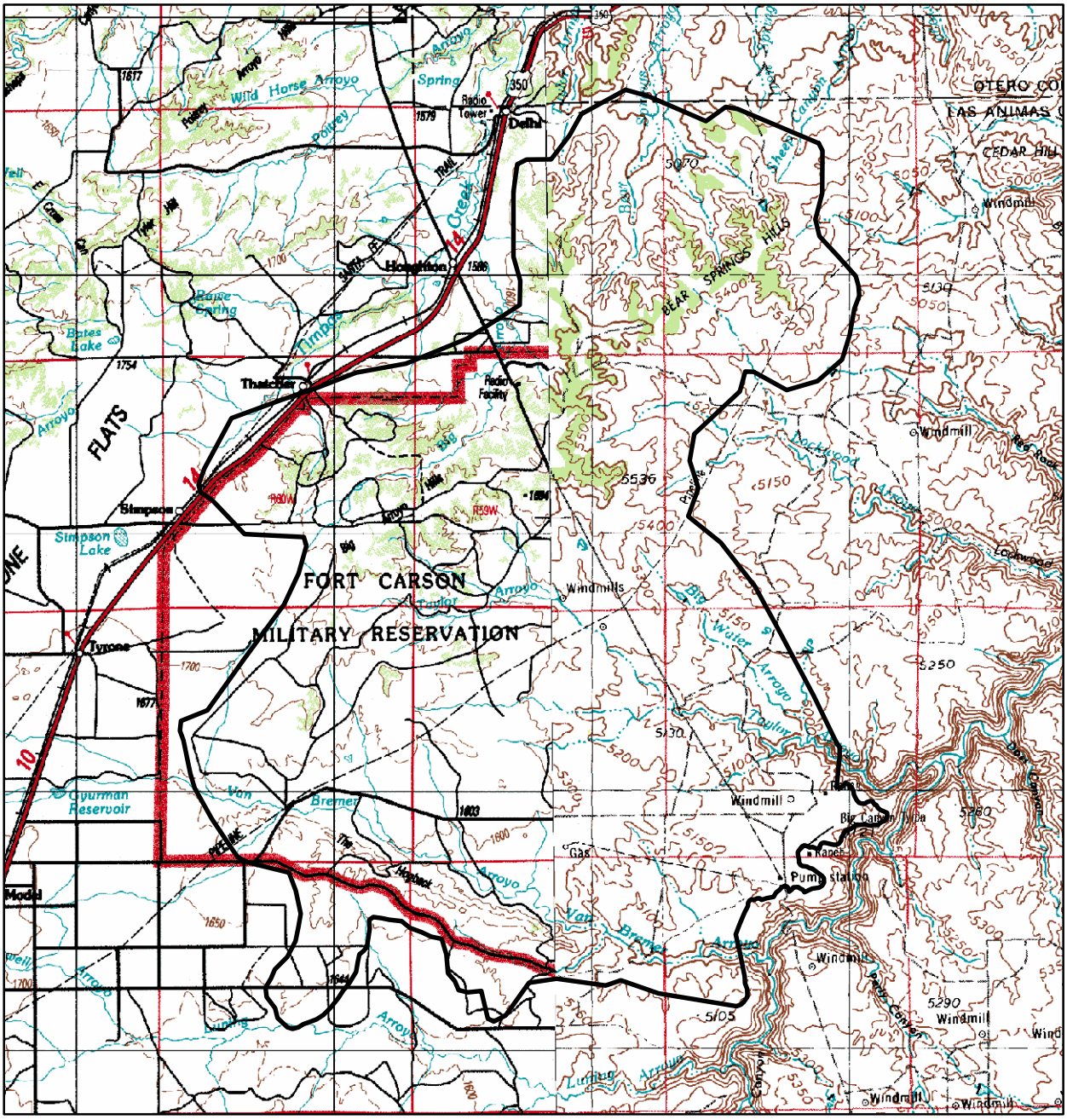
Neid, S., K. Decker, J. Handwerk, and S. Spackman Panjabi. 2007. Final Report: Rare Plant Surveys on Pinon Canyon Maneuver Site 2006-2007. Colorado Natural Heritage Program, Fort Collins, CO.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Spackman Panjabi, S. and K. Decker. 2007. Front Range Eco-regional Partnership Invasive Plant Species Strategic Plan. Unpublished report prepared for the U.S. Department of Defense by the Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Panjabi, S.S. and R.J. Rondeau

Version Date: 02/01/2009



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Map Date: 01/28/2010

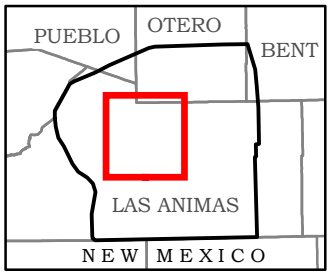
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 1. Big Spring and Big Arroyo Hills Potential Conservation Area, B2: Very High Biodiversity Significance

Bruno Canyon

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

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

Size: 722 acres (292 ha) **Elevation:** 4,510 - 4,880 ft. (1,375 - 1,487 m)

General Description: Bruno Canyon is a striking red rock canyon that enters the Purgatoire River just upstream of Chacuaco Canyon. This narrow and restricted canyon is noted for the abundance of red walls and smooth rock slopes. Access into the canyon generally requires rock scrambling unless accessed from the Purgatoire River. The oldest strata (Permian and Triassic age) in southeast Colorado make up the canyon walls and is seldom seen elsewhere in eastern Colorado. Once inside the canyon a suite of riparian trees grow beside the ephemeral creek. Plains cottonwoods (*Populus deltoides*), peach leaf willow (*Salix amygdaloides*) and boxelder maple (*Acer negundo*) are the most common trees. Coyote willow (*Salix exigua*) is common in patches throughout the canyon. Unlike many eastern plains streams, this stream is dominated by a native understory of grasses and forbs due to its limited use by livestock. Common grasses include Indian grass (*Sorghastrum nutans*), switch grass (*Panicum virgatum*), scratchgrass (*Muhlenbergia asperifolia*), and Springfield's beardgrass (*Bothriochloa springfieldii*). Although Bruno Creek is ephemeral, springs are scattered throughout the canyon creating permanent ponds with cattails lining the edges. The vegetation changes frequently throughout the canyon based on floodplain width and depth of soil and proximity to channel, thus making it hard to generalize the overall community type. A few tamarisk were found near the confluence with Purgatoire River. During good precipitation years the Plains leopard frog is abundant in the deeper pools. One pool near the confluence appears to be permanent and was full of small fishes. The landuse by humans is limited due to the difficult access however periodic stray cattle will graze the canyon bottom during the winter months although few cattle signs exist in the canyon.

Key Environmental Factors: Surface and ground water flows are critical to the vegetation and aquatic animal community associated with the creek and canyon bottom. Periodic flash floods are needed for cottonwood regeneration. Groundwater is critical to the maintenance of the numerous seeps and springs found throughout the canyon.

Land Use History: Periodic livestock grazing occurs but this is predominantly a wild canyon.

Cultural Features: Native American artifacts were present.

Biodiversity Significance Rank Comments (B2): The site supports an excellent

(A-ranked) occurrence of the globally imperiled (G2/S2) *Populus deltoides / Panicum virgatum - Schizachyrium scoparium* plains cottonwood riparian forest and a good (B-ranked) occurrence of the state rare (G5/S2) plant *Lobelia cardinalis*.

Natural Heritage element occurrences at the Bruno 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
Natural Communities	Populus deltoides / Panicum virgatum - Schizachyrium scoparium Woodland	Plains Cottonwood Riparian Forests	G2	S2				A	2009-09-29
Vascular Plants	Lobelia cardinalis		G5	S2				B	2009-09-29

** 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 to include the canyon bottom, slopes, and rimrock of Bruno Canyon. All known occurrences of rare elements associated with Bruno Canyon were included. The boundary was digitized while referencing a one meter digital color orthophoto quad and a 1:24,000 digital quad.

Protection Urgency Rank Comments (P5): Much of JE Canyon Ranch has a conservation easement, of which Bruno Canyon is part of.

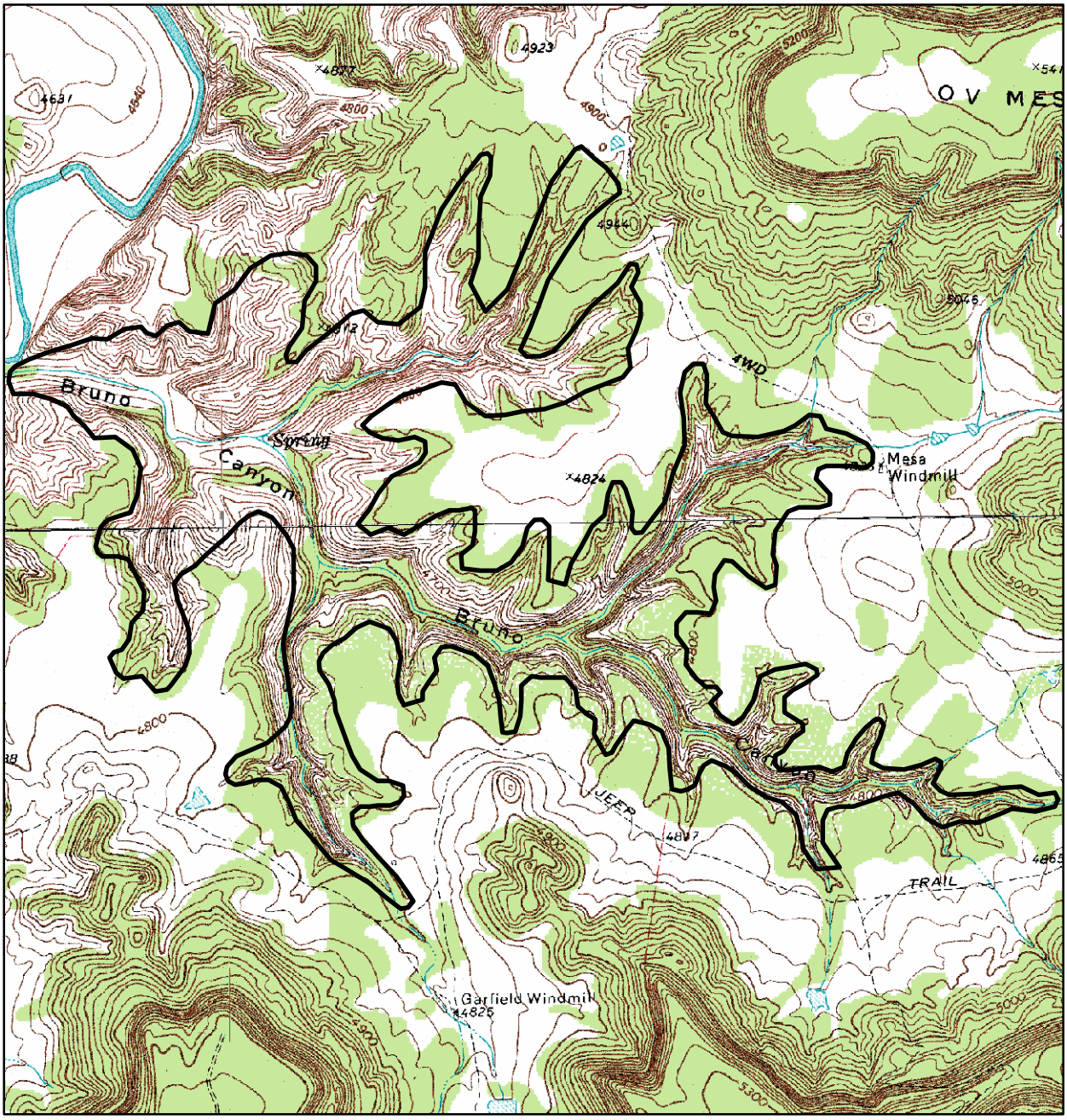
Management Urgency Rank Comments (M3): The presence of tamarisk near the confluence is alarming. Rapid elimination of the few trees would prevent further encroachment. Some cheatgrass was also noted. The most important management tool is to maintain the lack of livestock grazing.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Rondeau, R.J.

Version Date: 02/03/2010



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Projection: UTM
NAD83 Zone 13

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Map Date: 02/09/2010

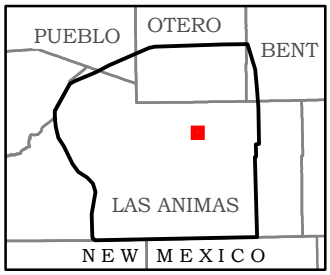
Legend

PCA Boundary

Johnson Canyon, 37103-D6
OV Mesa, 37103-E6

7.5 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 2. Bruno Canyon Potential Conservation Area, B2: Very High Biodiversity Significance

Cobert Mesa

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 9,578 acres (3,876 ha) **Elevation:** 5,100 - 6,220 ft. (1,554 - 1,896 m)

General Description: Cobert Mesa is a part of the Mesa de Maya uplift straddling the Colorado/New Mexico state line. The area is capped with basaltic material which forms extensive cliffs around the edge of the mesa. The southern slopes are generally xeric grasses with the vegetation nearer the cliffs grading to pinon - juniper. Some Gambel oaks (*Quercus gambelii*) are found in the understory at or near the mesa's rim. The mesa top is largely grassland with a few scattered trees and shrubs. The grasses include several gramas, including extensive areas of sideoats grama (*Bouteloua curtipendula*). Little bluestem (*Schizachyrium scoparium*) is also common. The northern slopes are more heavily vegetated, but with similar composition as on southern slopes. It was noted that there are pure pinon pine (*Pinus edulis*) stands on the north slopes. Many small canyons that dissect the slopes of the mesa have older stands of juniper. Signs of historic post cutting is evident, but often, these areas could be considered older growth. At the heads of some of these canyons are splash pools that support amphibian communities. These areas are also important watering holes for resident wildlife.

Key Environmental Factors: The ecosystem is dominated by the xeric climate. Along with rainfall, wind, fire, and geology play important roles. Whereas the intensity of grazing native ungulates is not well known, they did inhabit the area. Today, cattle grazing occurs throughout the area.

Land Use History: The entire Mesa de Maya area was inhabited by Native Americans as evidenced by points, teepee rings, rock art, and other signs. During the 18th and early 19th century, citizens of the Spanish colonial government inhabited the area, probably using the land for self-sustaining agriculture including small crops and livestock. The remnants of adobe dwellings are common on the ranch. Since the mid-19th century, citizens of the United States have used the area for ranching. From the grand ranches of the late 1800's to the somewhat more modest ranches of today, the area is supported almost entirely by ranching. Along the river bottom on the southern portion of the ranch are significant areas of hay through irrigation.

Cultural Features: Petroglyphs, camp rings, historic trails, and remnant historic homes are common.

Biodiversity Significance Rank Comments (B2): This site contains two good

(B-ranked) occurrences of a globally imperiled (G2?/S2) xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium*) and occurrences of mixed and shortgrass prairies.

Natural Heritage element occurrences at the Cobert Mesa 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				B	1994-07-01
Natural Communities	Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie	G2?	S2				B	1994-06-28
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				D	1994-07-01
Natural Communities	Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation	Shortgrass Prairie	G5	SU				B	1994-07-01
Natural Communities	Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation	Shortgrass Prairie	G5	SU				B	1994-06-28
Vascular Plants	Asclepias oenotheroides	zizotes milkweed	G4G5	S1					1993-10-99

** 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 near the base of the mesa slopes. For the most part, this is at the edge of vegetation that retains it natural character. The existing land use of adjacent land provides and adequate buffer against undesirable economic change. The entire mesa is included within the design along with its side canyons.

Protection Urgency Rank Comments (P4): This site is a mix of private (majority) and state lands and operated as a working ranch. No known threats exist to the current tenure of this site.

Management Urgency Rank Comments (M3): Owner is developing water holes and increasing grazing. Existing limitations to the number of cattle on Cobert Mesa are directly related to the lack of available water. Areas that are near functioning windmills are notably more degraded. However, all of the natural communities on the top of the mesa are considered to be of good to excellent quality or recoverable.

Land Use Comments: The site occurs within a ranch of approximately 55,000 acres (including State Land Board leases). There are two active ranch houses and several roads that dissect the area. There are many historical structures and remnants of past times. Although not abundant, signs of indigenous people are widespread. The single current use is for livestock grazing.

Natural Hazard Comments: Rattlesnakes dwell in the area and there are some treacherous cliffs. Thunderstorms are not common but present significant threats from lightening strikes.

Exotic Species Comments: The area is dominated by native grass species, but some exotics are known to occur. As expected, exotic species are found in the areas of most intensive use (e.g. water holes, ditches, and developed springs).

Off-Site Considerations: All lands of the area are used as grazing lands or hay production. The entire region is remote and sparsely populated.

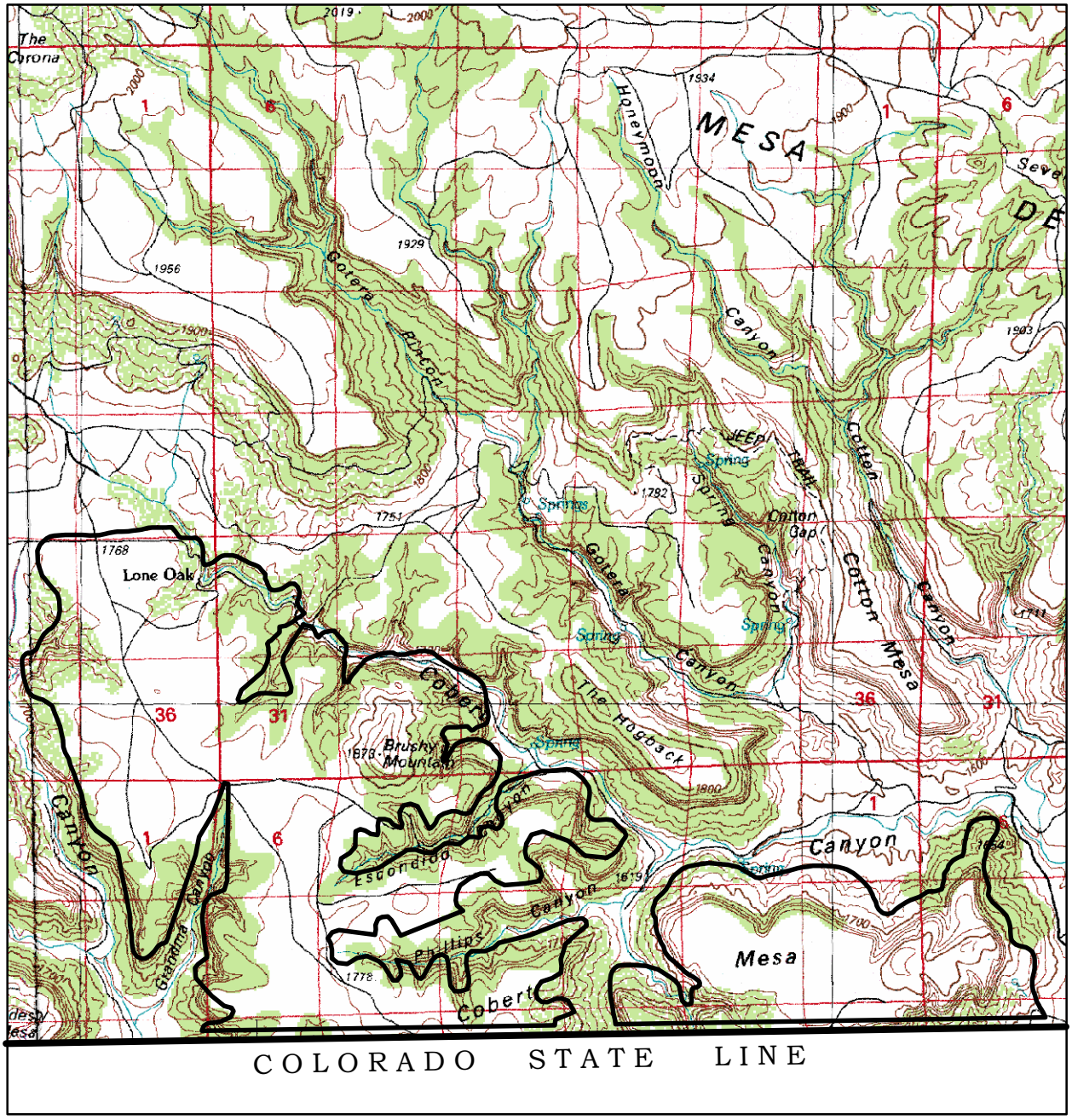
Information Needs: Additional inventory is warranted, especially for butterflies, natural communities, and other insect groups. Additional plant surveys could be conducted for rare species. There is little information on the New Mexico portion of the site. We have a need to look much more carefully at the natural communities of the area, assuring that the existing variation is incorporated.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A. and D.B. Burkhard

Version Date: 01/14/1996



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Map Date: 02/09/2010

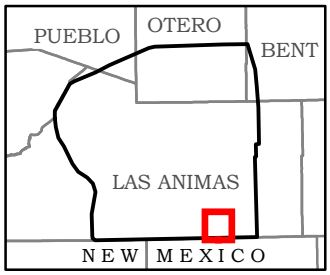
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 3. Cobert Mesa Potential Conservation Area, B2: Very High Biodiversity Significance

Cordova Mesa

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

Size: 65,509 acres (26,510 ha) **Elevation:** 5,430 - 6,530 ft. (1,655 - 1,990 m)

General Description: This site is characterized by shale hills, escarpments, mesas, and outwash prairies embedded in the shortgrass prairie. The original sediments of the hills were created when a shallow ocean covered the area some 87-92 million years ago, also known as the Upper Cretaceous period (Kauffman 1977). Most of the Upper Cretaceous period in eastern Colorado has eroded away, with the exception being the shale hills, of which Cordova Mesa is one example. The Cretaceous period was a relatively warm climate with changing sea levels, mostly increasing. The oceans and seas were populated with now extinct marine reptiles, ammonites, and bivalves. The abundant ocean life can still be viewed today in the form of fossils. This fossil rich area contains specimens of ammonites, sharks teeth, clam shells, and many other sea creatures. In addition to fossils the area is rich in geologic oddities, e.g., geodes (aka turtle rocks), concretions, and cones in cones. The sedimentary units that comprise the hills are Carlile shale, Greenhorn limestone and Graneros shale, dark-gray shale, gray limestone, and gray shale (Johnson 1969 geologic map). The vegetation of the hills is tightly associated with the geology and is noticeably different than the surrounding prairie in that it is dominated by junipers and occasional pinons and generally has very little soil build up thus giving a white hue to the hills. The whiteness of the hills is due to the white-gray shale and limestone substrate. The understory varies from sparse to dense vegetation depending on slope, aspect, and grazing regime. The outwash areas are the bajadas of the hills and are comprised of colluvial soils derived from the eroding shale hills. These outwash areas are generally dominated by grasses and occasional shrubs, especially cholla (*Cylindropuntia imbricata*) and four-winged saltbush (*Atriplex canescens*). Typical grasses throughout the site are blue grama (*Bouteloua gracilis*), New Mexico feather grass (*Hesperostipa neomexicana*), galleta grass (*Pleuraphis jamesii*), and threeawn grass (*Aristida purpurea*). Many of the sparsely vegetated slopes (barrens) are dominated by *Frankenia jamesii*, a species that is the only representative of its family (the Frankenia Family, or *Frankeniaceae*) in Colorado and relatively uncommon in Colorado. The shale breaks and associated colluvial outwash areas are particularly important because they support significant plants and plant communities. Several Colorado endemic plants that are globally rare are only associated with this habitat, specifically, Arkansas Valley evening primrose (*Oenothera harringtonii*), and rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), both tightly associated with the colluvial outwash while Rocky Mountain bladder pod (*Lesquerella calcicola*) is more

commonly found on the shale slopes and mesa tops. The juniper / New Mexico feathergrass (*Juniperus monosperma / Hesperostipa neomexicana)* community occurs on the mesa tops and is a rare community of interest that is tightly associated with grazing regimes. Additional dominant plant species include: *Gutierrezia sarothrae, Echinocereus reichenbachii, Melampodium leucanthum, Piptatherum micranthum, Achnatherum scribneri, Acnatherum hymenoides,* and *Bouteloua curtipendula*. Several animal species of concern also utilize this habitat, especially the triploid checkered whiptail, Texas horned lizard, and Colorado blue butterfly.

Key Environmental Factors: Geology, soil depth, drought, grazing, fires, and slope play a critical role in determining the vegetation species composition. Fires kill junipers yet much of the area has relatively low biomass thus preventing large scale fires. Old-growth junipers and pinons are common throughout, denoting that fires are infrequent. Adequate soil depth coupled with low intensity grazing favors New Mexico feathergrass while high intensity grazing favors blue grama. Slopes are generally less vegetated than the mesa tops or the outwash.

Land Use History: Livestock grazing and seasonal hunting are the primary land uses.

Cultural Features: Numerous Native American and homesteader artifacts occur throughout the area.

Biodiversity Significance Rank Comments (B2): The site supports excellent (A-ranked) and good (B-ranked) occurrences of the globally imperiled (G2/S2) *Frankenia jamesii / Achnatherum hymenoides* foothills shrubland. Significant plants in the site include a good (B-ranked) occurrence of the globally imperiled (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Rocky Mountain bladderpod (*Lesquerella calcicola*), an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Fendler cloak-fern (*Argyrochosma fendleri*), and a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*). There are also several state-rare plant species and significant plant communities.

Natural Heritage element occurrences at the Cordova Mesa 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	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	G2	S2				B	2009-06-09
Natural Communities	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	G2	S2				C	2009-08-26
Natural Communities	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	G2	S2				A	2009-06-09
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				B	2009-06-09
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				A	2009-05-28
Natural Communities	Juniperus monosperma / Hesperostipa neomexicana Woodland	Foothills Pinyon - Juniper Woodlands	G4	S3				C	2009-08-26
Natural Communities	Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation	Shortgrass Prairie	G5	SU				C	2009-05-21
Natural Communities	Juniperus monosperma / Quercus X pauciloba Woodland		G5	S1				B	2009-06-09
Natural Communities	Pinus edulis - Juniperus spp. / Cercocarpus montanus Woodland	Mesic Western Slope Pinyon - Juniper Woodlands	G5	S4				A	2009-05-19
Vascular Plants	Argyrochosma fendleri	Fendler cloak - fern	G3	S3				A	2009-09-02

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	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				A	2009-09-01
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				B	2009-06-09
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	2007-08-07
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	C	2009-05-28
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	CD	2007-08-08
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2007-08-07
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2				A	2009-05-28
Vascular Plants	Forsellesia planitierum	Texas greasebush	G4	S2				C	2009-08-26
Vascular Plants	Penstemon jamesii	James' beard - tongue	G4	S1				A	2009-06-09
Vascular Plants	Bothriochloa springfieldii	Springfield bluestem	G5	S1				C	2009-09-02

** 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 include the known occurrences, additional potential habitat, and the local mosaic of plant communities. The boundary was digitized while referencing a one meter digital color orthophoto quad, a 1:24,000 digital quad, and a GIS model developed by CNHP that shows the probability of the presence of shale loving plants.

Protection Urgency Rank Comments (P4): The site includes a mix of private and state-managed lands. The current livestock grazing regimes appear compatible with the continued viability of the rare plants and significant plant communities. 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. Wind energy companies have leased many of these hills and wind monitoring towers along the escarpments but as of 2009 no wind energy development was present. Future wind development should attempt to avoid areas

with high quality occurrences of tracked elements, utilize best management practices, and mitigate for any loss of habitat.

Land Use Comments: The existing land use of livestock grazing appears compatible with the continued viability of the elements. Appropriate timing, intensity of grazing and periodic prescribed burning can be valuable and necessary management tools. In 2009, many of the escarpments contained wind monitoring towers that indicate the potential for wind development but there were no wind farms in the area.

References

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Johnson, R.B. 1969. Geologic map of the Trinidad quadrangle south-central Colorado. Miscellaneous Geologic Investigations. Map 1-558. USGS.

Kauffman, E.G. 1977. Geological and biological overview: Western interior Cretaceous basin. The Mountain Geologist, v. 14, nos. 3-4; p. 75-99.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

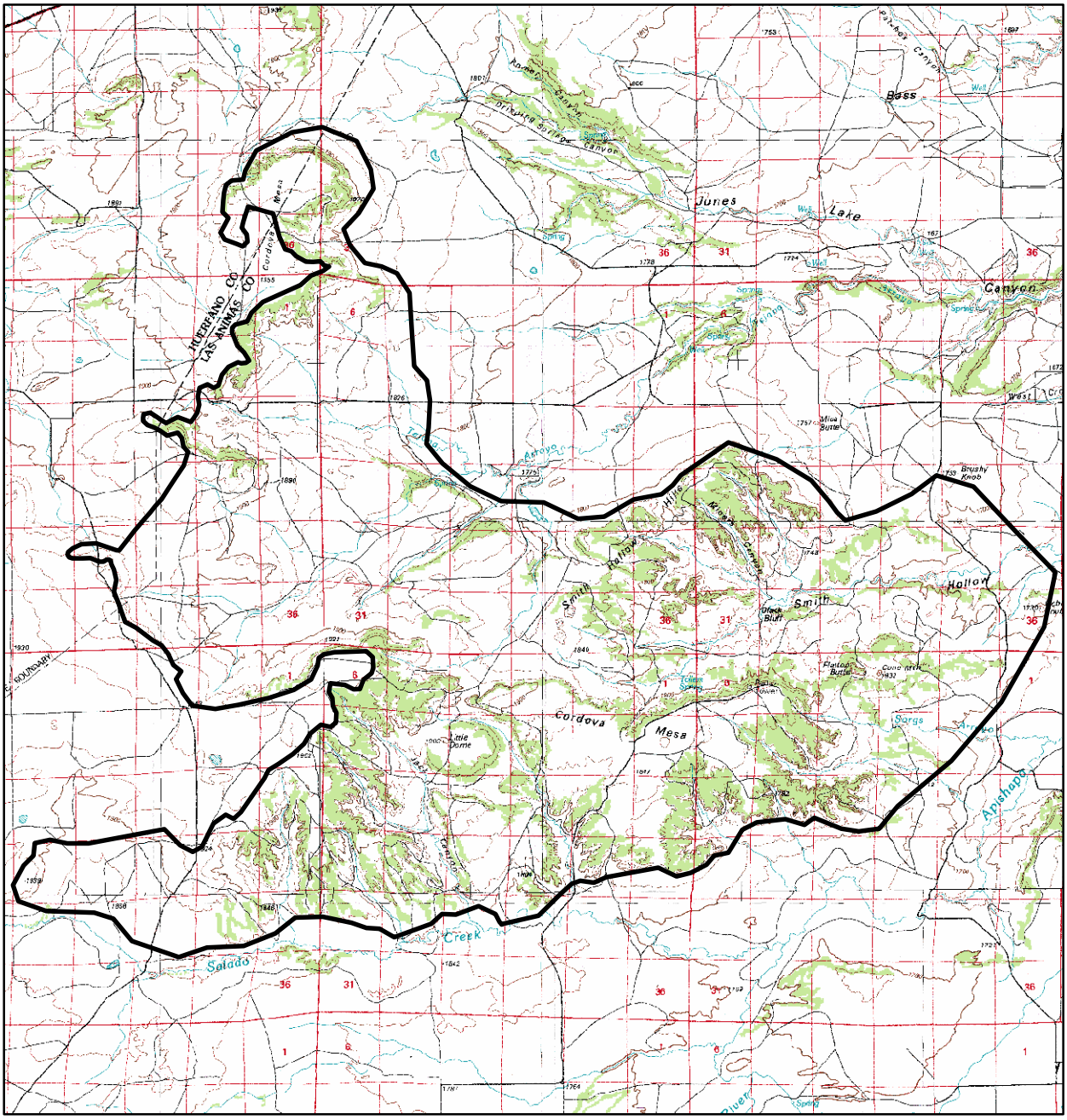
Stevens, J.E. and J. R. Sovell. 2008. Final Report: Southeastern Colorado Survey of Critical Biological Resources 2008. Colorado Natural Heritage Program, Fort Collins, CO.

Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

U.S. Department of Agriculture, Soil Conservation Service. 1994. State Soil Geographic (STATSGO) database for Colorado. Fort Worth, TX.

Version Author: Panjabi, S.S. and R.J. Rondeau

Version Date: 02/01/2010



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Map Date: 01/26/2010

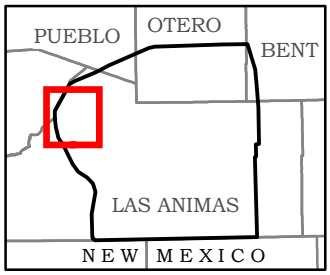
Legend

PCA Boundary

Trinidad, 37104-A1
Walsenburg, 37104-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 4. Cordova Mesa Potential Conservation Area, B2: Very High Biodiversity Significance

Gilligan's Island

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

Size: 15,635 acres (6,327 ha) **Elevation:** 5,235 - 5,915 ft. (1,596 - 1,803 m)

General Description: The Gilligan's Island site includes a mix of shortgrass prairie, pinon - juniper woodlands, and sparsely vegetated outcrops of Greenhorn limestone. Steep colluvial sideslopes of mesas and hills reveal limestone outcrops and support concentrations of the globally imperiled plant species, *Oxybaphus rotundifolius*. Other plant species found at this site include *Juniperus monosperma*, *Forsellesia planitierum, Frankenia jamesii, Achnatherum hymenoides, Tetraneuris acaulis, Bouteloua curtipendula, Hesperostipa neomexicana, Eriogonoum* sp., *Penstemon auriberbis, Asclepia asperula, Yucca glauca, Artemisia bigelovii*, *Gutierrezia sarothrae*, *Paronychia jamesii*, *Eriogonum* sp., *Hilaria jamesii, Atriplex canescens*, and *Krascheninnikovia lanata.*

Biodiversity Significance Rank Comments (B2): This site supports two excellent (A-ranked) occurrences of the globally imperiled (G2/S2) round-leaf four-o'clock (*Oxybaphus rotundifolius*). These occurrences are also significant because they are disjunct from the main part of the species' range.

Natural Heritage element occurrences at the Gilligan's Island 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	Oxybaphus rotundifolius	round - leaf four - o'clock	G2	S2				A	2007-06-29
Vascular Plants	Oxybaphus rotundifolius	round - leaf four - o'clock	G2	S2				A	2007-06-30

** 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 include the element occurrences and additional potential habitat, as well as some representation of the locally adjacent plant communities.

Protection Urgency Rank Comments (P4): This site is owned and managed by the Department of Defense and they are aware of the biological significance of this site.

Management Urgency Rank Comments (M2): The area shows some signs of degradation from tank maneuvers, but is still in relatively good condition. No noxious weeds were noted, however, sixteen noxious weeds are known from the

Pinon Canyon Maneuver Site (Spackman Panjabi and Decker 2007) and have the potential to infest areas within the Gilligan's Island site, especially in areas with periodic ground disturbances. Natural resource personnel at PCMS are aware of the sensitive plant locations, and are actively managing noxious weeds.

References

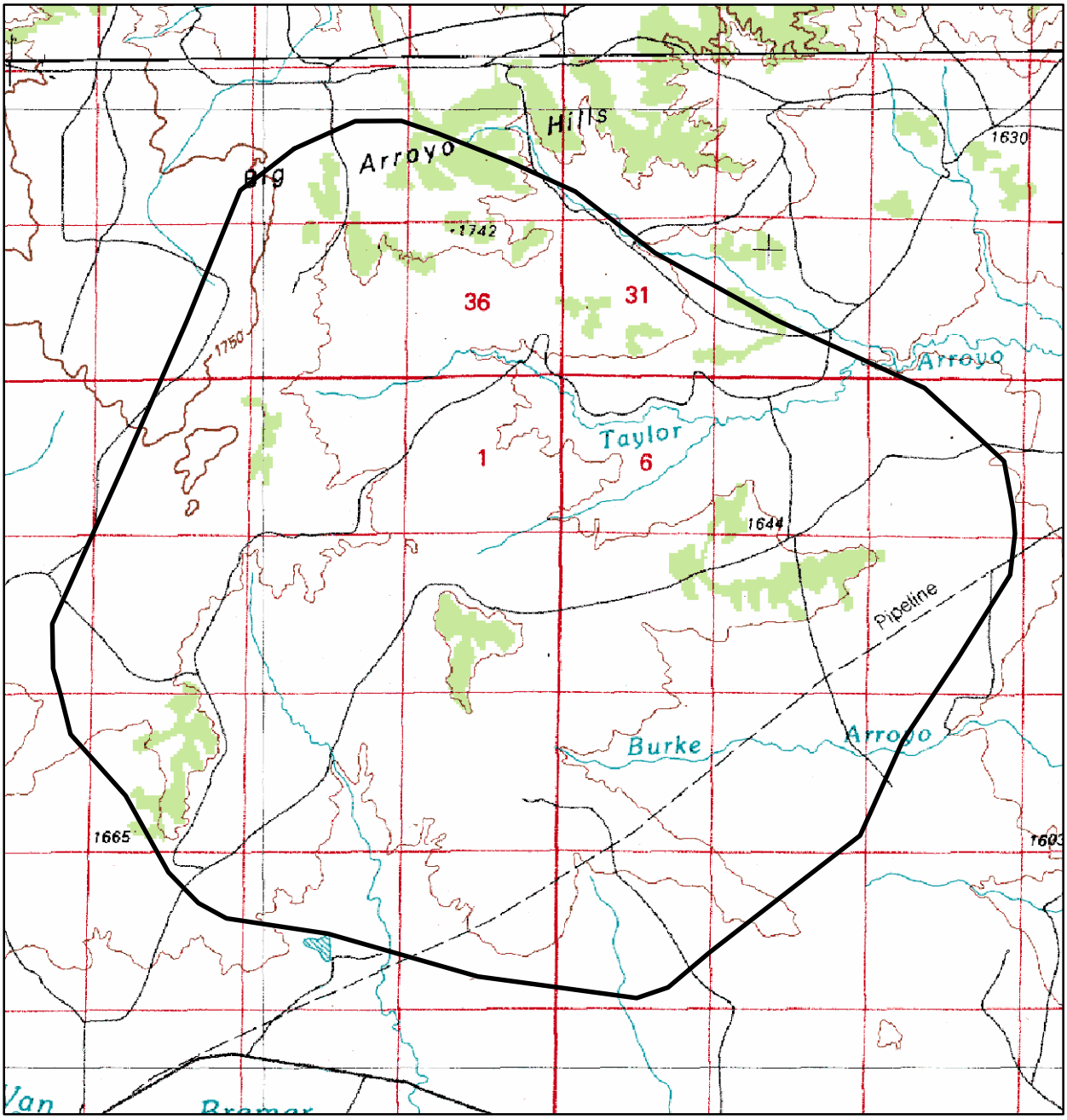
Neid, S., K. Decker, J. Handwerk, and S. Spackman Panjabi. 2007. Final Report: Rare Plant Surveys on Pinon Canyon Maneuver Site 2006-2007. Colorado Natural Heritage Program, Fort Collins, CO.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Spackman Panjabi, S. and K. Decker. 2007. Front Range Eco-regional Partnership Invasive Plant Species Strategic Plan. Unpublished report prepared for the U.S. Department of Defense by the Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Panjabi, S.S.

Version Date: 12/10/2007



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PCA Boundary

Trinidad, 37104-A1

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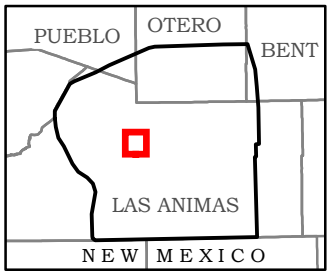
Location in Project Area



Map 5. Gilligan's Island Potential Conservation Area, B2: Very High Biodiversity Significance

Gotera Rincon

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 6,027 acres (2,439 ha) **Elevation:** 5,774 - 6,364 ft. (1,760 - 1,940 m)

General Description: Gotera Rincon is located in southeastern Las Animas County, on the Mesa de Maya, approximately six miles from the New Mexico state line. It is characterized by pinon - juniper woodland, with an associated understory predominately composed of shrubs such as oak (*Quercus gambelii*), yucca (*Yucca glauca*), mountain mahogany (*Cercocarpus montanus*), prickly pear (*Opuntia* sp.) and skunkbrush (*Rhus trilobata*). Blue grama (*Bouteloua gracilis*) and sideoats grama (*Bouteloua curtipendula*) dominate the graminoid layer. The aspect varies, but trends to the southeast with 6-20% slopes. Soils are shallow, rocky clay loam which also contains some exposed rim rock.

Biodiversity Significance Rank Comments (B2): This site contains a good (B-ranked) occurrence of a globally imperiled (G2?/S2) xeric tallgrass prairie, *Andropogon gerardii - Schizachyrium scoparium*, and a good (B-ranked) occurrence of a globally imperiled (G2/S2) *Juniperus scopulorum / Cercocarpus montanus* woodland. There is also an extant occurrence of the globally vulnerable(G3/S3) Rocky Mountain bladderpod (*Lesquerella calcicola*).

Natural Heritage element occurrences at the Gotera Rincon 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	Juniperus scopulorum / Cercocarpus montanus Woodland	Foothills Pinyon - Juniper Woodlands/Scarp Woodlands	G2	S2				B	1988-09-06
Natural Communities	Andropogon gerardii - Schizachyrium scoparium Western Great Plains Herbaceous Vegetation	Xeric Tallgrass Prairie	G2?	S2				B	1988-09-06
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				E	1994-06-26

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

Boundary Justification: This site was drawn to protect two plant communities in good condition. The boundary includes the entire reach of the middle portion of Gotera Canyon, the canyon walls including those on the east side of Corbet Canyon, and the tallgrass prairie on Mesa de Maya lying between Corbet and Gotera canyons. All side canyons are also included. The biological elements that are targeted in this site are canyon-dwellers or are limited in distribution by the availability of water.

Protection Urgency Rank Comments (P4): There is no known urgency.

Management Urgency Rank Comments (M3): As with most lands in this area, there is some need to improve grazing management prescriptions.

Land Use Comments: The area has been used for livestock grazing for more than 100 years.

Natural Hazard Comments: There are steep cliffs, loose rocks, and bad roads in the area.

Off-Site Considerations: There are no special off-site concerns since the entire region is dominated by livestock grazing.

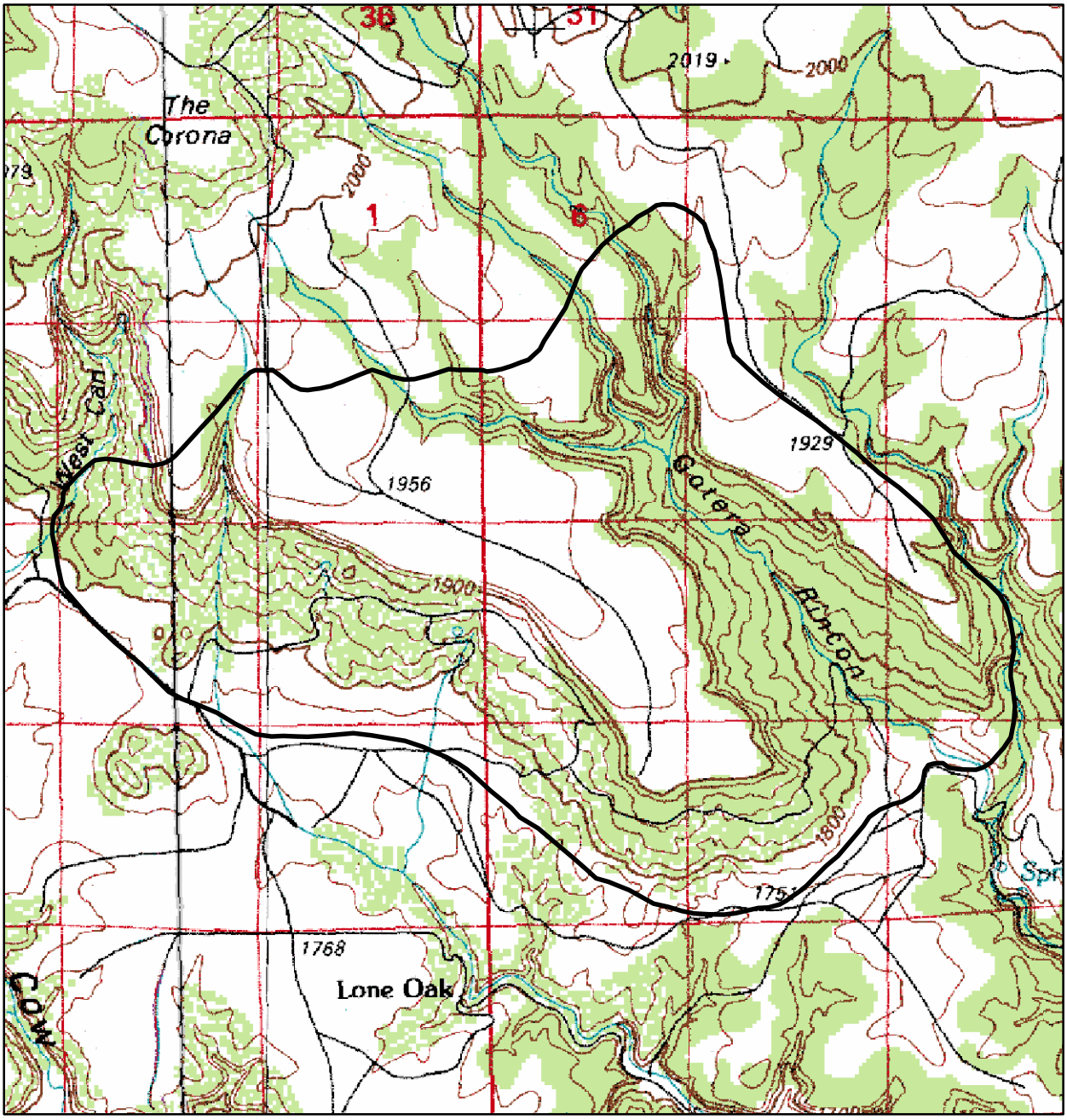
Information Needs: There has been no recent inventory of this area. Moreover, there is only the poorest of records of animals. There is high potential for Mesa de Maya proper, but particularly for the highest elevation areas. Communities have not been updated since 1988.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A.

Version Date: 01/14/1996



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PCA Boundary

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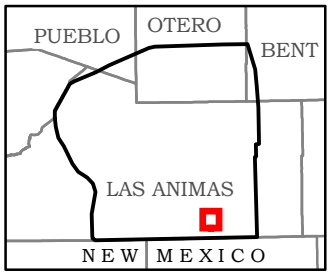
Location in Project Area



Map 6. Gotera Rincon Potential Conservation Area, B2: Very High Biodiversity Significance

Jesus Mesa

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 14,850 acres (6,010 ha) **Elevation:** 5,000 - 5,900 ft. (1,524 - 1,798 m)

General Description: Jesus Mesa is a southward extension of Mesa de Maya. It is distinguished from the Mesa de Maya by the 500 ft cliffs of Jesus Canyon on the east and the broad Cobert Canyon to the west. The top of the mesa is an extensive, flat, short- to mid- grass prairie wherein exists a large playa. The edges of the basalt-capped mesa form broken cliffs which quickly become more gradually sloped grasslands and shrublands. The largely inaccessible slopes are covered with a rich grassland or shrubland community. Jesus Canyon is a rugged canyon with permanent pools of water containing fishes. The head of this canyon is extremely rugged and heavily vegetated.

Key Environmental Factors: The dominant ecological process is the presence of water, especially in flash flooding. Wind and livestock grazing also play a significant role.

Land Use History: Indigenous peoples have utilized the Mesa de Maya area for at least 5,000 years. Indian relics have been identified throughout the area. In the late 18th and early 19th centuries, the Spanish (Mexican) citizens colonized the lands around the Mesa. Evidence of their adobe homes are prevalent. With the immigration of Americans into the area came small scale farming on homesteads. Finally, with drought and economic difficulties, farming abated and livestock production began. Today, livestock grazing (mostly cattle) is the sole use of the area.

Cultural Features: Numerous historic and archaeological sites occur on Jesus Mesa. Poorly studied, these sites are easily located and observed. The time period covered is early indigenous to the homesteading period.

Biodiversity Significance Rank Comments (B2): The site supports a good (B-ranked) occurrence of a globally imperiled (G2?/S2) xeric tallgrass prairie (*Andropogon gerardii - Schizachyrium scoparium*). In addition, there are multiple excellent (A-ranked) and good (B-ranked) quality occurrences of globally vulnerable and state rare communities and plants.

Natural Heritage element occurrences at the Jesus Mesa 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				B	1992-07-30
Natural Communities	Cercocarpus montanus / Hesperostipa neomexicana Shrubland	Foothills Shrubland	G2G3	S2S3				C	1994-06-29
Natural Communities	Bouteloua eriopoda - Pleuraphis jamesii Herbaceous Vegetation	Shortgrass Prairie	G3	SU				B	1994-06-30
Natural Communities	Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Herbaceous Vegetation	Great Plains Mixed Grass Prairies (Sandstone / Gravel Breaks)	G3	S2				C	1994-06-30
Natural Communities	Nolina texana Shrubland	Desert Shrubland	GU	S1				A	1994-06-28
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2					1993-08-04
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1					1994-05-29
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1				A	1993-05-19
Vascular Plants	Sarcostemma crispum	twinevine	G4G5	S1					1993-08-04
Vascular Plants	Nolina texana	Texas beargrass	G5	S1					1994-05-29
Vascular Plants	Sapindus drummondii	soapberry	G5T5	S1				B	1994-05-27

** 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 entire mesa and its slopes down

to where they begin leveling out. The site also includes Jesus Canyon. The boundary onto the Mesa de Maya goes beyond the headwaters of Jesus Creek to include a significant buffer toward the mesa's peak.

Protection Urgency Rank Comments (P4): This is a privately-owned working cattle ranch. It is noteworthy that it appears that there could be little use of this land except for livestock grazing.

Management Urgency Rank Comments (M3): The current management of the ranch has maintained viable natural communities in most areas. A change in ownership may create more pressure to heavily utilize many grasslands. Current trends in the existing management are toward increasing livestock use (1995 comment from C. Pague).

Land Use Comments: The current land use is for livestock grazing and supporting hay production. No hay production occurs on Jesus Mesa. Grazing is restricted to areas where water development occurs or where natural water persists. Cattle tanks are present in several places, but the main water development is that of windmill pumps. There are two roads cut onto the mesa, one from Jesus Canyon and the other, the main road, from Cobert Canyon.

Natural Hazard Comments: Steep cliffs and broken rock occur on the slopes of the mesas. Rattlesnakes are seen but are not more common than elsewhere. The roads can be rutted and have numerous fallen rocks on them, particularly after a hard rain. The roads can be quite slick after rains.

Exotic Species Comments: Some cheatgrass and Japanese brome occur; however, the density is very low. Most of the other weeds are merely native increasers. Most exotics are in areas which have been traditionally grazed hard by cattle.

Off-Site Considerations: The adjacent landscape is similarly utilized for livestock production for many miles around. Small amounts of hay production occurs along the Dry Cimarron River. Fences are complex and some are locked. There is a elk-ranching operation adjacent to the site.

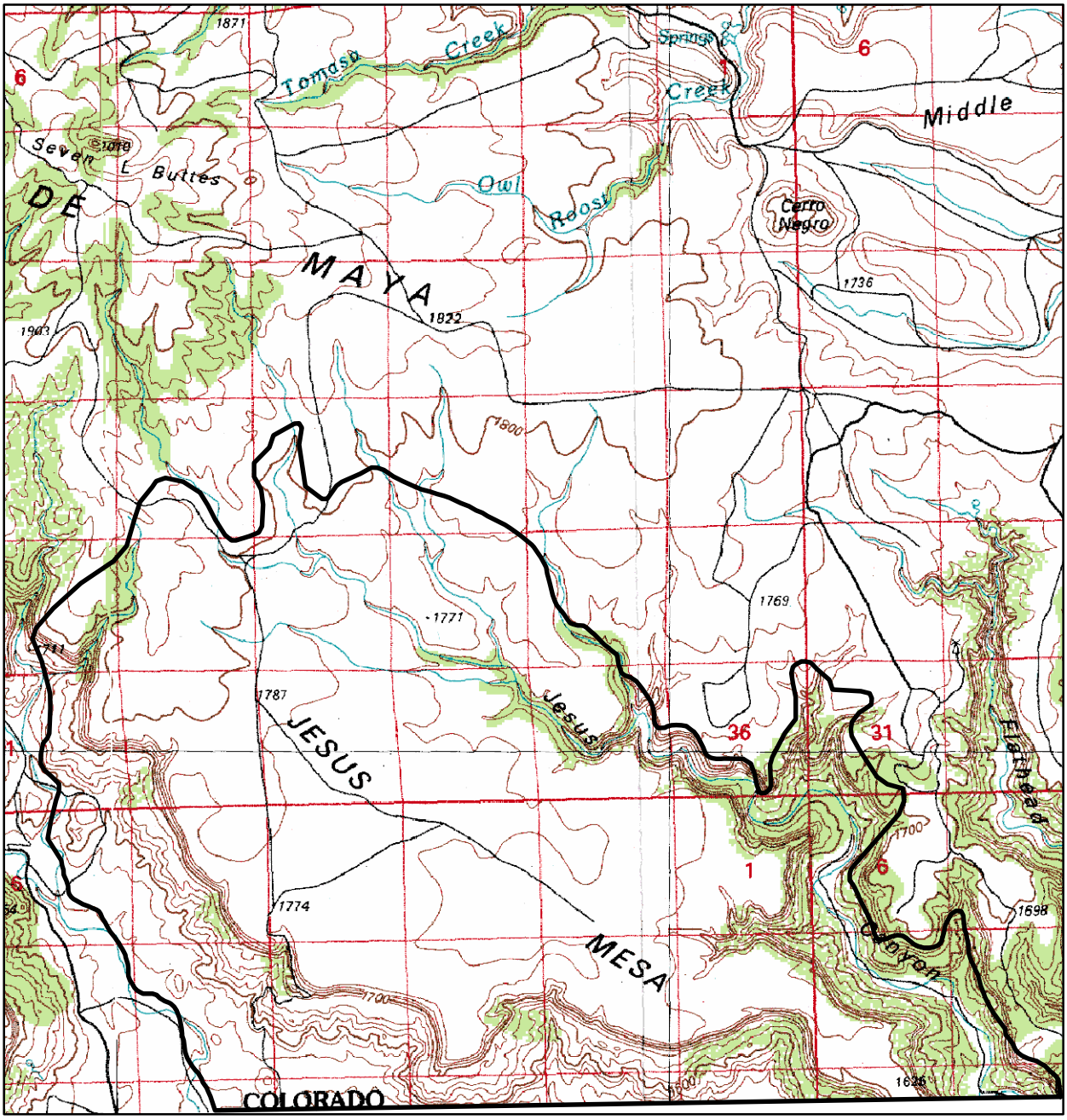
Information Needs: An understanding of fire impacts on the landscape ecology would be useful. More inventory for state-rare elements is warranted, but most importantly is the inventory of natural community variety and condition. Comparisons with other similar occurrences elsewhere are needed. Some of this is occurring with a planning exercise of the entire Mesa de May area. That effort is being led by Oklahoma.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A.

Version Date: 09/30/1995



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Legend

PCA Boundary

Kim, 37103-A1

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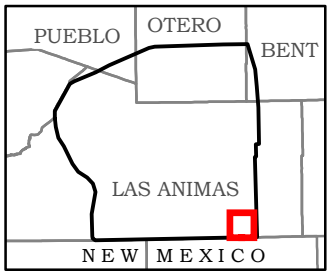
Location in Project Area



Map 7. Jesus Mesa 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

Size: 16,849 acres (6,818 ha) **Elevation:** 5,300 - 5,740 ft. (1,615 - 1,750 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. Vegetation at the site varies from scattered juniper trees with a sparse understory to shrub dominated slopes and grassland dominated colluvial outwash. The oneseed juniper (*Juniperus monosperma*) generally occurs at the top of the hills and commonly occurs with Bigelow sage (*Artemisia bigelovii*) and New Mexico feathergrass (*Hesperostipa neomexicana*) and a suite of cushion plants. The slopes are dominated by *Frankenia jamesii*, and *Forsellesia planitierum,* two species with limited global distributions. The shale breaks and associated colluvial outwash areas are particularly important because they support significant plants and plant communities. Several Colorado endemic plants that are globally rare are only associated with this habitat, specifically, Arkansas Valley evening primrose (*Oenothera harringtonii*), and rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), both tightly associated with the colluvial outwash while Rocky Mountain bladder pod (*Lesquerella calcicola*) is more commonly found on the shale slopes and mesa tops. Other common plant species include galleta grass (*Pleuraphis jamesii*), blue grama (*Bouteloua gracilis*), Indian rice grass (*Achnatherum hymenoides*), and winterfat (*Krascheninnikovia lanata*).

Key Environmental Factors: Geology, soil depth, drought, grazing, fires, and slope play a critical role in determining the vegetation species composition. Fires kill junipers yet much of the area has relatively low biomass thus preventing large scale fires. Old-growth junipers and pinons are common throughout, denoting that fires are infrequent. Adequate soil depth coupled with low intensity grazing favors New Mexico feathergrass while high intensity grazing favors blue grama. Slopes are generally less vegetated than the mesa tops or the outwash.

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): This site supports a good (B-ranked) occurrence of a globally imperiled (G2/S2) foothills shrubland community, *Frankenia jamesii / Achnatherum hymenoides*, an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) Great Plains mixed grass prairie, *Hesperostipa neomexicana*, and an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) plains escarpment prairie, *Artemisia bigelovii / Achnatherum hymenoides*. Significant plants of concern include a good (B-ranked) and a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*), an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Rocky Mountain bladderpod (*Lesquerella calcicola*), and a good (B-ranked) and a fair (C-ranked) occurrence of the globally imperiled subspecies (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*).

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
Natural Communities	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	G2	S2				B	2009-06-02
Natural Communities	Artemisia bigelovii / Achnatherum hymenoides Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3	S3				A	2009-06-01
Natural Communities	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3				A	2009-06-01
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				A	2009-06-02
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	C	2009-06-02
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	2009-06-02
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				B	2009-06-02
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				C	2009-06-03

** 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 include the known occurrences, additional potential habitat, and the local mosaic of plant communities. The

boundary was digitized while referencing a one meter digital color orthophoto quad, a 1:100,000 digital quad, and a GIS model developed by CNHP that shows the probability of the presence of shale barren plants.

Protection Urgency Rank Comments (P4): The site is on private land. 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. Harvest or thinning of the juniper woodland should be avoided as well as mining or other excavation of the soils and rock. A grazing management plan that incorporates managing for the biodiversity unique to this geologic substrate would benefit the area.

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.

References

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

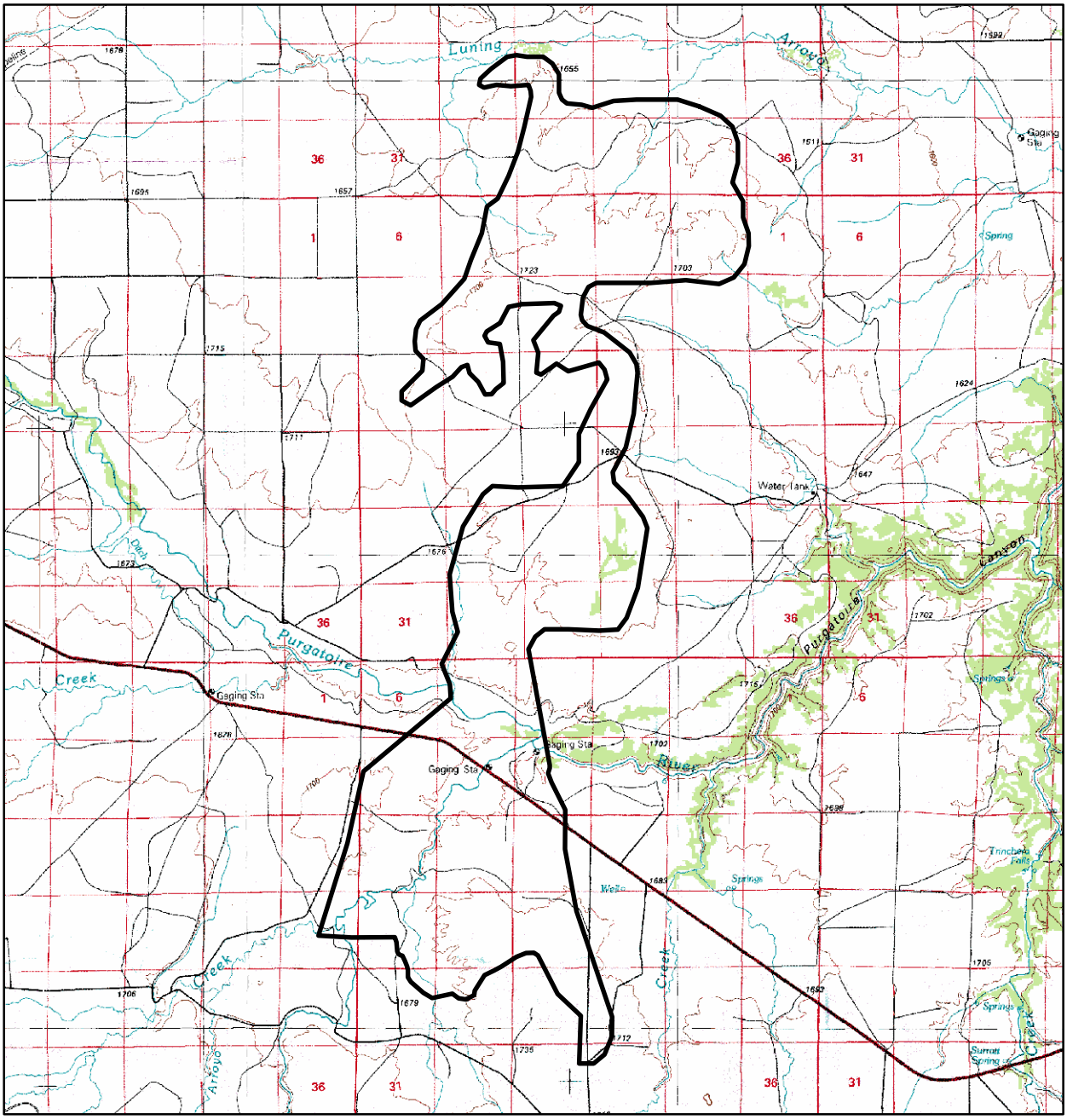
Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Stevens, J.E. and J. R. Sovell. 2008. Final Report: Southeastern Colorado Survey of Critical Biological Resources 2008. Colorado Natural Heritage Program, Fort Collins, CO.

Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

U.S. Department of Agriculture, Soil Conservation Service. 1994. State Soil Geographic (STATSGO) database for Colorado. Fort Worth, TX.

Version Author: Panjabi, S.S. and J.E. Stevens
Version Date: 02/05/2010



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Map Date: 01/29/2010

Legend

PCA Boundary

Trinidad, 37104-A1

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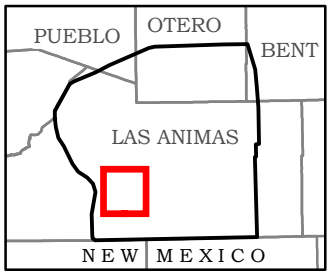
Location in Project Area



Map 8. Luning Promontory Potential Conservation Area, B2: Very High Biodiversity Significance

Pasture 10A North

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

Size: 252 acres (102 ha) **Elevation:** 5,715 - 5,830 ft. (1,742 - 1,777 m)

General Description: The Pasture 10A North site is a southern shortgrass prairie dissected by a highway. The site is open and relatively flat with sparse yucca and sage. Dominant plants include purple threeawn (*Aristida purpurea*), buckwheat (*Eriogonum* spp.), and stemless daisy (*Tetraneuris acaulis*).

Biodiversity Significance Rank Comments (B2): The Pasture 10A site supports an excellent (A-ranked) occurrence of the globally imperiled (G2G3/S2S3) plant species, Colorado green gentian (*Frasera coloradensis*).

Natural Heritage element occurrences at the Pasture 10A North 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	Frasera coloradensis	Colorado green gentian	G2G3	S2S3				A	2007-08-01

** 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 plant occurrence and provides a buffer which includes the limestone outcrop, potential habitat for the species. The NE corner has been ground verified for the rare plant.

Protection Urgency Rank Comments (P4): The area is within the Comanche National Grassland and is given no special designation. No threats in the foreseeable future.

Management Urgency Rank Comments (M4): Although not currently threatened, management may be needed in the future to maintain current quality of element occurrence.

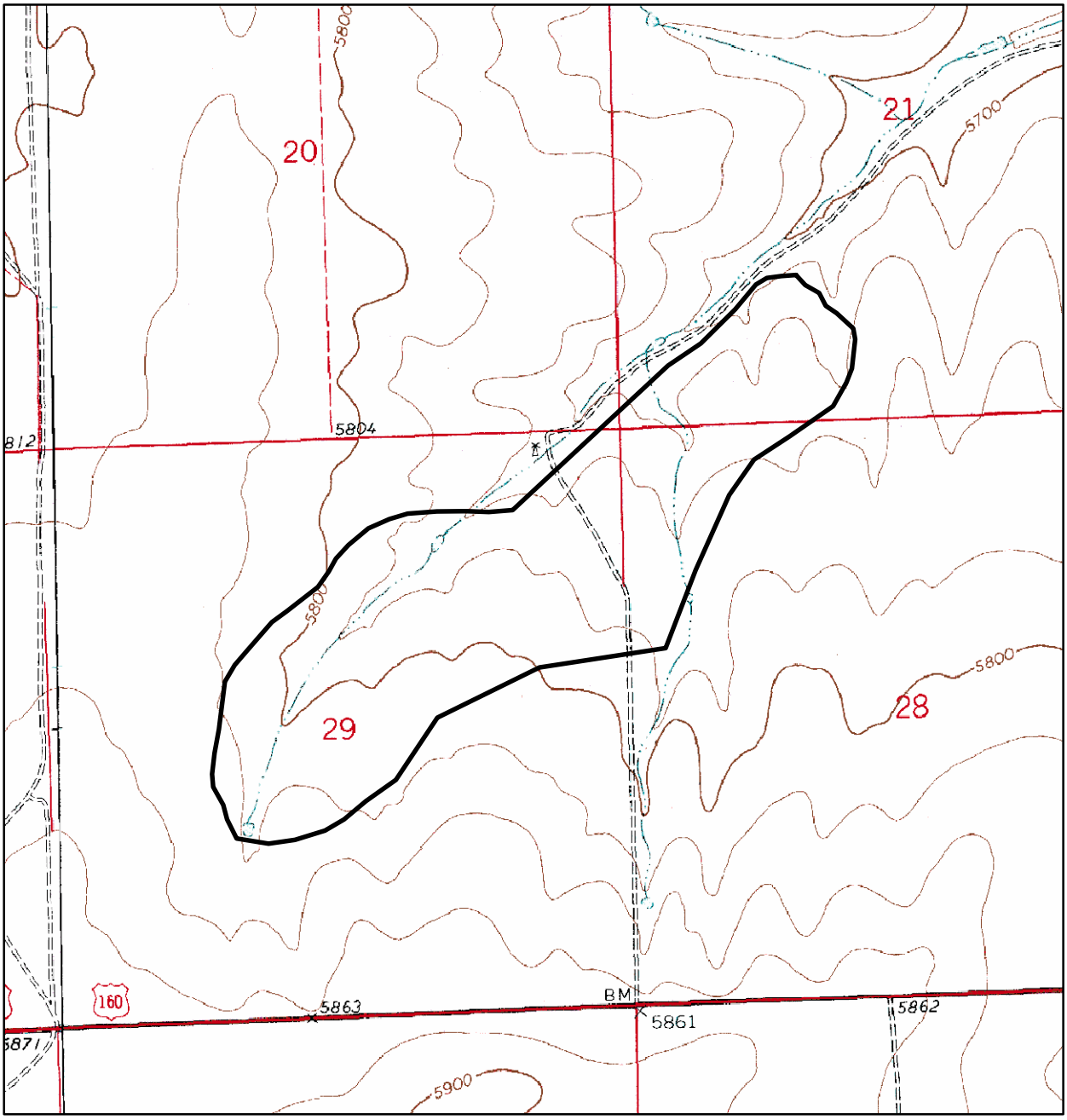
Information Needs: The population of the Colorado green gentian needs to be monitored and reproductive success documented. Occurrence was last observed in 1995 so current field work is needed.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A. and C.C. Fleming

Version Date: 06/12/1997



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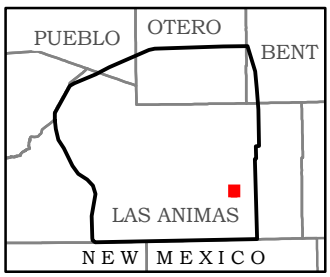
Legend

PCA Boundary

Dalerose Mesa, 37103-B4

7.5 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 9. Pasture 10A North Potential Conservation Area, B2: Very High Biodiversity Significance

South and Averson Canyons

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

Size: 8,919 acres (3,609 ha) **Elevation:** 5,240 - 5,980 ft. (1,597 - 1,823 m)

General Description: The topography of South and Averson Canyons is striking with red rock cliffs and deep canyon walls. Human occupation of the area dates back 100's of years and the site is currently used for ranching. The site includes the canyons as well as the juniper woodland that extends from the canyon rim for a few 100 meters out onto the escarpment. Within the juniper, the understory includes a great deal of rock and bare ground with sideoats grama (*Bouteloua curtipendula*), other grasses, and numerous forbs. There is a shrub intermediate layer of mountain mahogany (*Cercocarpus montanus*) both on the escarpment and the steep sides of the canyon. The ground cover also includes pasture sage (*Artemisia frigida*), broom snakeweed (*Gutierrezia sarothrae*), and cactus (*Opuntia*). The shrub layer and juniper forest create suitable habitat for the rare triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*). 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 juniper woodland is the key environmental characteristic for the triploid Colorado checkered whiptail. Maintaining the ecological integrity of the woodland is important for this lizard. Changes to the fire regime that cause increases in fire frequency, resulting in reduced cover of junipers, would be detrimental to the whiptail.

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 homesteaders partaking in dryland farming 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, cattle ranching continues to dominate the landscape. 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 contains a good

(B-ranked) occurrence of the globally imperiled (G2G3/S2) triploid Colorado checkered whiptail (*Aspidoscelis neotesselata*) and an excellent (A-ranked) occurrence of a state imperiled (GU/S1) *Rhus trilobata - Philadelphus microphyllus* shrubland.

Natural Heritage element occurrences at the South and Averson Canyons 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	Rhus trilobata - Philadelphus microphyllus Shrubland	Shrubland	GU	S1				A	2009-06-11
Reptiles	Aspidoscelis neotesselata	Triploid Colorado Checkered Whiptail	G2G3	S2		SC		B	2009-05-28

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

Boundary Justification: The boundary includes South and Averson Canyons, their slopes, and most of the juniper woodland in the vicinity. The boundary is intended to adequately protect areas currently harboring the triploid Colorado checkered whiptail as well as adjacent areas of suitable habitat that are also probably occupied by the whiptail. 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 2001-2003).

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 two owners making it relatively simple to safeguard by taking measures to increase the intent and tenure of legal protection (e.g. easements), which would assist with preservation of the rare whiptail.

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).

Land Use Comments: Ranching is the current use of the land and cattle grazing currently occurs within the site.

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

Information Needs: Additional surveys are needed throughout the area to

determine the distributional extent of the triploid Colorado checkered whiptail. More information on the dynamics of juniper (*Juniperus monosperma*) woodlands and how they are affected by fire suppression are needed.

References

Colorado Division of Wildlife. 2001-2003. Basinwide Vegetation Classification. Online at http://www.ndis.nrel.colostate.edu.

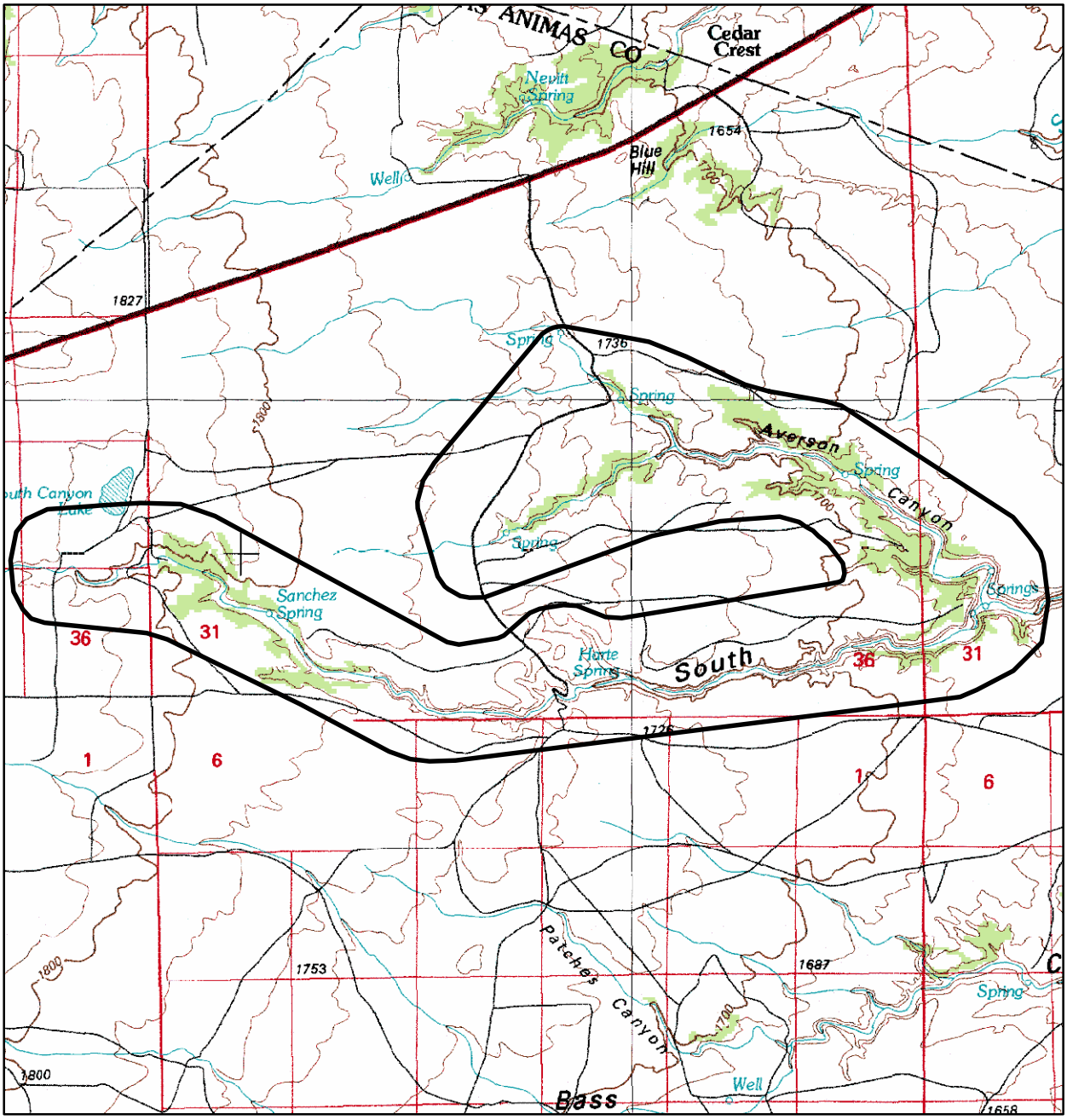
Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Sovell, J.R.

Version Date: 01/26/2010



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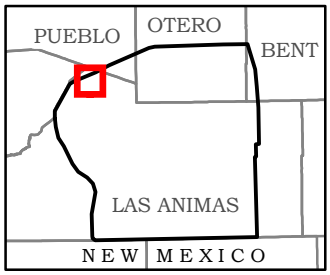
Legend

PCA Boundary

Walsenburg, 37104-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 10. South and Averson Canyons Potential Conservation Area, B2: Very High Biodiversity Significance

Cedar Hill Flats

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

Size: 24,256 acres (9,816 ha) **Elevation:** 4,470 - 5,175 ft. (1,362 - 1,577 m)

General Description: This site is characterized by open grasslands dissected by juniper woodlands, mesas, and canyons. Dominant plants include *Hesperostipa* sp., blue grama (*Bouteloua gracilis*), James' galleta (*Hilaria jamesii*), and juniper (*Juniperus monosperma*). Parts of the surrounding area are strongly dominated by cheatgrass (*Bromus tectorum*) with scattered cholla (*Opuntia imbricata*), pricklypear (*O. polyacantha*), broom snakeweed (*Gutierrezia sarothrae*), daisy (*Tetraneuris acaulis*), buffalo grass (*Buchloe dactyloides*), yucca (*Yucca glauca*), and sideoats grama (*Bouteloua curtipendula*).

Biodiversity Significance Rank Comments (B3): This site contains two good (B-ranked) occurrences of the globally imperiled (G3G4T2T3/S2) dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*). There are few good to excellent examples of this subspecies known from Colorado. The globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*) has also been documented in good to fair (BC-ranked) condition.

Natural Heritage element occurrences at the Cedar Hill Flats 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				C	1997-05-29
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	E	2005-05-12
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	BC	2008-05-16
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/USFS	B	2007-05-20
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/USFS	B	2007-05-21

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

Boundary Justification: This site includes occurrences of *Asclepias uncialis* ssp. *uncialis* and *Oenothera harringtonii*, adjacent potential habitat, and some representation of the local mosaic of plant communities.

Protection Urgency Rank Comments (P4): This site is located within U.S. Department of Defense lands in the Pinon Canyon Maneuver Site (PCMS). The area is used by the military for training purposes, which could have a negative impact on the native vegetation depending on the rigorousness and extent of the training activities. Natural resource personnel at PCMS are aware of the sensitive plant locations. However, the natural resource personnel do not have the last word to direct the training exercises.

Management Urgency Rank Comments (M3): Some areas of the grassland are in good condition while others are weedy. *Bromus tectorum* is the only state-listed noxious weed that has been documented at the site. A total of sixteen noxious weeds are known from the Pinon Canyon Maneuver Site (Spackman Panjabi and Decker 2007) and have the potential to infest areas within this site, especially in areas with periodic ground disturbances.

Exotic Species Comments: *Bromus tectorum* is the only state-listed noxious weed that has been documented at the site.

References

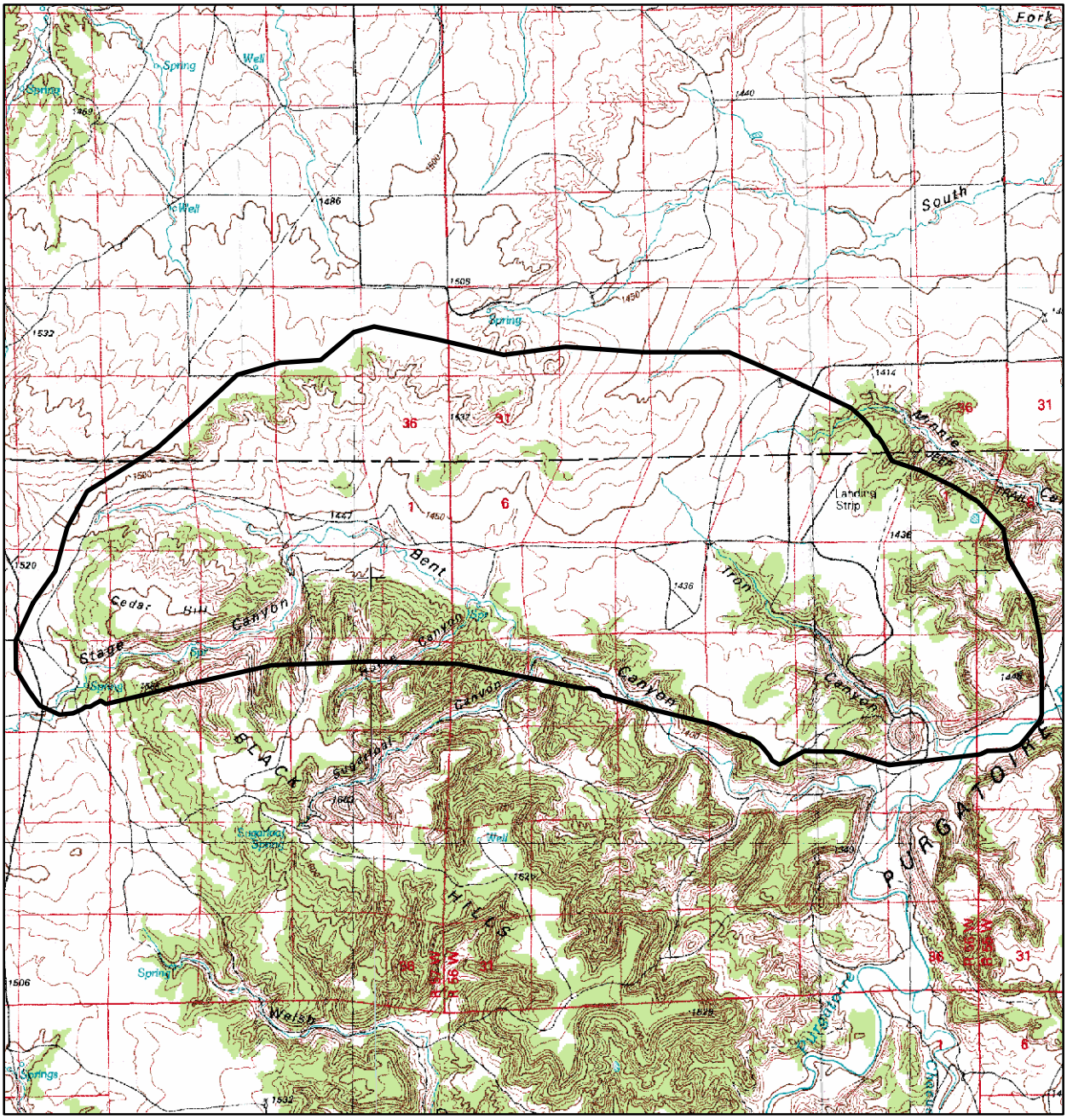
Neid, S., K. Decker, J. Handwerk, and S. Spackman Panjabi. 2007. Final Report: Rare Plant Surveys on Pinon Canyon Maneuver Site 2006-2007. Colorado Natural Heritage Program, Fort Collins, CO.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Spackman Panjabi, S. and K. Decker. 2007. Front Range Eco-regional Partnership Invasive Plant Species Strategic Plan. Unpublished report prepared for the U.S. Department of Defense by the Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Panjabi, S.S. and R.J. Rondeau

Version Date: 02/01/2010



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Map Date: 01/27/2010

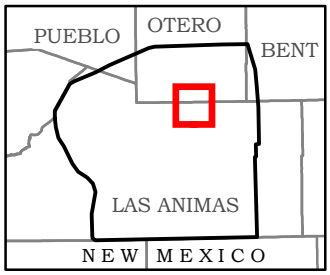
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 11. Cedar Hill Flats Potential Conservation Area, B3: High Biodiversity Significance

Dinosaur Track Greasewood Flat

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

Size: 395 acres (160 ha) **Elevation:** 4,380 - 4,800 ft. (1,335 - 1,463 m)

General Description: Dinosaur Track Greasewood Flat lies in the floodplain and adjacent to the banks of the Purgatoire River. It is nearly level and elevated approximately 3m above the river by undercut banks. The vegetation is dominated by greasewood (*Sarcobatus vermiculatus*), and is apparently typical of plant communities found on the Limon series silty clay loam soils (Larsen et al. 1972). The understory vegetation generally contains a mosaic of alkali sacaton (*Sporobolus airoides*), blue grama (*Bouteloua gracilis*), ring muhly (*Muhlenbergia torreyi*), and a few prickly pear cactus (*Opuntia* sp.) with a high percentage of bare ground. The slopes above the site are covered by juniper woodlands (*Juniperus monosperma*). This community supports a bird community that is distinct within the canyon in that it includes typical grassland birds as well as those that prefer semi-desert shrublands. Superficial sampling indicates low mammal density. Butterflies and tiger beetles are surprisingly few or absent.

Key Environmental Factors: The proximity of the greasewood community to the river channel and the underlying groundwater likely allows this facultative wetland species to survive in a site that would otherwise be too xeric for it.

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 dryland 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 rank is based on a fair (C-ranked) occurrence of a globally critically imperiled (G1Q/SU) bottomland shrubland, *Sarcobatus vermiculatus / Bouteloua gracilis*.

Natural Heritage element occurrences at the Dinosaur Track Greasewood Flat 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	Sarcobatus vermiculatus / Bouteloua gracilis Shrubland	Saline Bottomland Shrublands	G1Q	SU				C	1994-08-15

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

Boundary Justification: The boundary is intended to protect the greasewood community from direct physical disturbance, disturbance to the slopes above the occurrence, and disturbance to the floodplain and channel areas adjacent to the occurrence. Local processes that are important to maintaining the greasewood community include the depth to, and fluctuation of, the local water table.

Protection Urgency Rank Comments (P4): Ownership is simple and under special management by USFS. Protection could be completed by special designation of site by USFS or Colorado Natural Areas Program.

Management Urgency Rank Comments (M3): This site is directly adjacent to the prime public attraction to the Picket Wire Canyonlands, the dinosaur tracks, and current management promotes public visitation. Furthermore, the occurrence is dissected by an existing two-track road that provides the primary access to the tracks. Closure of the road and the development of alternative, less intrusive access is recommended. Non-native invasive species are prevalent and threaten the viability and quality of the greasewood community. Invasion of the element by cheatgrass (*Bromus tectorum*) and other herbaceous weeds can eliminate the native herbaceous species common to this community type. Infestation of the floodplain and banks of the channel by tamarisk (*Tamarix ramosissima*) has the potential to dewater the groundwater level and to directly displace the greasewood. Management to control invasive species is needed.

Land Use Comments: The nearby Rourke Ranch was settled in the 1870s, the headquarters was constructed by the early 1900s.

Exotic Species Comments: Infestation of tamarisk (*Tamarix ramosissima*) along the banks of the river may be of concern due to their tendency to locally deplete water

tables and displace species of concern. A very large area of the former greasewood community has been replaced by exotic monoculture or degraded by invading grasses in the understory. *Kochia* sp. covers the abandoned fields. *Elymus* and *Bromus* sp. are present in varying densities, mostly outside the identified occurrence. In general, the greasewood flats contain a higher concentration of weeds and exotic grasses nearer to roads and areas of apparent soil disturbance such as the old fields. Few exotics are present in areas more than 10m from roads.

Off-Site Considerations: Off-site considerations will be essential to the long-term viability of this community type within the Picket Wire Canyonlands. The formation of the alluvial soil deposits on which these greasewood flats are restricted is apparently the result of specific hydrological character of the Purgatoire River. These fine textured soils are deposited only under low stream velocities. Similarly, river erosion is constantly eliminating portions of the floodplain. Maintaining this natural dynamic is essential to maintaining the natural community. Therefore, maintaining or restoring natural hydrology and hydroperiod of the Purgatoire River may be the most important management possible.

Information Needs: More information is needed on the hydrological history at the site, rates of deposition and erosion that control greasewood flat dynamics and water table depth and fluctuation.

References

Comanche National Grassland. 1993. Picket Wire Canyonlands Interim Management Direction, 2nd draft. U.S.D.A. Forest Service.

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

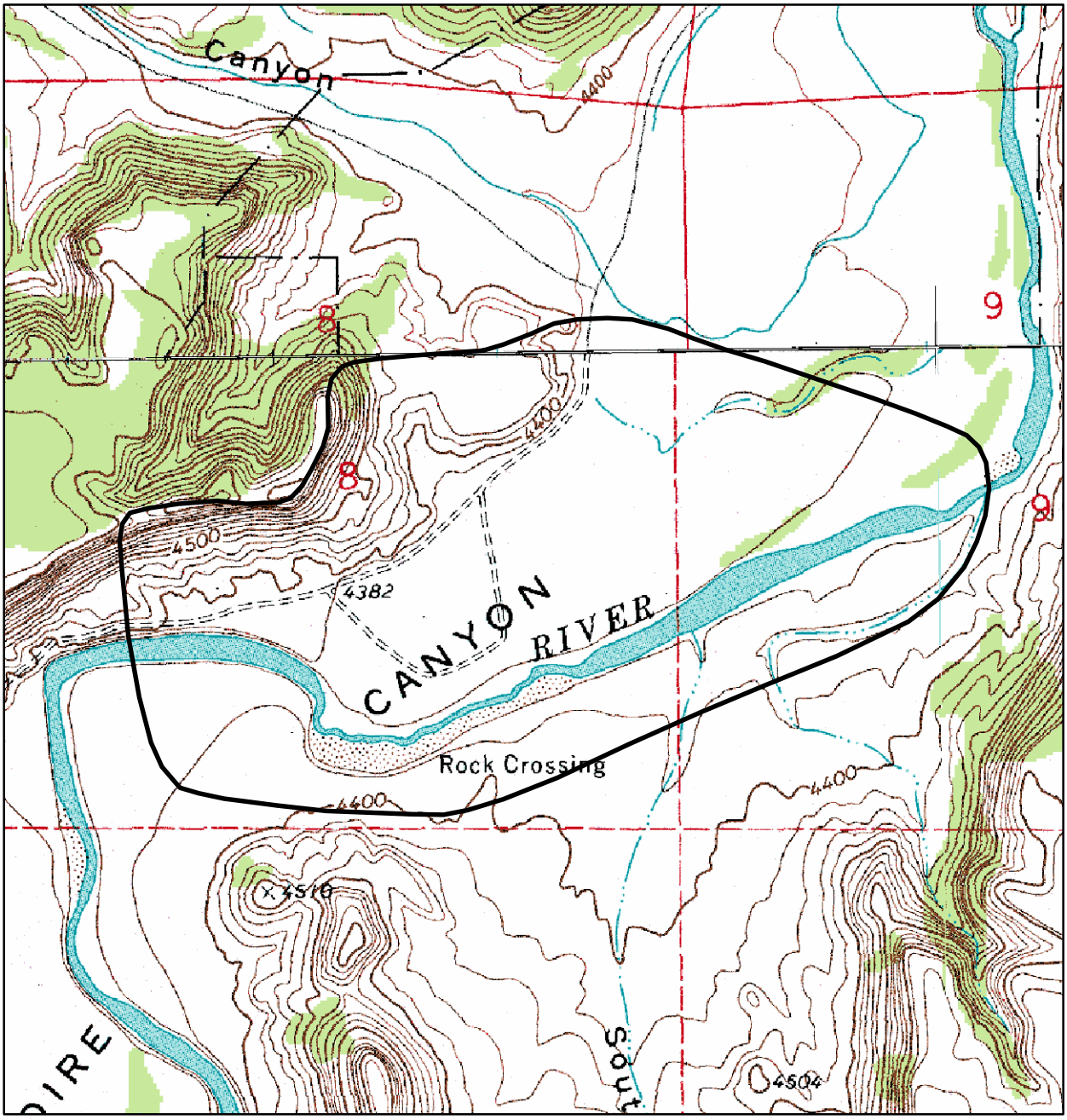
HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Larsen, Roy J., Donald L. Martin, and M. Bruce McCullough. 1972. Soil Survey of Otero County, Colorado. Soil conservation Service. 84pp.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Stevens, J.E.

Version Date: 04/27/2008



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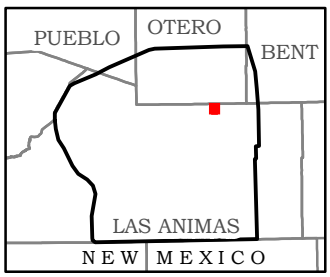
Legend

PCA Boundary

Beaty Canyon, 37103-E5
Riley Canyon, 37103-F5

7.5 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 12. Dinosaur Track Greasewood Flat Potential Conservation Area, B3: High Biodiversity Significance

Model

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

Size: 113,505 acres (45,934 ha) **Elevation:** 5,610 - 6,135 ft. (1,710 - 1,870 m)

General Description: This is a large area dominated by shortgrass prairie, greasewood flats, and *Frankenia* habitats. There are many county roads which dissect the landscape and support a variety of exotic plant species. Shortgrass prairie characterizes the site, and some of the more common graminoids include buffalograss, needle and thread, Indian ricegrass and galleta grass. Bitterbrush, yucca, greasewood, prickly pear cactus, and scarlet globemallow dominate the forb layer. The soils are generally of clay loam. This site contains numerous locations of the Colorado endemic and rare rayless goldenweed (*Oonopsis foliosa* var. *monocephala*).

Biodiversity Significance Rank Comments (B3): This site contains two excellent (A-ranked) occurrences of the globally imperiled (G3G4T2/ S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*). A degraded occurrence of the globally imperiled (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*) has been documented, but the site was not drawn for this species.

Natural Heritage element occurrences at the Model 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				A	1998-06-25
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				E	1998-06-28
Vascular Plants	Oonopsis foliosa var. monocephala	rayless goldenweed	G3G4T2	S2				A	1998-06-28

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

Boundary Justification: This site encompasses approximately half of the precise locations known for rayless goldenweed (*Oonopsis foliosa* var. *monocephala*) in the world. The occurrences were mostly documented from the roads, however it is suspected that the plants continue into the natural vegetation. The site boundary encompasses what is currently believed to be the western extent of this species range.

Protection Urgency Rank Comments (P4): Most of the site is found on private lands. Plans of the private land owners are unknown.

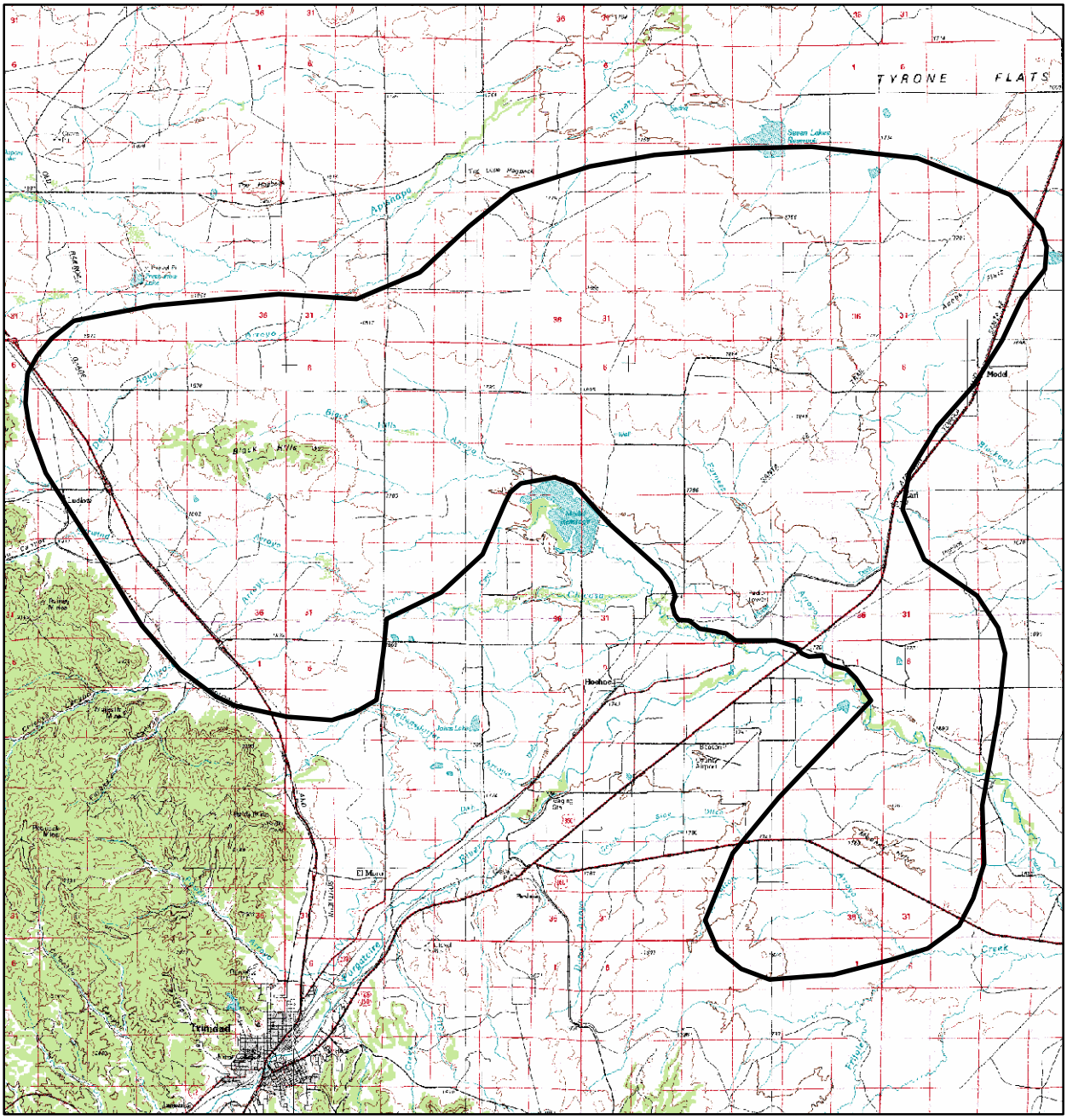
Management Urgency Rank Comments (M3): Grazing is a natural part of this ecosystem and cattle grazing is the predominant land use at this site. The rare plants appear to do well with grazing, however little is known how different grazing regimes impact the rayless goldenweed. It is common to find this species growing where some natural erosion is taking place, thus insinuating that this species does fairly well with disturbance. Ideally, future monitoring and research would help determine the requirements of the rare plants. Exotic plant species are abundant along the roads and have the potential to spread which would have a negative impact to the site. There are numerous roads, telephone lines, and power lines dissecting the site.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Panjabi, S.S.

Version Date: 12/10/2007



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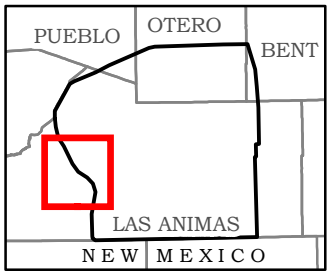
Legend

PCA Boundary

Trinidad, 37104-A1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



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

Packers Gap North

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

Size: 19,888 acres (8,048 ha) **Elevation:** 4,600 - 4,848 ft. (1,402 - 1,478 m)

General Description: Packers Gap North is characterized by rolling shortgrass prairie with shale or limestone ridges and bluffs. Several stock ponds have been excavated on ephemeral streams that dissect the area. Elevations range from about 4,600 ft near the East Branch of Crooked Arroyo and the North Fork of Jack Canyon to about 4,848 ft at Packers Gap. Shortgrass prairie dominates the lower slopes and flats along the creeks. Several county roads run through the site. The top of ridges and edges of the bluffs where white shales or limestones are exposed at the surface are dominated by sparse cover of Bigelow's sagebrush (*Artemisia bigelovii*) with New Mexico feathergrass (*Hesperostipa neomexicana*) and Indian ricegrass (*Achnatherum hymenoides*). The geology is described as being the Smokey Hill marl and Fort Hayes limestone members of the Niobrara Formation. There is little surface soil development.

Biodiversity Significance Rank Comments (B3): This site contains an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*) and an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) shrubland community, *Artemisia bigelovii / Achnatherum hymenoides*.

Natural Heritage element occurrences at the Packers Gap North 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	Artemisia bigelovii / Achnatherum hymenoides Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3	S3				A	1997-08-30
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	A	2007-05-12

** 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 designate an area which, given

the available data regarding the ecological processes that support these elements, is believed necessary. This boundary would protect a large example of the community from direct disturbance. The community is usually confined to the rocky outcrops. Fire and herbivory were probably important ecological influences but other ecological factors and processes necessary for long-term viability of the community are unknown at this time.

Protection Urgency Rank Comments (P3): The site encompasses USFS land with some private inholdings. Mining has occurred in the area. Expansion may threaten the site.

Management Urgency Rank Comments (M4): Although not currently threatened, management may be needed in the future to maintain current quality of the community. Heavy grazing has occurred in 1997 on a nearby parcel with the same plant community. Long-term grazing management on the site is unknown but rotational grazing and deferment may help to ensure the continued viability of the community. There is public access from a county road.

Land Use Comments: Most of the site is within the Comanche National Grassland. Currently, livestock graze the area and a small mine has been excavated along the Rourke Road.

Information Needs: Other large outcrops of similar geology exist in the nearby area. These outcrops may be habitat for more extensive examples of this community. USFS or NRCS staff could probably help rank the importance of this site for the community occurrence.

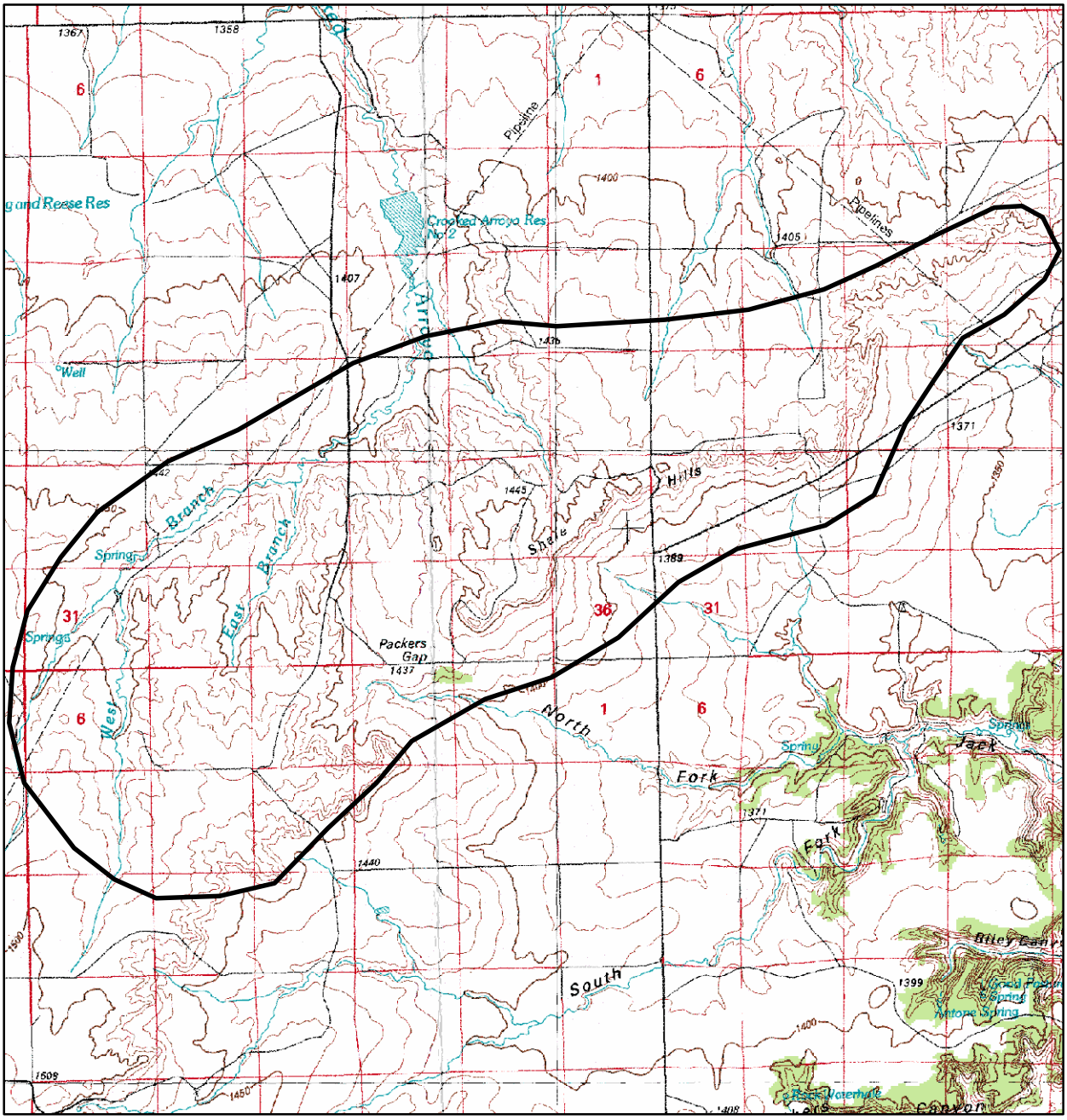
References

Culver, D., M. A. March, S. Kettler and C. Pague. 1996. Natural Heritage Inventory of Significant Animals and Plants and Classification of Riparian Plant Associations: Timpas Grazing District and Kim Grazing Association. unpub CNHP report for U.S. Forest Service. 215+ p.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A., C.C. Fleming and S.M. Kettler

Version Date: 06/12/1997



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Map Date: 01/26/2010

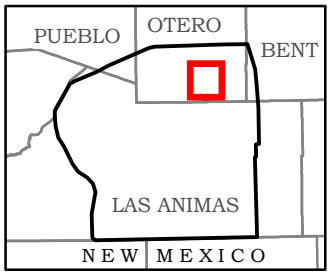
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 14. Packers Gap North Potential Conservation Area, B3: High Biodiversity Significance

Poitrey Hills

Biodiversity Rank - B3: High Biodiversity Significance

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

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

Size: 84,600 acres (34,237 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, open juniper woodlands, and shale hills and breaks. The topography of Poitrey Hills and the surrounding area is striking and includes hills covered in juniper woodlands that are imbedded in lower elevation areas of shortgrass prairie. It includes the headwater portions of numerous intermittent streams that drain to the north and east. Rare plants occur along roads and throughout grasslands and woodlands and are extremely abundant. Some of the common plants found at the site include New Mexico feathergrass (*Hesperostipa neomexicana*), western wheat grass (*Pascopyron smithii*), alkali sacaton (*Sporobolus airoides*), galleta grass (*Pleuraphis jamesii*), little barley (*Hordeum pusillum*), oneseed juniper (*Juniperus monosperma*), pinon pine (*Pinus edulis*), blackfoot daisy (*Melampodium leucanthum*), hairy woollygrass (*Erioneuron pillosum*), broom snakeweed (*Gutierrezia sarothrae*), fourwing saltbush (*Atriplex canescens*), winterfat (*Krascheninnikovia lanata*), and Prince's plume (*Stanleya pinnata*). The geology associated with the shale hills create soils suitable for the larval hostplants of the imperiled Colorado blue butterfly (*Euphilotes rita coloradensis*), which inhabits the site. Beneath the juniper of these hills, the understory includes a great deal of rock and bare ground with sideoats grama (*Bouteloua curtipendula*), and other grasses, and forbs including numerous populations of wild buckwheat.

Key Environmental Factors: Geology, soil depth, drought, grazing, fires, and slope play a critical role in determining the vegetation species composition. Fires kill junipers yet much of the area has relatively low biomass thus preventing large scale fires. Old-growth junipers and pinons are common throughout, denoting that fires are infrequent. Adequate soil depth coupled with low intensity grazing favors New Mexico feathergrass while high intensity grazing favors blue grama. Slopes are generally less vegetated than the mesa tops or the outwash.

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985).

Biodiversity Significance Rank Comments (B3): The site supports an excellent (A-ranked) occurrence of the globally imperiled (G3G4T2/S2) rayless goldenweed (*Oonopsis foliosa* var. *monocephala*), a good (B-ranked) occurrence of the globally vulnerable (G3/S3) Arkansas Valley evening primrose (*Oenothera harringtonii*), and a

fair (C-ranked) occurrence of the state rare (G4/S2) long-hood milkweed (*Asclepias macrotis*). The site also supports occurrences of the globally rare (G3G4T2T3/S2) Colorado blue (*Euphilotes rita coloradensis*) and a fair (C-ranked) occurrence of the state rare (G4/S3) Simius roadside skipper (*Amblyscirtes simius*).

Natural Heritage element occurrences at the Poitrey Hills 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	G3G4T2T3	S2				E	2009-08-11
Insects	Euphilotes rita coloradensis	Colorado Blue	G3G4T2T3	S2				E	1994-08-13
Insects	Amblyscirtes simius	Simius Roadside Skipper	G4	S3				C	1994-06-05
Vascular Plants	Oenothera harringtonii	Arkansas Valley evening primrose	G3	S3			USFS	B	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

** 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 rare plants and butterflies 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. In addition, the long-term persistence of butterfly populations is favored by the protection of an area larger than the area occupied by the occurrence in any one year. Habitat heterogeneity improves long-term persistence in butterflies, a habitat component that is enhanced by a large protected area. Within this site, numerous terrace benches, low ridges, drainages, and shortgrass prairie support a mosaic of habitat patches that have potential for colonization by the rare butterflies.

Protection Urgency Rank Comments (P3): The site is mostly 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).

Management Urgency Rank Comments (M3): 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. Little barley(*Hordeum pusillum*) was abundant in 2009.

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

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

References

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

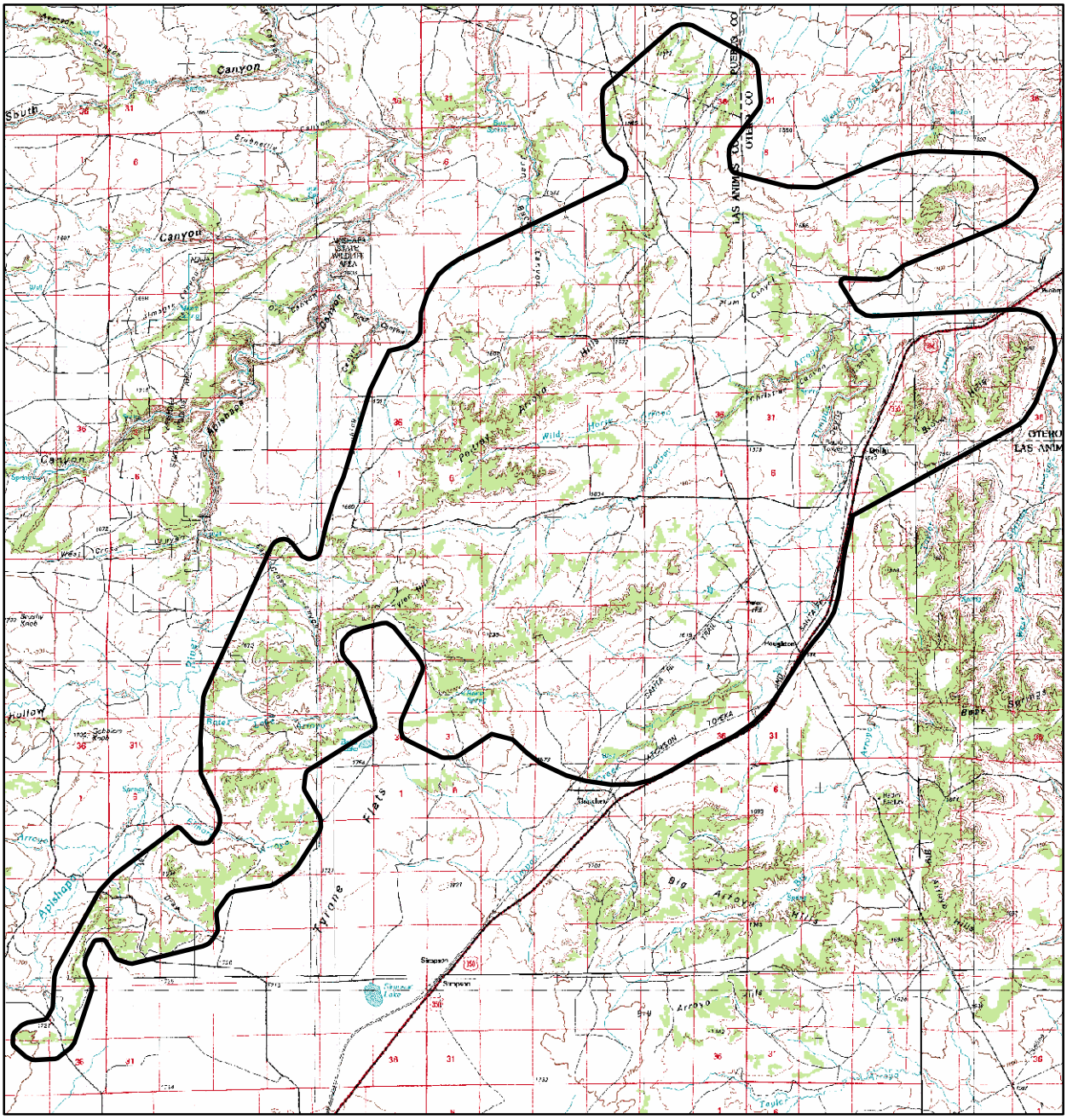
Stevens, J.E. and J. R. Sovell. 2008. Final Report: Southeastern Colorado Survey of Critical Biological Resources 2008. Colorado Natural Heritage Program, Fort Collins, CO.

Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

U.S. Department of Agriculture, Soil Conservation Service. 1994. State Soil Geographic (STATSGO) database for Colorado. Fort Worth, TX.

Version Author: Sovell, J.R.

Version Date: 02/01/2010



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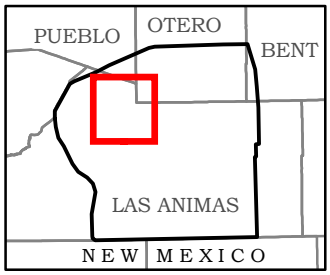
Legend

PCA Boundary

La Junta, 37103-E1
Trinidad, 37104-A1
Walsenburg, 37104-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 15. Poitrey Hills Potential Conservation Area, B3: High Biodiversity Significance

Sanford Hills

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

Size: 53,539 acres (21,666 ha) **Elevation:** 4,690 - 5,400 ft. (1,430 - 1,646 m)

General Description: The Sanford Hills are comprised of juniper breaks (limestone and shale barrens, hills, and mesas) surrounded by shortgrass prairie. The tops and slopes of the breaks are dominated by oneseed juniper (*Juniperus monosperma*), Bigelow's sage (*Artemisia bigelovii*), and New Mexico feathergrass (*Hesperostipa neomexicana*). *Juniperus monosperma / Artemisia bigelovii* plant communities are generally on flat surfaces at the tops of the breaks, while *Juniperus monosperma / Hesperostipa neomexicana* communities can be on either the flats or the slopes. These areas also support cushion plant communities, and are particularly important for rare plant species. The adjacent grassland is a large, lightly-fragmented shortgrass prairie dominated by blue grama (*Bouteloua gracilis)* and galleta grass (*Hilaria jamesii)*. Other common plant species include: *Oreocarya thyrsiflora, Echinocereus reichenbachii, Eremogone hookeri, Eriogonum lachnogynum, Melampodium leucanthum, Virgulus fendleri,* and *Yucca glauca.* The shale and limestone hills are full of fossilized seabeds, concretions, geodes, and cones making this an interesting geologic area in addition to the important botanical area. The shale barrens or breaks are important rare plant habitat in addition to providing refuge for cattle during winter storms. The bird community is different on the breaks as well because of the woody structure of the trees and shrubs, which are absent in the grasslands. The highly erodible hills effect the soil qualities of the nearby grasslands and several rare plants do exceptionally well on the toe slopes and associated grasslands, especially Rocky Mountain bladder pod (*Lesquerella calcicola*), Arkansas evening primrose (*Oenothera harringtonii*), and dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*). Soils are shallow well-drained clays derived from shale. Platy shale flakes often lie on the surface. Several drainages in the site are infested with tamarisk, yet they support important examples of native vegetation as well.

Key Environmental Factors: Geology, soil depth, drought, grazing, fires, and slope play a critical role in determining the vegetation species composition. Fires kill junipers yet much of the area has relatively low biomass thus preventing large scale fires. Old-growth junipers and pinons are common throughout, denoting that fires are infrequent. Adequate soil depth coupled with low intensity grazing favors New Mexico feathergrass while high intensity grazing favors blue grama. Slopes are generally less vegetated than the mesa tops or the outwash.

Biodiversity Significance Rank Comments (B3): This site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Rocky Mountain bladderpod (*Lesquerella calcicola*), a good (B-ranked) occurrence of the globally vulnerable (G3?/S2) *Juniperus monosperma / Artemisia bigelovii* woodland community, a good (B-ranked) occurrence of the globally vulnerable (G3/S3) plains escarpment prairie (*Artemisia bigelovii / Achnatherum hymenoides*), a good (B-ranked) occurrence of a globally secure (G5/S4) *Eleocharis palustris* emergent wetland, and a fair (C-ranked) occurrence of a globally imperiled plant subspecies (G3G4T2T3/S2), dwarf milkweed (*Asclepias uncialis* ssp. *uncialis*).

Natural Heritage element occurrences at the Sanford Hills 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	Artemisia bigelovii / Achnatherum hymenoides Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3	S3				B	2009-08-27
Natural Communities	Juniperus monosperma / Artemisia bigelovii Woodland	Juniper / Sagebrush Woodland	G3?	S2				B	2009-06-18
Natural Communities	Eleocharis palustris Herbaceous Vegetation	Emergent Wetland	G5	S4				B	1995-08-08
Vascular Plants	Lesquerella calcicola	Rocky Mountain bladderpod	G3	S3				A	2009-06-16
Vascular Plants	Asclepias uncialis ssp. uncialis	dwarf milkweed	G3G4T2T3	S2			BLM/ USFS	C	2009-06-16

** 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 include the known occurrence, additional potential habitat, and the local mosaic of plant communities. The boundary was digitized while referencing a one meter digital color orthophoto quad, a 1:100,000 digital quad, and a GIS model developed by CNHP that shows the probability of the presence of shale barren plants.

Protection Urgency Rank Comments (P3): This site contains a mix of private lands and public lands managed by the Comanche National Grassland or the State of Colorado. Permanent protection actions could benefit the long-term viability of the occurrences.

Management Urgency Rank Comments (M4): Parts of the site have signs of heavy grazing. Riparian areas have infestations of tamarisk. Additional field surveys are needed throughout the site.

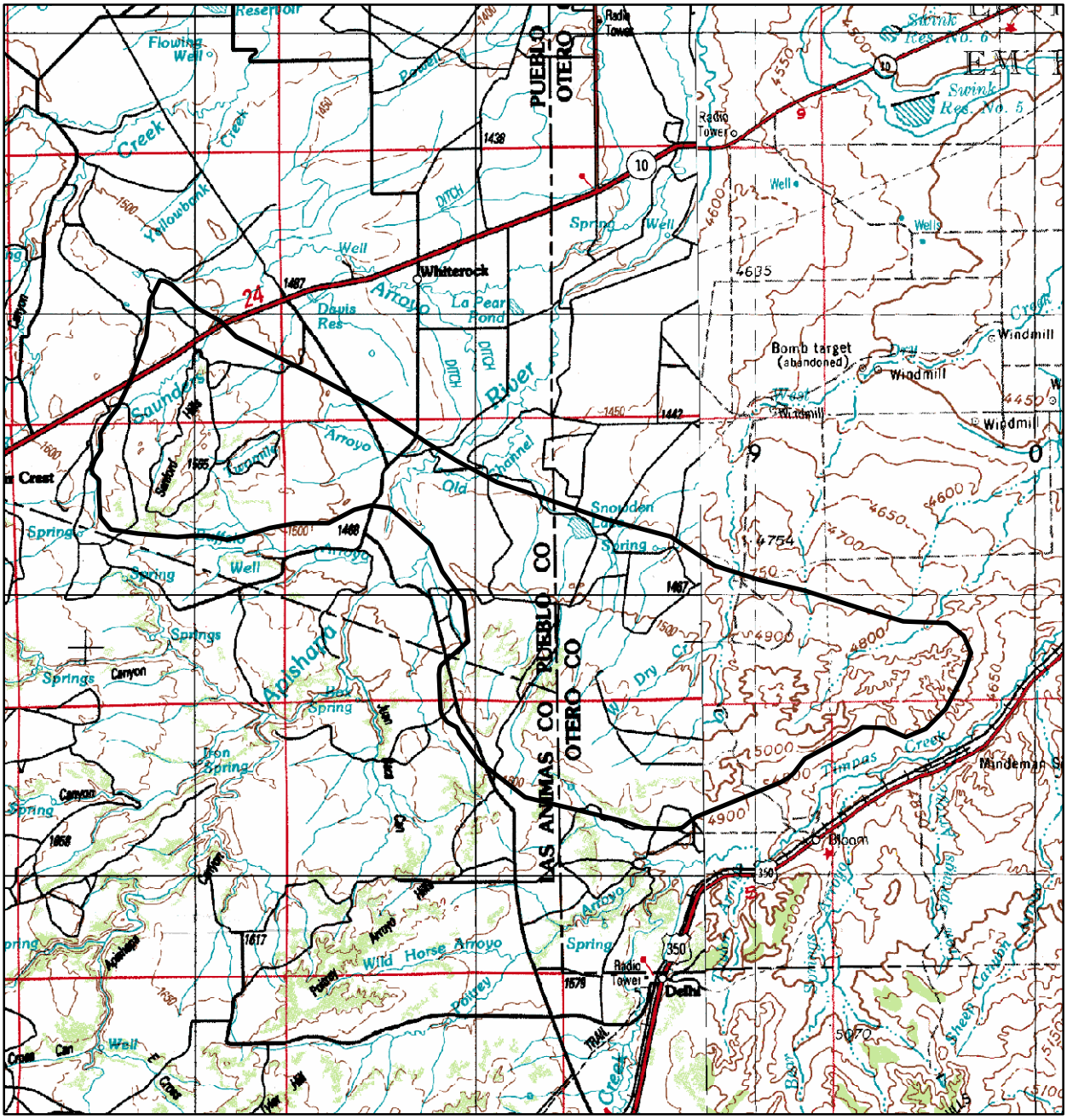
Land Use Comments: The area is primarily used for cattle grazing. The escarpments in the area have wind energy potential and several wind monitoring towers were observed in 2009, however no wind development projects existed in 2009.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Panjabi, S.S. and R.J. Rondeau

Version Date: 01/22/2010



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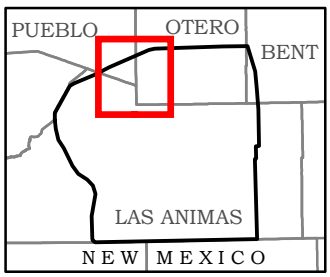
Legend

PCA Boundary

La Junta, 37102-A1
Trinidad, 37104-A1

1x2 Degree Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 16. Sanford Hills Potential Conservation Area, B3: High Biodiversity Significance

Vogel Canyon

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

Size: 1,080 acres (437 ha) **Elevation:** 4,300 - 4,400 ft. (1,311 - 1,341 m)

General Description: Vogel Canyon is a moderately wide canyon with an ephemeral stream that has two permanent springs in the lower reaches of the canyon. The standing water is dominated by cattail (*Typha domingensis*) and bulrush (*Schoenoplectus pungens*) with infrequent stands of cottonwoods (*Populus deltoides*) and tamarisk (*Tamarix ramosissima*). The mesic meadows on the valley floor adjacent to the stream channel are dominated by western wheatgrass (*Agropyron smithii*), blue grama (*Bouteloua gracilis*) and sideoats grama (*Bouteloua curtipendula*). The rimrock and upper slopes are dominated by communities of oneseed juniper (*Juniperus monosperma*) and skunkbush (*Rhus trilobata*).

Key Environmental Factors: The integrity of the stream channel and the surface and ground water hydrology is important to the continued viability of the cattail (*Typha domingensis*), bulrush (*Schoenoplectus pungens*), and cottonwood (*Populus deltoides*) communities. The viability and quality of the rare communities are vulnerable to the effects of exotic species and heavy recreational use.

Land Use History: Land use has historically been dominated by ranching of sheep and cattle since the mid 1800's (Friedman 1985). The site is located on a portion of the Comanche National Grassland where recreation and cattle ranching are the primary land uses.

Biodiversity Significance Rank Comments (B3): The Vogel Canyon site supports a fair (C-ranked) occurrence of a globally imperiled (G2G3/S2S3) shrubland community (*Cercocarpus montanus - Rhus trilobata / Andropogon gerardii*) and a good to fair (BC-ranked) occurrence of a globally vulnerable (G3G4/S3) bulrush community (*Schoenoplectus pungens*).

Natural Heritage element occurrences at the Vogel 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
Natural Communities	Cercocarpus montanus - Rhus trilobata / Andropogon gerardii Shrubland	Mountain Mahogany - Skunkbush / Big Bluestem Shrubland	G2G3	S2S3				C	1995-09-04
Natural Communities	Schoenoplectus pungens Herbaceous Vegetation	Bulrush	G3G4	S3				BC	1995-07-27

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

Boundary Justification: The boundary follows the natural topographic features, encompassing the canyon rimrock, the shrub-dominated slopes, and the Vogel Canyon bottoms. The boundary is intended to protect the rare communities, habitat for potential new occurrences and the ecological processes that support them from physical destruction. However, hydrology is particularly important to the elements found on the valley bottom and the site only nominally includes the sphere of hydrologic influence. Hydrologic modifications (e.g. groundwater pumping) have the potential to impact the site hydrology from outside the site boundary.

Protection Urgency Rank Comments (P4): The area is partly within the Comanche National Grassland and partly on private ranch land. The portions within the Comanche National Grassland are designated as a picnic area. Protection of the communities could be improved by taking measures to increase the intent and tenure of legal protection. Such measures may include establishing perpetual easements, seeking natural area designations, or habitat conservation plans.

Management Urgency Rank Comments (M2): The area is partly within the Comanche National Grassland and is a designated picnic area that receives very high recreational use. The remainder of the site is privately owned. Some portions, particularly the valley bottoms, have been invaded by non-native weedy species such as tamarisk, cheatgrass, and kochia, and management is needed to eliminate these species and revegetate degraded areas with native species appropriate to the communities. To ensure the quality and viability of the communities over the long-term, it is important that owners and managers take measures to halt the increasing spread of non-native species. Such efforts might include simulating more natural grazing and fire regimes through the use of prescribed burning and altered grazing rotations. To be most effective this will require collaboration among the public and private land owners.

Land Use Comments: The current land use of livestock grazing appears compatible

with the continued viability of the elements of concern.

Exotic Species Comments: Management needs to consider the expansion of weedy species, especially cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola australis*) and tamarisk (*Tamarix ramosissima*) which dominates the canyon bottom and stream banks. Short duration, intensive grazing in the canyon bottom may be used as a management tool for control of cheatgrass and other weedy species (Johnston and Reed 1991). The existence of tamarisk in the riparian area may be of concern. Because of tamarisk's ability to outcompete native vegetation and its high rate of proliferation, it is difficult to manage and will present long-term challenges to land managers (Johnston and Reed 1991).

References

Culver, D., M. A. March, S. Kettler and C. Pague. 1996. Natural Heritage Inventory of Significant Animals and Plants and Classification of Riparian Plant Associations: Timpas Grazing District and Kim Grazing Association. unpub CNHP report for U.S. Forest Service. 215+ p.

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

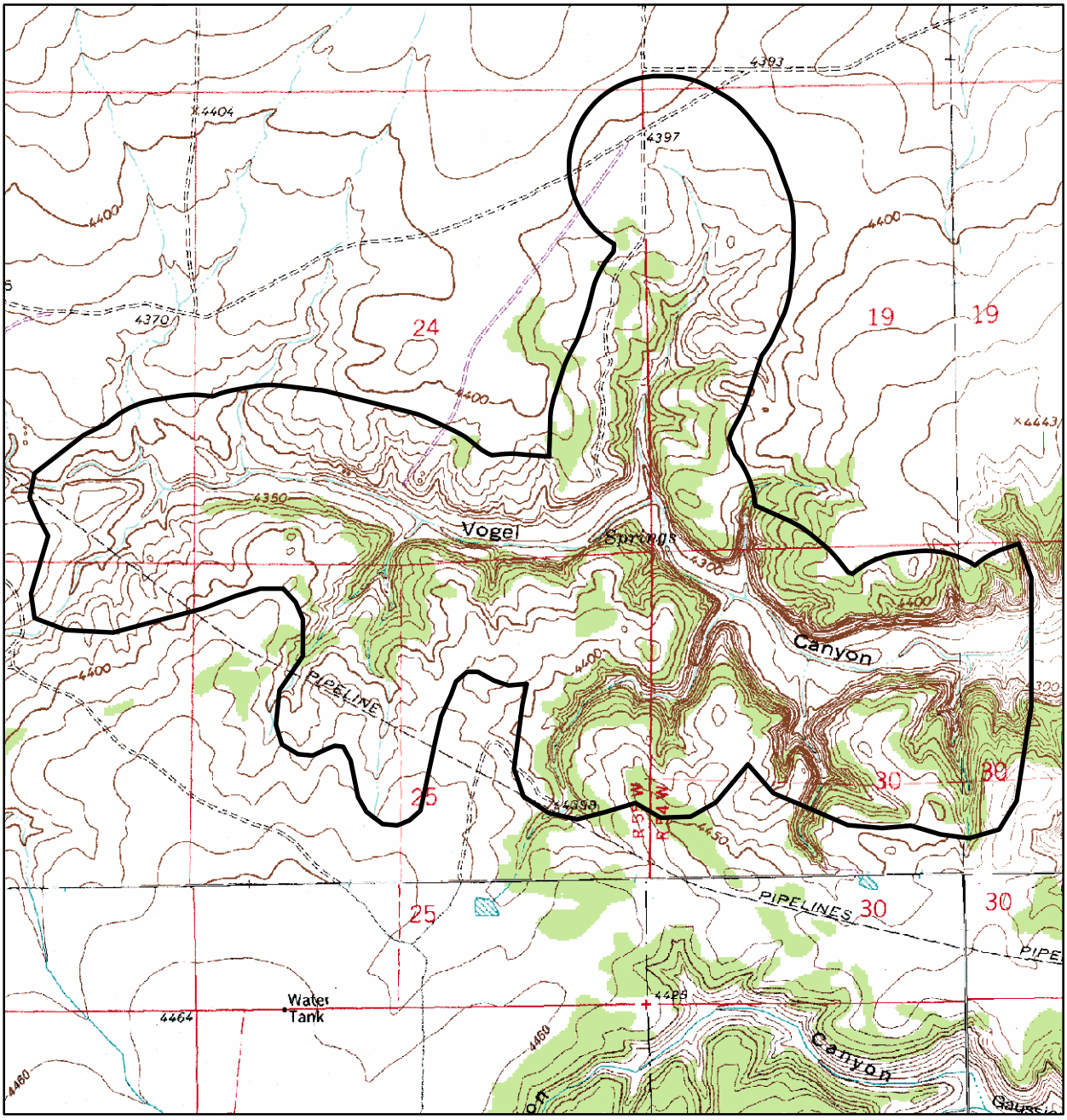
HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Johnston, Barry C. and Floyd Reed. 1991. Ecological inventory of Picketwire Canyonlands. USDA Forest Service, Comanche National Grassland. 22pp.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Fleming, C.C.

Version Date: 08/29/1997



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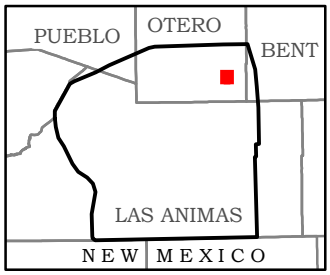
Legend

PCA Boundary

Higbee, 37103-G4
La Junta SE, 37103-G5

7.5 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 17. Vogel Canyon Potential Conservation Area, B3: High Biodiversity Significance

Cobert Canyon

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 3,010 acres (1,218 ha) **Elevation:** 5,240 - 5,800 ft. (1,597 - 1,768 m)

General Description: Cobert Canyon is a fairly large canyon that has approximately 3.5 miles of grassland in the floor. The stream is ephemeral, but with some waterholes/springs. The canyon slopes are shrublands or woodlands in most areas, but with benches where there is a mosaic of grasslands and woodlands. Cliffs rise for 200-300 feet over the canyon forming spectacular views. Side canyons are rugged and often un-roaded. These areas contain what appears to be old growth juniper woodlands. At the heads of some canyons are splash pools. The canyon continues for approximately seven miles with many miles of side canyons. Some of the steeper canyon slopes are covered with shrubs, generally mountain mahogany (*Cercocarpus montanus*), although Gambel's oak (*Quercus gambelii*) is also common. Some woodlands are almost pure pinon pine (*Pinus edulis*).

Key Environmental Factors: The most important environmental factors regulating these plant communities are the lack of consistent water, hot summers, and cold, windy winters.

Land Use History: There is an extensive history for this area, beginning with Folsom Man. The type locality for Folsom Points is a short distance from here. Signs of indigenous peoples are common and include points, arrow heads, teepee rings, vision quest sites, and hunting shelters. Spanish habitation is marked by adobe and rock shelters. These early peoples no doubt conducted small scale agriculture and grazing of livestock. By the end of the 19th century, grazing had taken the form of huge ranching kingdoms. Although the ownerships have been considerably split up, the dominant land use remains as fairly large ranching operations.

Cultural Features: There are numerous sites for early peoples, whether they be European or natives.

Biodiversity Significance Rank Comments (B4): This site supports several state imperiled ferns. There is an excellent (A-ranked) occurrence of the state critically imperiled (G4/S1) Standley's cloak fern (*Cheilanthes standleyi*), an excellent (A-ranked) occurrence of the state imperiled (G5?/S1S2) Eaton's lip fern (*Cheilanthes eatonii*) and an unranked occurrence of the state critically imperiled (G5/S1) Wooten's lip fern (*Cheilanthes wootonii*).

Natural Heritage element occurrences at the Cobert 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	Cheilanthes standleyi	Standley's cloak fern	G4	S1				E	1994-05-28
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1				A	1994-05-28
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1					1994-05-28
Vascular Plants	Cheilanthes wootonii	Wooton's lip fern	G5	S1					1994-05-28
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S1S2				E	1994-05-28
Vascular Plants	Cheilanthes eatonii	Eaton's lip fern	G5?	S1S2				A	1994-05-28

** 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 entirety of Cobert Canyon. Generally, the walls of the canyon are coincident with the boundary. Such a boundary includes all of the known plants in the canyon and a significant buffer.

Protection Urgency Rank Comments (P4): This site is on a privately owned working cattle ranch. The ferns are on canyon walls that are afforded natural protection.

Management Urgency Rank Comments (M3): Although the canyon walls and cliffs are in excellent condition, the canyon floor is more disturbed. There is a threat from invasive exotic plant species. This should be watched carefully and controlled wherever possible.

Land Use Comments: For the past 100 years, the land in this region has been used primarily for cattle and sheep grazing.

Natural Hazard Comments: There are numerous cliffs, unstable rocks, rattlesnakes and scorpions.

Exotic Species Comments: Burros are widespread on the ranch, but particularly on the hogback, just north of the site. There are a few tamarisk in Cobert Canyon. The Cotton Mesa has aoudads for game ranching purposes.

Off-Site Considerations: All adjacent lands are used similarly for cattle operations, except the Cotton Mesa. That ranch is managed as a game farm.

Information Needs: There is an abundance of information that is needed about the ranch ecosystem. Particularly, we need to have better documentation of the natural

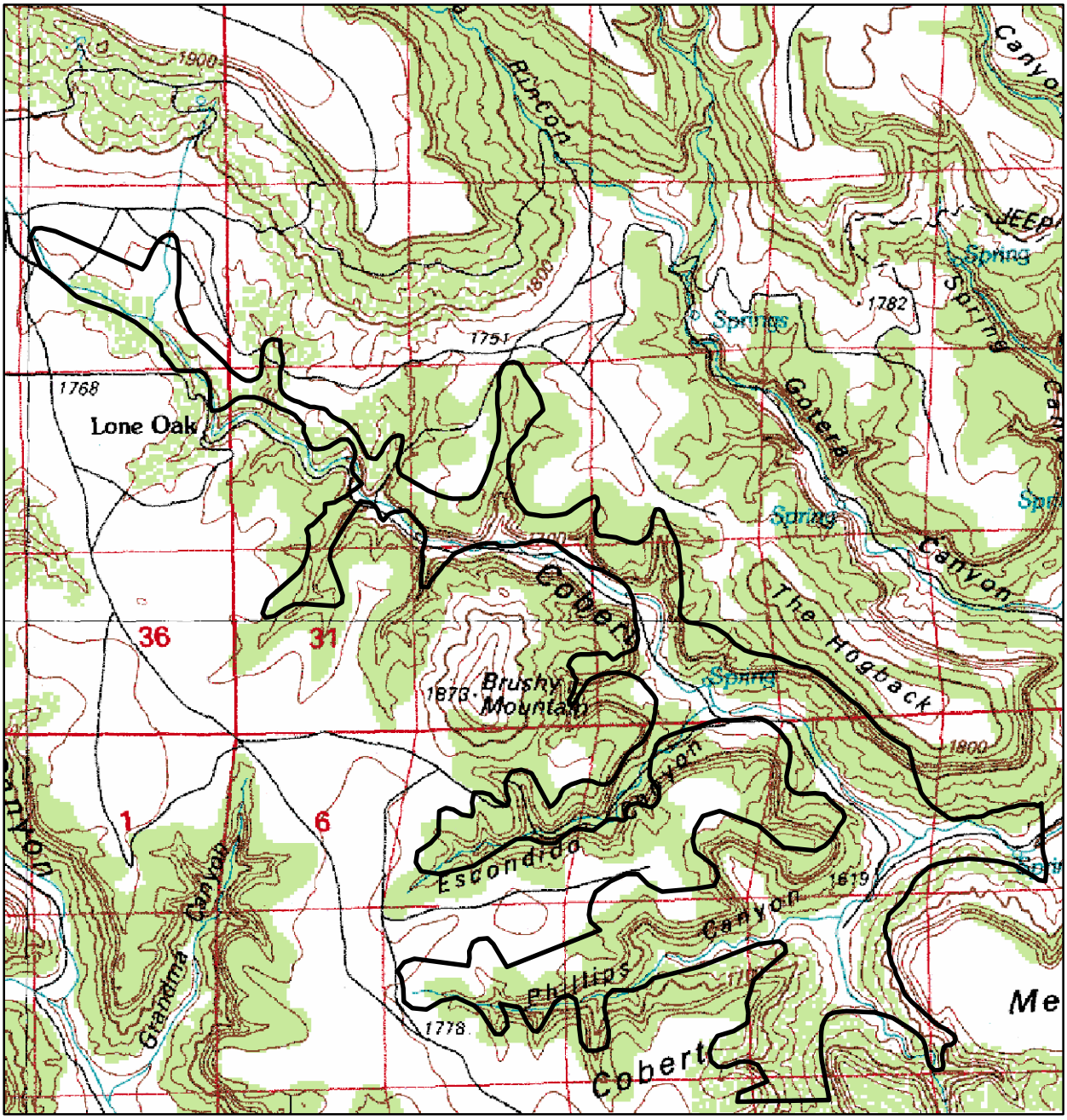
communities.

References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Pague, C.A.

Version Date: 01/14/1996



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Map Date: 01/29/2010

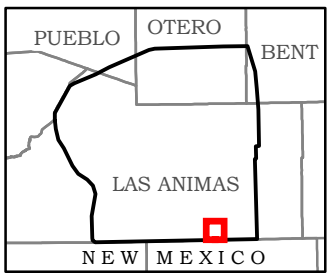
Legend

PCA Boundary

Kim, 37103-A1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 18. Cobert Canyon Potential Conservation Area, B4: Moderate Biodiversity Significance

Gotera Canyon

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

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

Size: 1,502 acres (608 ha) **Elevation:** 5,000 - 5,700 ft. (1,524 - 1,737 m)

General Description: Gotera Canyon dissects the highest portion of Mesa de Maya; however, this site is the lower of two canyon reaches. The stream is ephemeral but with permanent pools. The mouth of the canyon is a weedy grassland bordered by canyon slopes of shrubs and grasses on the north and woodland to forest on the south. The woods are pinon and juniper with scattered oak. The shrubs and grasses include *Nolina texana*, a state rare community. Moving upstream the canyon quickly narrows. There are numerous old adobe and rock houses from past inhabitants. Most of the bottomlands and benches are heavily utilized by cattle, but the slopes are of high quality. Patches of cottonwoods are found along the stream corridor, particularly where there are springs. Some of the springs have deep holes with amphibians and numerous aquatic insects. Higher in the canyon the walls close in forming a spectacular environment. Oak trees and shrubs adorn the walls along with the usual amount of juniper. Springs or pools become more common. Side canyons are evident and often form spectacular rock walls. There is a dirt road through the canyon which is in reasonable condition for trucks and 4 x 4's. At the upper end of the site, the canyon opens onto a bench where grasslands dominate the habitat. At this point, the cooler areas have ponderosa pine, some rather large. The canyon is small, but spectacular. The area provides a cooler environment than much of the surrounding landscape and is diverse in its animals and plants.

Key Environmental Factors: The Mesa de Maya region is known for its dry conditions. The same environment has challenged ranchers and farmers for centuries. The streams are indicators of flash-flood systems.

Land Use History: There are excellent signs of prehistoric peoples inhabiting the region. Gotera Canyon is very near the type locality of the Folsom Man. These early hunter-gatherers inhabited the region as much as 11-12,000 years ago. Native Americans of many tribes followed in the area. The Mesa de Maya was a part of the Spanish territory, therefore, it is no surprise to find many relict homesites from that era. After the Indians were removed from the area, large-scale ranching activities dominated the lands. This activity has continued to this day. Mesa de Maya is off the beaten path and presents many challenges to making a living. These factors have preserved much of the old way of life and a healthy ecosystem at the same time.

Cultural Features: There are numerous Native American, Mexican, and early

American sites on the Spool Ranch and adjacent Loudon Ranch. There is at least one historic cemetery, perhaps dating back to the Mexican domination.

Biodiversity Significance Rank Comments (B4): This site contains an excellent (A-rank) occurrence of a state rare (GU/S1) desert shrubland (*Nolina texana*), which is the highest ranked occurrence of this natural community in Colorado. There are also several good occurrences of plant species which are critically imperiled in the state. The plants species include zizotes milkweed (*Asclepias oenotheroides*), Wright's Cliff-brake *(Pellaea wrightiana*), Standley's cloak fern (*Cheilanthes standleyi*), long-hood milkweed (*Asclepias macrotis*), and twinevine (*Sarcostemma crispum*).

Natural Heritage element occurrences at the Gotera 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
Natural Communities	Juniperus monosperma / Cercocarpus montanus Woodland		GNR	SU					1992-09-16
Natural Communities	Nolina texana Shrubland	Desert Shrubland	GU	S1				A	1994-06-28
Vascular Plants	Asclepias macrotis	long - hood milkweed	G4	S2				BC	1993-06-11
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1				E	1993-06-11
Vascular Plants	Cheilanthes standleyi	Standley's cloak fern	G4	S1					1993-06-11
Vascular Plants	Asclepias oenotheroides	zizotes milkweed	G4G5	S1				B	1993-06-11
Vascular Plants	Sarcostemma crispum	twinevine	G4G5	S1					1993-06-12
Vascular Plants	Nolina texana	Texas beargrass	G5	S1				E	1994-05-28
Vascular Plants	Pellaea wrightiana	Wright's cliff - brake	G5	S2				BC	1993-06-11
Vascular Plants	Pellaea wrightiana	Wright's cliff - brake	G5	S2				AB	1994-05-28

** 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 entire reach of lower Gotera Canyon, the canyon walls, and a buffer on the rim. All side canyons are also included. The mouth of the canyon is included from lip to lip. All biological elements that are targeted in this site are canyon-dwellers or are limited in distribution by the availability of water.

Protection Urgency Rank Comments (P4): The Spool Ranch is privately-owned working cattle ranch. The threats to the land are dependent on the current ownership. Good land stewards will not destroy the landscape. Should the ranch turn over to a less than caring owner, there could be severe damage to Gotera Canyon. The most sensitive habitats are, of course, the watering holes.

Management Urgency Rank Comments (M3): Some of the grasslands along the canyon floor are heavily utilized. Severe damage could result if there is not some restoration efforts within the next decade.

Land Use Comments: This canyon has apparently been used for livestock grazing for many years. Undoubtedly, the condition of the range has improved. Homesteaders or earlier dwellers must have attempted subsistence agriculture and grazing to some degree. Today, the entire region is used almost solely for livestock and hay.

Natural Hazard Comments: There are numerous steep cliffs and unstable rocks. Rattlesnakes are present, but we did not find them particularly common. Scorpions were abundant. There is some danger of being caught in the canyon during flash-flood conditions.

Exotic Species Comments: There are relatively few exotic species on the entire ranch. Nonetheless, cheatgrass is present, as is tamarisk (albeit in very small amounts). Starlings occur around the ranch houses. Burros are on the ranch with estimated populations of about 60-70 (Wittenburg, personal communication). There are aoudad on the adjacent ranch. None are known to be outside of their fenced area.

Off-Site Considerations: The adjacent ranch, Cotton Mesa, is used as an elk ranch. Hunters are brought in to kill the fenced elk herd. Many animals are taken each year. There are also aoudad on this ranch.

Information Needs: Inventory is highly fragmented at this time. There is clearly an abundance of state rare species. The natural communities are poorly described.

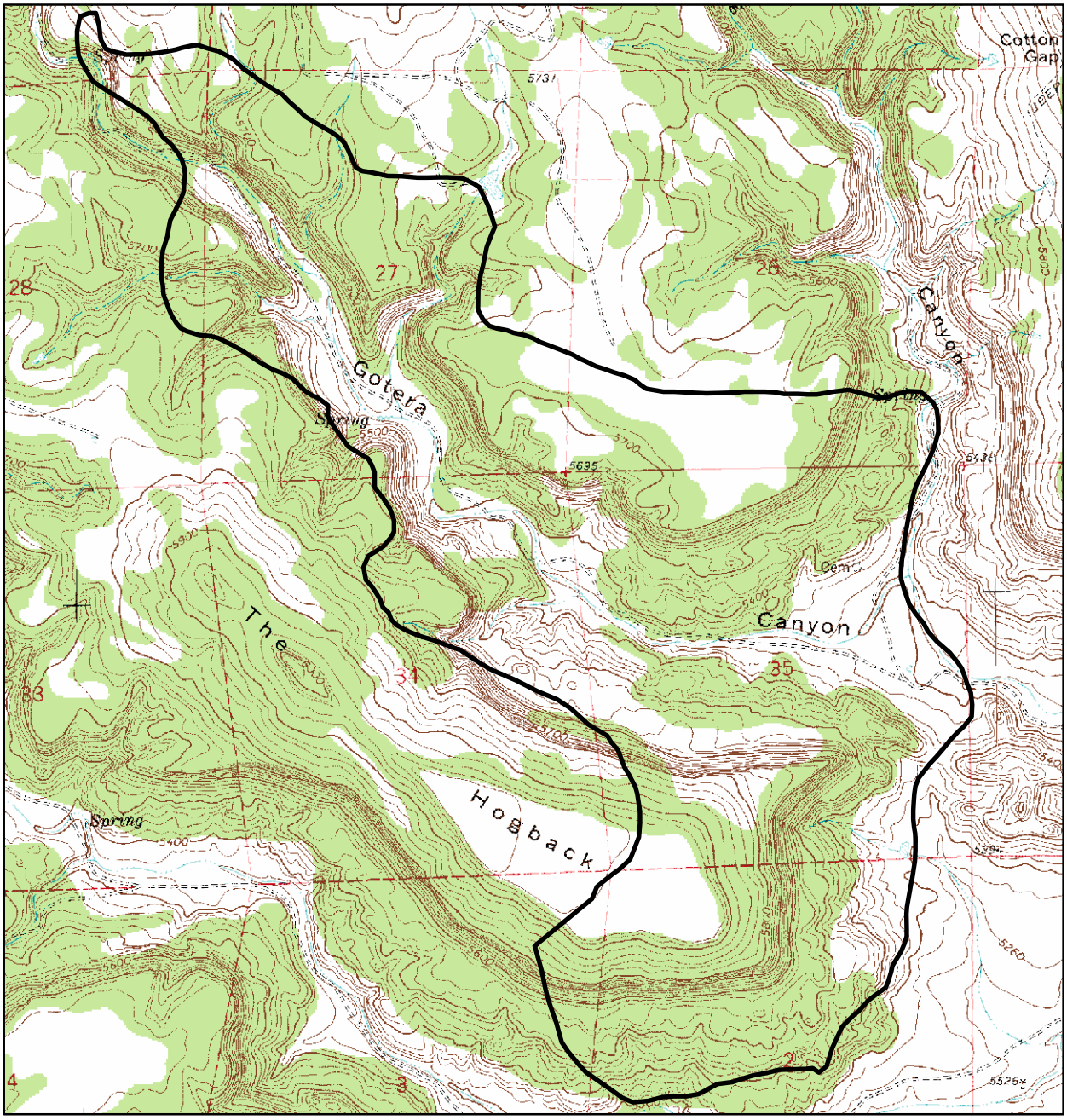
References

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Wittenburg, R. 1995. Personal Communication to CNHP.

Version Author: Pague, C.A.

Version Date: 01/14/1996



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NAD83 Zone 13

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Map Date: 01/29/2010

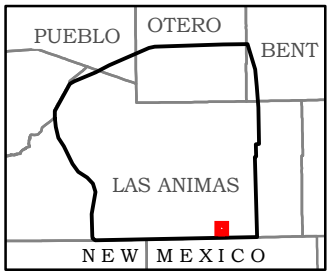
Legend

PCA Boundary

Cobert Mesa North, 37103-A5

7.5 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 19. Gotera Canyon Potential Conservation Area, B4: Moderate Biodiversity Significance

Apishapa River and Tributaries

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

Size: 13,398 acres (5,422 ha) **Elevation:** 4,880 - 5,920 ft. (1,487 - 1,804 m)

General Description: The Apishapa River and Tributaries site includes the main channel of the Apishapa and its larger tributaries within the center reach of the river. Parts of the northern portion of the site include some of the extensive canyon system within the Apishapa State Wildlife Area and the views into the network of red sandstone canyons of the wildlife area 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 Apishapa River has long seen human habitation, and now contains 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 that house 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. In the southern portion of the site the Apishapa River flows through a landscape of less relief that is dominated by shortgrass prairie. In this portion of the site some of the flats above the Apishapa contain large areas of greasewood and shadscale shrubland. Here the main channel of the Apishapa and its tributaries are at the same elevation as the surrounding landscape and yet the drainage still supports seasonally flooded pools and spring fed ponds that also house populations of the plains leopard frog.

Key Environmental Factors: The main environmental factor sustaining the plains leopard frog is the natural flows of surface and ground waters. These flows are fairly intact, although there are some developed cattle ponds within the area and there are, scattered throughout the area, cattle tanks that are pumping ground water for livestock use. However, the pools and springs of the Apishapa River and its canyons are still receiving substantial amounts of water, but during periods of drought water use might influence viability of the plains leopards frogs at this site.

Land Use History: Much of the following information regarding land use history is from Friedman 1985. The area of this site 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. Cattle and sheep ranching dominated the area until around 1909 when homesteaders engaged in dryland farming fenced the land. In the 1920s and 1930s, the 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 the private lands of this site.

Biodiversity Significance Rank Comments (B5): The site supports two extant occurrences of the state rare (G5/S3) plains leopard frog (*Rana blairi*).

Natural Heritage element occurrences at the Apishapa 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	E	2009-08-12
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	2009-05-21

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

Boundary Justification: The site contains the middle reach of the Apishapa River, its major tributaries, and their associated canyons. It uses a buffer of 300m on each side of the canyon to ensure inclusion of the river channel, the floodplain, and the walls and bottoms of the canyons. The buffer is intended to protect the physical structure of the floodplain and canyons, as well as their associated surface and groundwater flows that the population of plains leopard frogs are dependent upon. Protection of the river and its flows is also necessary for sustaining the frog population.

Protection Urgency Rank Comments (P4): The site is a mixture of private and State lands. 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): 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 frog 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 frogs from unnatural levels of predation and competition.

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 canyon system of the Apishapa State Wildlife Area include steep slopes and cliffs and safety should be considered when hiking within these areas.

Exotic Species Comments: The introduction of exotic animals (e.g., fishes, bullfrogs) should be prohibited to prevent unnatural levels of predation and competition. Management also needs to consider the expansion of exotic plants, especially cheatgrass (*Bromus tectorum*) and tamarisk (*Tamarix ramosissima*), which occur in the floodplain, valley bottoms, and along the stream banks. Short duration, intensive grazing in the floodplain and canyon bottoms may be used as a management tool for control of cheatgrass and other weedy species (Johnston and Reed 1991). The existence of tamarisk in the riparian area may be of concern. Tamarisk's ability to outcompete native vegetation and its high rate of proliferation make it difficult to manage, and it will present long-term challenges to land managers (Johnston and Reed 1991).

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.

References

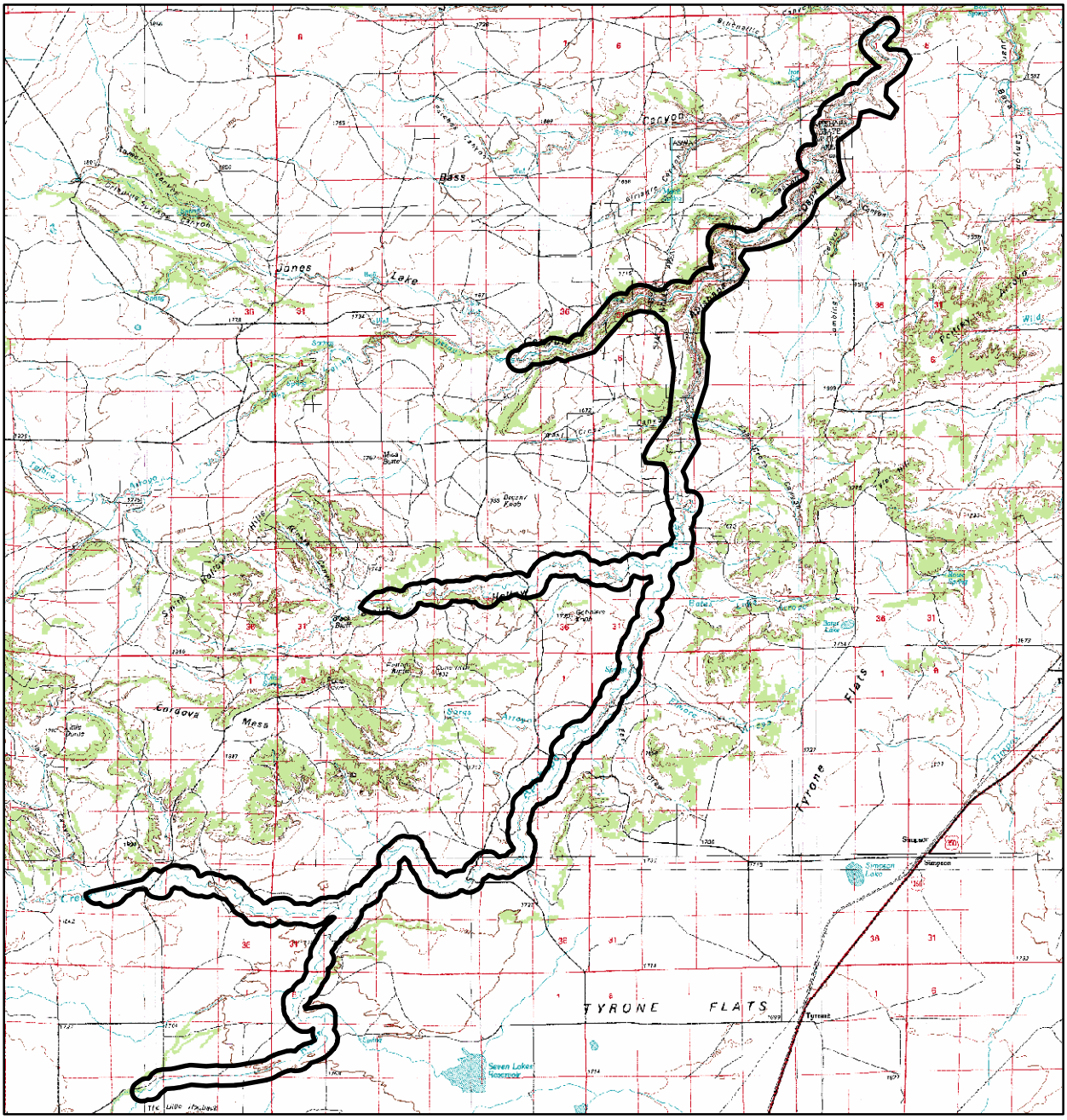
Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Johnston, Barry C. and Floyd Reed. 1991. Ecological inventory of Picketwire Canyonlands. USDA Forest Service, Comanche National Grassland. 22pp.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Sovell, J.R.
Version Date: 01/26/2010



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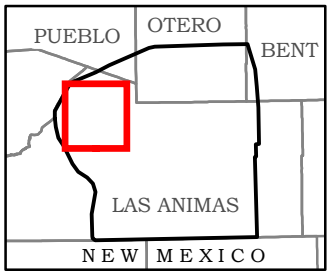
Legend

PCA Boundary

Trinidad, 37104-A1
Walsenburg, 37104-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 20. Apishapa River and Tributaries Potential Conservation Area, B5: General Biodiversity Interest

Smith, Vogel and McMahon Canyons

Biodiversity Rank - B5: General Biodiversity Interest

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

Size: 13,369 acres (5,410 ha) **Elevation:** 4,180 - 4,880 ft. (1,274 - 1,487 m)

General Description: The Smith, Vogel, and McMahon Canyons site includes Smith and Vogel Canyons and McMahon Arroyo, as well as parts of the Purgatoire River and some of their side canyons. A large portion of the site includes the broad valley bottoms of the Purgatoire River and Smith Canyon. Parts of the site rise from the canyon floor to the top of the surrounding plateaus that include river terraces of various size and steep rocky canyon walls. Within this setting are a series of mesas and inter-fluvial plateaus ranging from small to large. The areas within the main valley of the Purgatoire River and Smith Canyon have long been used for human habitation, and now contain a number of non-native species including cheatgrass and tamarisk, but there are also a number of native species present including blue grama, needle-and-thread grass, sand dropseed, sagebrush, rabbitbrush and greasewood. Cottonwood forests are also present along the Purgatoire River as are irrigated pasturelands. The deep side canyons are more inaccessible and typically contain communities of mostly native vegetation. The broad valley and the bottoms of the side canyons support seasonally flooded pools that house populations of Couch's spadefoot, green toad, and plains leopard frog. At the higher elevations of the site there are open juniper woodlands with an abundance of bedrock and bare ground, cactus, yucca, and various native grasses.

Key Environmental Factors: The important feature sustaining the amphibian populations is the natural flows of surface and ground waters. Couch's spadefoot and the green toad rely upon the summer monsoons that stimulate them to emerge from their subterranean estivation to breed in the temporary ponds created by the heavy runoff. These runoff flows are fairly intact, although there are some developed cattle ponds at the head of some canyons and there are, scattered throughout the area, cattle tanks that are pumping ground water for livestock use. However, the valley and canyon pools are still receiving substantial amounts of water. The developed ponds may actually create additional habitat for the green toad and Couch's spadefoot, but during periods of drought, water use might influence viability of the plains leopards frogs at this location.

Land Use History: Much of the following information regarding land use history is from Friedman 1985. People have inhabited the Purgatoire Canyon and surrounding

area 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 of the Purgatoire River by the late 1880s. Cattle and sheep ranching dominated the area until around 1909 when dryland farming homesteaders fenced the land. In the 1920s and 1930s, the Dust Bowl affected the Purgatoire Canyon and many abandoned their homes, leaving the area to sheep and cattle ranchers. While sheep grazing was mostly discontinued in the 1950s, cattle grazing continues today as the primary land use on most private lands of the site.

Cultural Features: There are numerous archaeological and paleontological sites in the canyons of the Purgatoire and Chacuaco River and probably in the canyons of the surrounding area including Smith Canyon.

Biodiversity Significance Rank Comments (B5): The site supports an occurrence of the state imperiled (G5/S1) Couch's spadefoot (*Scaphiopus couchii*), two occurrences of the state rare (G5/S2) green toad (*Bufo debilis*) and several occurrences of the state vulnerable (G5/S3) plains leopard frog (*Rana blairi*).

Natural Heritage element occurrences at the Smith, Vogel and McMahon Canyons 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					1995-07-22
Amphibians	Bufo debilis	Green Toad	G5	S2				E	1997-08-09
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	2008-99-99
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	1996-08-31
Amphibians	Rana blairi	Plains Leopard Frog	G5	S3		SC	BLM/ USFS	E	1997-08-10
Amphibians	Scaphiopus couchii	Couch's Spadefoot	G5	S1		SC		E	1997-08-10

** 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 McMahon Arroyo and

Smith and Vogel canyons and 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. Hydrology is particularly important to the elements found on the valley bottom, the buffer is intended to protect the surface and groundwater flows that the amphibian populations depend upon, but the site only nominally includes the sphere of hydrologic influence. Hydrologic modifications (e.g. groundwater pumping) have the potential to affect the site hydrology from outside the site boundary.

Protection Urgency Rank Comments (P3): The site is a mixture of private land, State land, and USFS land (Comanche National Grasslands). 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 or incorporating Farm Bill programs such as the Wetland Reserve Program).

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 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 amphibian population from unnatural levels of predation and competition. Some portions, particularly the valley bottoms, have been invaded by non-native weedy species such as tamarisk, cheatgrass, and kochia, and management is needed to eliminate these species and revegetate degraded areas with native species appropriate to the communities. Such restoration although important to the overall quality of the natural resource is not imperative to the viability of the amphibian population. It would also be beneficial over the long-term for owners and managers take measures to halt the increasing spread of non-native species. Such efforts might include simulating more natural grazing and fire regimes using prescribed burning and altered grazing rotations. To be most effective this will require collaboration among the public and private landowners.

Land Use Comments: The current level of livestock grazing is compatible with the continued viability of the elements of concern.

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

Exotic Species Comments: The introduction of exotic animals (e.g., fishes, bullfrogs) should be prohibited to prevent unnatural levels of predation and competition. Management also needs to consider the expansion of exotic plants, especially cheatgrass (*Bromus tectorum*) and tamarisk (*Tamarix ramosissima*), which occur in the valley bottoms and along the stream banks. Short duration, intensive grazing in the canyon bottom may be used as a management tool for control of cheatgrass and other weedy species (Johnston and Reed 1991). The existence of tamarisk in the

riparian area may be of concern. Tamarisk's ability to outcompete native vegetation and its high rate of proliferation make it difficult to manage, and it will present long-term challenges to land managers (Johnston and Reed 1991).

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 amphibians occupying the site.

References

Friedman, Paul D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

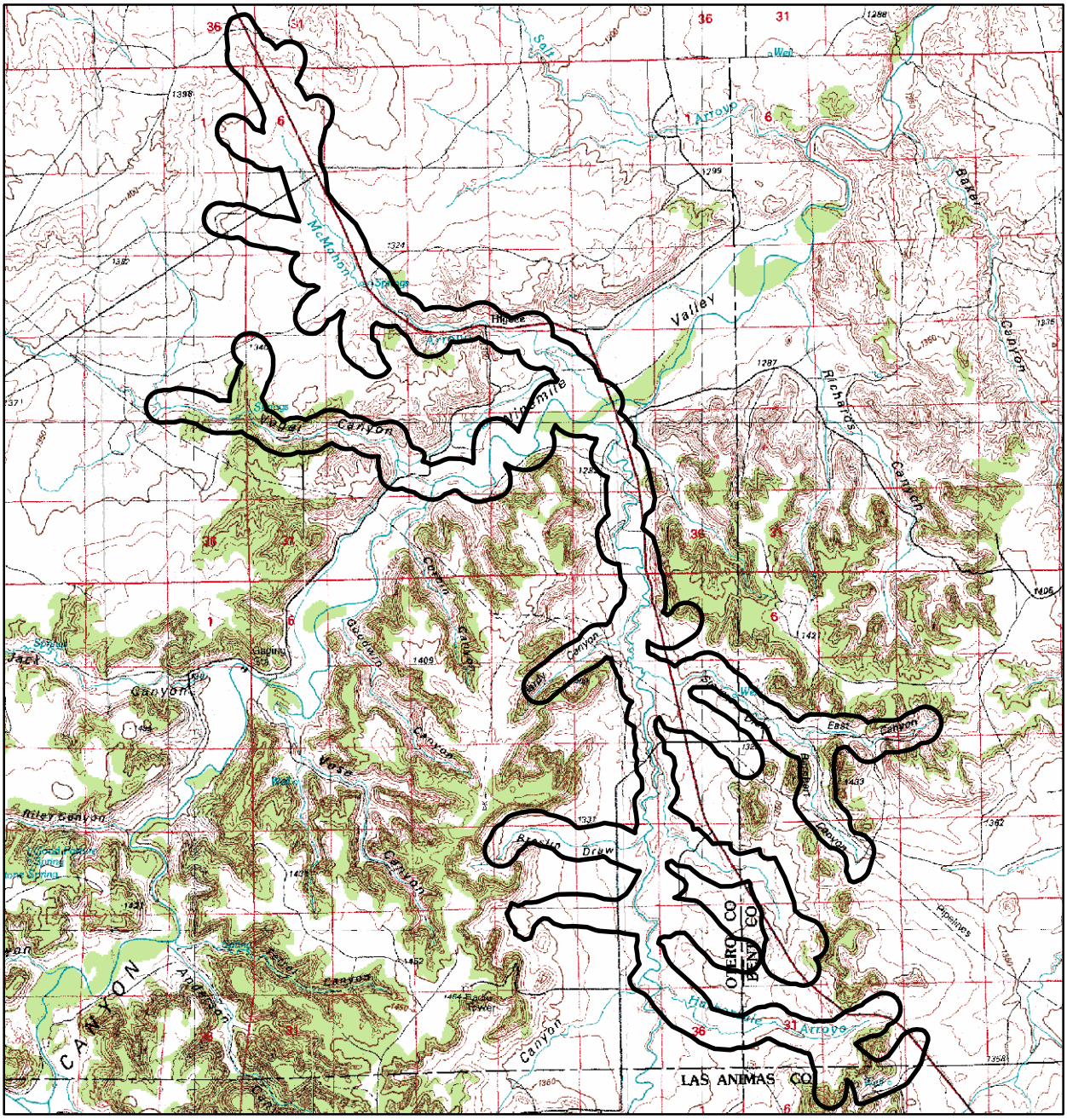
HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page:

Johnston, Barry C. and Floyd Reed. 1991. Ecological inventory of Picketwire Canyonlands. USDA Forest Service, Comanche National Grassland. 22pp.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Final Report: Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Version Author: Sovell, J.R.

Version Date: 01/26/2010



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Projection: UTM
NAD83 Zone 13

Colorado Natural Heritage Program
Colorado State University
254 General Services Building
1474 Campus Delivery
Fort Collins, CO 80523-1474

Ph (970) 491-1309
Fax (970) 491-3349
www.cnhp.colostate.edu

Map Date: 01/26/2010

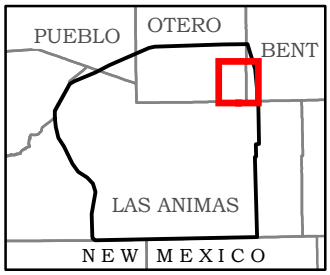
Legend

PCA Boundary

La Junta, 37103-E1

30x60 Minute Digital Raster Graphics Produced by the U.S. Geological Survey

Location in Project Area



Map 21. Smith, Vogel and McMahon Canyons Potential Conservation Area, B5: General Biodiversity Interest

LITERATURE CITED

Colorado Division of Wildlife. 2001-2003. Basinwide Vegetation Classification. Online at http://www.ndis.nrel.colostate.edu.

Comanche National Grassland. 1993. Picket Wire Canyonlands Interim Management Direction, 2nd draft. U.S.D.A. Forest Service.

Culver, D., M. A. March, S. Kettler and C. Pague. 1996. Natural Heritage Inventory of Significant Animals and Plants and Classification of Riparian Plant Associations: Timpas Grazing District and Kim Grazing Association. unpub CNHP report for U.S. Forest Service. 215+ p.

Friedman, P. D. 1985. Final Report of History and Oral History Studies of the Fort Carson Pinon Canyon Maneuver Area, Las Animas, Colorado. USDI. National Park Service, Interagency Archaeological Services Branch, Rocky Mountain Regional Office, Denver, CO.

HPRCC. 2008. High Plains Regional Climate Center Web Page. Based on data from automated weather stations operated by Colorado for southeastern Colorado area. High Plains Regional Climate Center Web Page: http://www.hprcc.unl.edu

Johnson, R.B. 1969. Geologic map of the Trinidad quadrangle south-central Colorado. Miscellaneous Geologic Investigations. Map 1-558. USGS.

Johnston, B. C. and F. Reed. 1991. Ecological inventory of Picketwire Canyonlands. USDA Forest Service, Comanche National Grassland. 22pp.

Kauffman, E.G. 1977. Geological and biological overview: Western interior Cretaceous basin. The Mountain Geologist, v. 14, nos. 3-4; p. 75-99.

Larsen, Roy J., Donald L. Martin, and M. Bruce McCullough. 1972. Soil Survey of Otero County, Colorado. Soil conservation Service. 84pp.

Neid, S., K. Decker, J. Handwerk, and S. Spackman Panjabi. 2007. Rare Plant Surveys on Pinon Canyon Maneuver Site 2006-2007. Colorado Natural Heritage Program, Fort Collins, CO.

Rondeau, R.J., J.R. Sovell, J.E. Stevens, D. Clark and L. Grunau. 2010. Southeast Colorado Survey of Critical Biological Resources 2009. Addendum to the 2007 Survey. Colorado Natural Heritage Program, Fort Collins, CO.

Spackman Panjabi, S. and K. Decker. 2007. Front Range Eco-regional Partnership Invasive Plant Species Strategic Plan. Unpublished report prepared for the U.S. Department of Defense by the Colorado Natural Heritage Program, Fort Collins, CO.

Stevens, J., J. Sovell, D. Culver, K. Decker, L. Grunau, A. Lavender, and C. Gaughan. 2008. Final Report: Southeastern Colorado Survey of Critical Biological Resources 2007. Colorado Natural Heritage Program, Fort Collins, CO.

Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

U.S. Department of Agriculture, Soil Conservation Service. 1994. State Soil Geographic (STATSGO) database for Colorado. Fort Worth, TX.

Wittenburg, R. 1995. Personal Communication to CNHP.

APPENDIX B: SPECIES AND COMMUNITY PROFILES

Animals

Elsa Sphinx Moth (*Sagenosoma elsa*)
A Tiger Moth *(Pygarctia neomexicana)*
New Mexico Threadsnake (*Leptotyphlops dissectus*)

Plants

Golden Columbine (*Aquilegia chrysantha* var. *rydbergii)*
Fendler Cloak-fern *(Argyrochosma fendleri)*
Green Spleenwort (*Asplenium trichomanes-ramosum)*
Eaton's Lipfern (*Cheilanthes eatonii*)
Giant Helleborine (*Epipactis gigantean*)
Purple-stem Cliffbrake (*Pellaea atropurpurea*)

Plant Communities

Black Grama - Hairy Grama Shortgrass Prairie (*Bouteloua eriopoda - Bouteloua hirsuta* Herbaceous Vegetation)
Shale Barren Shrubland (*Frankenia jamesii / Achnatherum hymenoides* Shrubland)
One-seed Juniper/Bigelow Sagebrush Woodland *(Juniperus monosperma / Artemisia bigelovii* Woodland)
Foothills Pinyon-Juniper Woodlands/Scarp Woodlands *(Juniperus scopulorum / Cercocarpus montanus* Woodland)
Rocky Mountain Juniper/ Mountain Mahogany woodland (*Juniperus scopulorum / Cercocarpus montanus* Woodland)
Great Plains Salt Meadows (*Muhlenbergia asperifolia* Herbaceous Vegetation)
Desert Shrubland *(Nolina texana Shrubland)*
Vine-mesquite Herbaceous Vegetation *(Panicum obtusum* Herbaceous Vegetation)
Plains Cottonwood Riparian Forests *(Populus deltoides / Panicum virgatum - Schizachyrium scoparium*Woodland)
Skunkbush - Littleleaf Mock Orange Shrubland (*Rhus trilobata - Philadelphus microphyllus* Shrubland)

ANIMAL ABSTRACTS

INSECTS

Elsa Sphinx Moth (*Sagenosoma elsa*)

Photo courtesy of Mississippi State University Entomological Museum

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. 2010).

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. 2010).

State Range: In Colorado the species has been recorded in the extreme southwest and extreme southeast portions of the state (Opler at al. 2010).

Habitat Comments: The habitat associations for this species have not been reported, however, the larval host plants are probably plants in the nightshade family (Solanaceae) (Opler et al. 2010).

Distribution/Abundance: Little is known about the rangewide distribution and abundance of this species. There is only one record of this species in CNHP's database from Las Animas County.

Known Threats and Management Issues: No information on the threats for this species is currently available (Opler et al. 2010). More research is needed on the population status and the ecological requirements of this species from throughout its range.

A Tiger Moth (*Pygarctia neomexicana*)

Taxonomy:
Class: Insecta
Order: Lepidoptera
Family: Noctuidae
Genus: *Pygarctia*

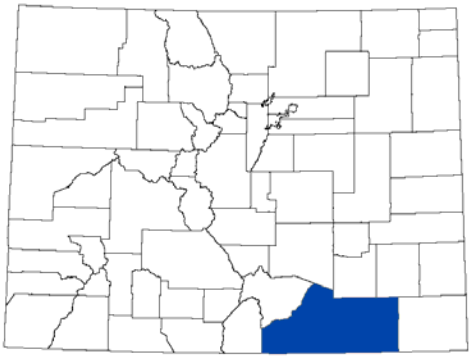
Photo Michael Menefee

Taxonomic Comments: Following Lafontaine and Fibiger (2006) and Schmidt and Opler (2008) the traditional Arctiidae have been transferred to the fareated as tribes. The circumscription of Arctiinae remains virtually identical to recent circumscriptions of Arctiidae, but circumscriptions of some taxa within the Arctiinae have changed. This is a very small genus with between 6 and 20 species (NatureServe 2009).

CNHP Rank: G3 S1

State/Federal Status: None.

Phenology: Little is known about the life cycle of this tiger moth (Opler et al. 2010).



Colorado Distribution (Opler *et al*. 2006)

Global Range: This tiger moth has a limited distribution and ranges from southern Colorado, Arizona, Utah and Texas probably into northern Mexico (NatureServe 2009).

State Range: In Colorado the species has been recorded in the extreme southeast of the State in Las Animas County .

Habitat Comments: The habitat associations for this species have not been reported, however, the larval host plant are milkweeds in the genus *Asclepias* that in Colorado inhabit the shale hills of southeastern Colorado (Neid et al. 2007).

Distribution/Abundance: Little is known about the rangewide distribution and abundance of this species. There is only one record of this species in CNHP's database from Las Animas County.

Known Threats and Management Issues: No information on the threats for this species is currently available (Opler et al. 2010). More research is needed on the population status and the ecological requirements for this species from throughout its range.

REPTILES

New Mexico Threadsnake (*Leptotyphlops dissectus*)

Photo William Wells

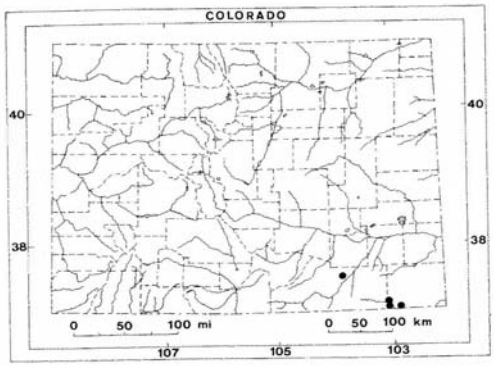
Taxonomy:
Class: Reptilia
Order: Squamata
Family: Leptotyphlopidae
Genus: *Leptotyphlops*

Taxonomic Comments: Dixon and Vaughan (2003) examined morphological variation in 867 individuals of Mexican and U.S. *Leptotyphlops* allied with *L. dulcis* and concluded that *L. dissectus*, *L. dulcis*, and *L. myopicus* (a Mexican species) should be regarded as distinct species. Formerly *dissectus* and *myopicus* were treated as subspecies of *L. dulcis*. Crother et al. (2003) adopted this taxonomic revision (NatureServe 2009).

CNHP Rank: G4G5 S1

State/Federal Status: None.

Phenology: This snake is active on the ground surface at night, especially in association with warm rains. In Colorado, this snake is active from May through September and it will form mating aggregations after which it lays clutches of from 2 to 7 eggs in underground cavities in late June or early July (Hammerson 1999).



Global Range: This snake inhabits southern New Mexico, southeastern Colorado, southern Kansas, Oklahoma, Texas, and north-central and northeastern Mexico (Hammerson 1999).

State Range: In Colorado the species has been recorded in the extreme southwestern Baca County and north-central Las Animas County.

Habitat Comments: Habitats include prairies and prairie canyons, rocky and sandy deserts, and pinyon-juniper and juniper-oak woodland (Degenhardt et al. 1996, Tennant 1998, Hammerson 1999, Ernst and Ernst 2003). This fossorial snake is usually found in damp loose soil and sometimes under rocks, logs, or debris.

Distribution/Abundance: Little is known about the rangewide distribution and abundance of this species, however it is probably scarce and it is considered extremely rare in Colorado because of the small number of occurrences, highly restricted state range, and assumed low numbers (Hammerson 1999). There are only four verified records of this snake in Colorado (all in Baca County) and one unverified record from Las Animas County, however, this secretive snake is difficult to detect and there probably are more undiscovered occurrences in southeastern Colorado.

Known Threats and Management Issues: There appear to be no threats to this species as the land use patterns throughout its range in Colorado are stable and compatible with the continued viability of existing populations (Hammerson 1999). There is a great deal of suitable habitat for the New Mexico threadsnake in southeastern Colorado and further inventory efforts are needed at known and probable occurrence sites.

LITERATURE CITED

Bard, D. 2002. Black-footed ferrets return to Mexico. Endangered Species Bulletin 27(2):36-37.

CDOW 2007. Species profile. http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/

Clark, T .W., S. C. Forrest, L. Richardson, D. Casey, and T. M. Campbell, III. 1986. Descriptive ethology and activity patterns of black-footed ferrets. Great Basin Naturalist 8:72 – 84.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Crother, B. I., J. Boundy, J. A. Campbell, K. de Quieroz, D. Frost, D. M. Green, R. Highton, J. B. Iverson, R. W. McDiarmid, P. A. Meylan, T. W. Reeder, M. E. Seidel, J. W. Sites, Jr., S. G. Tilley, and D. B. Wake. 2003. Scientific and standard English names of amphibians and reptiles of North America north of Mexico: update. Herpetological Review 34:198-203.

Degenhardt, W. G., C. W. Painter, and A. H. Price. 1996. Amphibians and reptiles of New Mexico. University of New Mexico Press, Albuquerque. xix + 431 pp.

Dixon, J. R., and R. K. Vaughan. 2003. The status of Mexican and southwestern United States blind snakes allied with *Leptotyphlops dulcis* (Serpentes: Leptotyphlopidae). Texas Journal of Science 55(1):3-24.

Ernst, C. H., and E. M. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Books, Washington, D.C.

Federal Register, 20 March 1996. EPA: Federal Register: Endangered and Threatened Wildlife and Plants Establishment.

Federal Register, 29 April 1997. Endangered and Threatened Wildlife and Plants: Proposed Establishment of a Nonessential Experimental Population of Black-footed Ferrets in Northwestern Colorado and Northeastern Utah.

Fitzgerald, J. P., C. A. Meaney, D. M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History and University Press of Colorado, Niwot, Colorado.

Forrest, S. C., T. W. Clark, L. Richardson, T. M. Campbell III. 1985. Black-footed Ferret Habitat: Some Management and Reintroduction Considerations. Wyoming BLM Wildlife Technical Bulletin No.2.

Hammerson, G. A. 1999. Amphibians and reptiles in Colorado: a Colorado field guide. University Press of Colorado, Niwot.

Lafontaine, J.D. and M. Fibiger. 2006. Revised higher classification of the Noctuoidea (Lepidoptera). Canadian Entomologist 138:610-635.

Schmidt, B.C. and P.A. Opler. 2008. Revised checklist of the tiger moths of the Continental United States and Canada. Zootaxa 1677:1-23.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 11, 2010).

Neid, S., J. Handwerk, and S. Spackman Panjabi. 2007. Rare Plant Surveys on the Pinon Canyon Maneuver Site 2006-2007. Colorado Natural Heritage Program.

Oldemeyer, J. L., et al. 1993. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. U.S. Fish and Wildlife Service Biological Report 13. iii + 96 pp.

Opler, P. A., K. Lotts, and T. Naberhaus, coordinators. 2010. Butterflies and Moths of North America. Bozeman, MT: Big Sky Institute. http://www.butterfliesandmoths.org/ (Version 02112010).

Rickart, E. A. 1987. Spermophilus townsendii. Mammalian Species 268:1-6.

Tennant, A. 1998. A field guide to Texas snakes. Second edition. Gulf Publishing Company, Houston, Texas.

USFWS. 1994. Black-footed ferret reintroduction Conata Basin/Badlands, South Dakota. Final environmental impact statement. Federal Register 59(122):33005-33006.

USFWS. 2008. Black-footed Ferret (*Mustela nigripes*) 5-year status review: summary and evaluation. U.S. Fish and Wildlife Service, South Dakota Field Office, Pierre, South Dakota November 2008. 38 pages.

Wilson, D. E., and D. M. Reeder (editors). 2005. Mammal species of the world: a taxonomic and geographic reference. Third edition. The Johns Hopkins University Press, Baltimore. Two volumes. 2,142 pp.

State Name: ***Aquilegia chrysantha*** **var. *rydbergii* (golden columbine)**

Global Name: ***Aquilegia chrysantha*** **var. *rydbergii* (Golden Columbine)**

Taxonomy

Class: Dicotyledoneae
Order: Ranunculales
Family: Ranunculaceae

Taxonomic Comments: The Flora of North America (Vol. 3, 1997) questions the distinctiveness of the variety *rydbergii*, saying that material seen displays traits which fall within the normal variation for the species.

Ranks and Status

Global Rank: G4T1Q
State Rank: S1
Federal Protection Status: BLM and USFS Sensitive Species
State Protection Status: None

Description and Phenology

Flowers yellow with long spurs; compound leaves are bluish-green, basal leaves are twice ternate (Spackman et al. 1997).

Look Alikes: Other species of columbine in south-central Colorado are blue and white, or red. This is the only all yellow columbine in the area (pers. comm. Jennings, 1994). All yellow forms of *A. elegantula* do occur at higher elevations in the mountains of southwestern Colorado which may look similar to this species (pers. comm. Coles 1994).

Phenology: The few collections known from Colorado suggest that this species flowers in June.

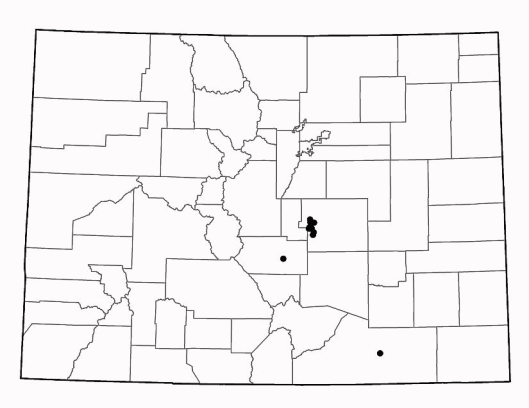
Habitat

In canyons and foothills along streams or in rocky ravines (Weber and Wittman 2001).

Elevation Range Feet: 5,500 - 6,000
Elevation Range Meters: 1,676 - 1,828

Distribution

Global Range: Endemic to Colorado; known from Fremont, El Paso, and Las Animas counties. The Flora of North America (Vol. 3, 1997) states that Colorado populations have been called *A. chrysantha* var. *rydbergii* and does not mention New Mexico or Arizona. Reports from New Mexico and Arizona are probably erroneous, possibly originating because NM and AZ are listed in the range of var. *rydbergii* in the 1985 Notice of Review for Listing as Endangered or Threatened Species. These reports have not otherwise been substantiated.



Threats and Management Issues

The species is most vulnerable to habitat loss caused by activities associated with recreation (Ladyman 2005). Much of the habitat for this taxon has already been severely altered and degraded. Occupied habitat on the Pike-San Isabel National Forest is currently managed primarily for recreation; hiking, biking, and horse-riding trails go through the existing occurrences (Ladyman 2005). Habitat encroachment by invasive weeds and livestock grazing are other potential threats. Long-term population sustainability may be vulnerable to declines in pollinator populations. As urbanization encroaches upon natural habitat, introduction of horticultural varieties of *A. chrysantha* may also become a concern. These varieties could hybridize with the natural populations and thus cause genetic dilution (Ladyman 2005). Hydrologic alteration could also impact this species. This plant occurs on land managed by the USFS, Department of Defense, BLM, City of Colorado Springs, El Paso County, and private land. There are no plans that specifically address the management of this taxon.

References

Coles, J. 1994. Personal communication about Rare Plant Guide Species.

Flora of North America Editorial Committee. 1997. Flora of North America north of Mexico. Vol. 3. Magnoliophyta: Magnoliidae and Hamamelidae. Oxford Univ. Press, New York. xxiii + 590 pp.

Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Jennings, W. 1994. Personal communication with CNHP staff.

Ladyman, J.A.R. 2005. Aquilegia chrysantha A. Gray var. rydbergii Munz (Rydberg's golden columbine): A Technical Conservation Assessment. [Online]. USDA Forest Service, Rocky Mountain Region. http://www.fs.fed.us/r2/projects/scp/assessments/aquilegiachrysanthavarrydbergii.pdf [2006-01-12]

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by Colorado Natural Heritage Program.

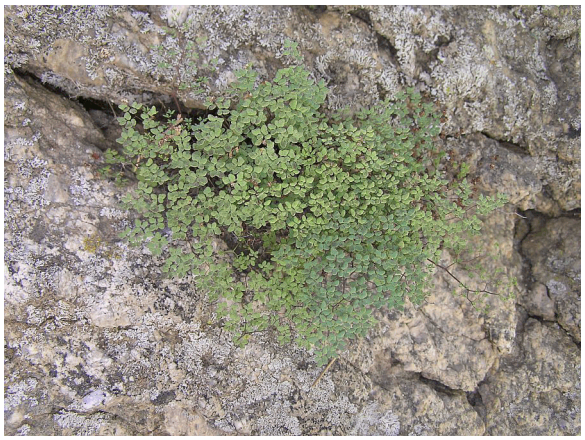
Weber, W. A. 1990. Colorado Flora: Eastern Slope. University Press of Colorado, Niwot, CO.

Weber, W. A. and R. C. Wittmann. 1992. Catalog of The Colorado Flora: A Biodiversity Baseline. University Press of Colorado, Niwot, CO.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

Version Date: 02/15/2010

State Name: *Argyrochosma fendleri* **(Fendler cloak-fern)**
Global Name: *Argyrochosma fendleri* **(Fendler Cloak-fern)**



Taxonomy
Class: Filicopsida
Order: Filicales
Family: Pteridaceae

Taxonomic Comments: Weber and Wittmann (2001) include this species in the Sinopteridaceae, the Lipfern family. Lellinger (1985) lists as *Notholaena fendleri*.

Ranks and Status
Global Rank: G3
State Rank: S3
Federal Protection Status: None
State Protection Status: None

Description and Phenology
Argyrochosma fendleri is a very delicate looking fern. Stipes (petioles) are 3-16 cm long. Rachis branches are widely spreading and zigzag. Leaves are 4-6 pinnate, and have very small pinnules with a white waxy covering on the underside. Plants are rhizomatous (Weber and Wittmann 2001, Lellinger 1985, Harrington 1954).

Diagnostic Characteristics: The fronds are widely branched, with very small ternate pinnules, which are white waxy beneath.

Look Alikes: This species is not likely to be confused with other fern species in Colorado.

Phenology: The Colorado collections housed at the University of Colorado Herbarium were made between May 22 and September 28.

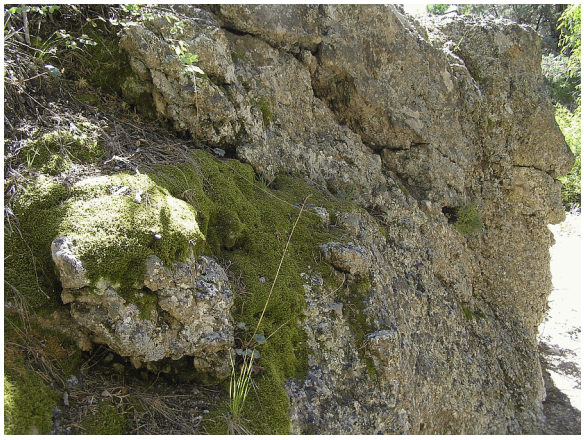
Habitat
Weber and Wittmann (2001) report that in Colorado this species is found on talus and cliff crevices of arid canyonsides. Colorado Natural Heritage Program occurrence records (2008) show that the species is often found on volcanic substrates within ponderosa pine or pinyon-juniper woodlands or various types of shrublands including Gambel's oak. Other commonly associated species include *Bouteloua gracilis* and *Selaginella mutica*. The species is found on slopes with variable aspects in Colorado, with an elevation range from just under 5000 feet in Baca County to about 9400 in Hinsdale County.

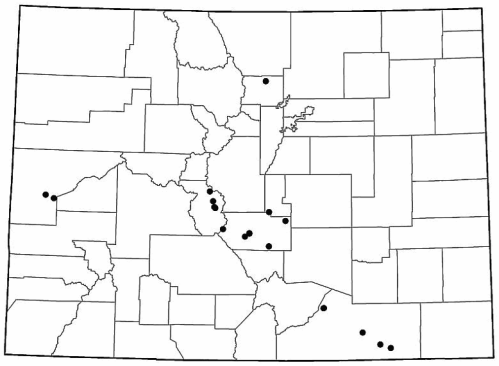
Elevation Range Feet: 5,000 - 9,400
Elevation Range Meters: 1,524 - 2,865

Distribution
Global Range: This species is found in Colorado, New Mexico, and Wyoming (Kartesz and the Biota of North America Program 1998, USDA NRCS 2007), and Sonora, Mexico (Flora of North America Editorial Committee 1993). Peripheral in Laramie County, in southeastern Wyoming (pers. comm. Walt Fertig WYNDD 1999 to Kim Fayette CNHP). This species is ranked S3 in Colorado, SNR in New Mexico, and S1 in Wyoming (NaureServe 2006). It is known from 16 counties in Colorado, 5 counties in New

Mexico, and 1 county in Wyoming (USDA NRCS 2007).

Colorado State Range: The University of Colorado Herbarium database (2007) shows that this species is known from 16 counties in Colorado: Alamosa, Baca, Boulder, Chaffee, Clear Creek, El Paso, Fremont, Gunnison, Hinsdale, Larimer, Las Animas, Mesa, Montrose, Park, Saguache, and Teller.





Threats and Management Issues

Anthropogenic threats appear to be minimal. One occurrence may be threatened by foot traffic. Most occurrences are in remote, rocky sites in areas that are used for recreation and/or cattle grazing.

References

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Flora of North America Editorial Committee. 1993. Flora of North America North of Mexico: Vol. 2. Oxford University Press, NY.

Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. 2nd edition. 2 vols. Timber Press, Portland, OR.

Kartesz, John and the Biota of North America Program. 1998. "A Synonymized Checklist of the Vascular Flora of the United States, Puerto Rico, and the Virgin Islands". http://plants.usda.gov. (May 15 1999).

Lellinger, D. B. 1985. A Field Manual of the Ferns and Fern-allies of the United States and Canada. Smithsonian Institution Press, Washington D.C.

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 16, 2007).

USDA, NRCS. 2007. The PLANTS Database (, 16 February 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

Weber, W.A. and R.C. Wittmann. 2001. Colorado Flora: Western Slope, Third Edition. University Press of Colorado, Niwot, CO.

Weber, W.A. and Ronald Wittmann. 1996. Colorado Flora: Western Slope. University Press of Colorado.

Weber, William A. and Ronald C. Wittmann. 1996. Colorado Flora: Eastern Slope.

Version Date: 02/23/2007

State Name: ***Asplenium trichomanes-ramosum*** **(green spleenwort)**
Global Name: ***Asplenium trichomanes-ramosum*** **(Green Spleenwort)**

Taxonomy
Class: Filicopsida
Order: Filicales
Family: Aspleniaceae

Taxonomic Comments: Generally called *Asplenium viride* in most floristic literature, but the Linnaean name *Asplenium trichomanes-ramosum* has priority. However, the 1994 ICBN (Tokyo), Article 23, example 14, provides that the '*trichomanes*' be dropped from this epithet, with the resulting name being *Asplenium ramosum*; that name, in turn, has been proposed for nomenclatural rejection (Zimmer & Greuter, Taxon 43: 303-304, 1994), which would revert usage back to the next-oldest name, apparently *Asplenium viride* again.

Ranks and Status
Global Rank: G4
State Rank: S1
Federal Protection Status: None
State Protection Status: None

Description and Phenology
Rhizomes short and scaly, but lacking median nerve; fronds 1 cm wide, up to 10 cm tall, densely tufted; stipes with deep groove and broad green margins, brown in lower part only, glabrous; pinnae herbaceous; sori near indistinct midvein (Hulten 1968).

Look Alikes: *Asplenium trichomanes-ramosum* is similar to *A. trichomanes*, but apparently not closely related (Hulten 1968).

Phenology: Produces spores from June through September (Great Plains Flora 1986).

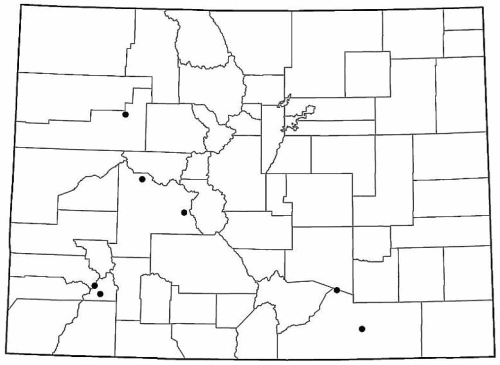
Habitat
Rock outcrops and crevices, commonly on limestone (Welsh 1974) and on talus slopes of limestone and other basic rocks (Lellinger 1985). Usually in moist areas, often near or above timberline (Cronquist 1972).

Elevation Range Feet: 5,000 - 12,000
Elevation Range Meters: 1,524 - 3,657

Distribution
Global Range: Yukon, southwestern District of Mackenzie, British Columbia, Alberta, Ontario, Quebec, NI, Nova Scotia, Canada; central Alaska, Vermont, north New York, northern Missouri, Dear County, Wisconsin, Montana, South Dakota, Utah, northeast Nevada, Oregon, Washington, northern California, United States and Mexico. Also in

southeast Greenland, Iceland and Eurasia. Known in California only from the Sierra Buttes (Skinner, 1997). In Idaho, occurring in Bear Lake and Clearwater Counties (Idaho Native Plant Society, 1992). In Nevada, known only from Elko County (Kartesz, 1988).

Colorado State Range: Known from and Garfield, Gunnison, Las Animas and San Juan counties.



Threats and Management Issues

Hydrologic alterations are the primary threat to this species. Anthropogenic threats appear to be minimal. Most occurrences are in remote, rocky sites in areas that are used infrequently for recreation and/or cattle grazing.

References

Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A. Volume One. Hafner Publishing CO. Inc. New York and London. 270pp.

Great Plains Flora Association. 1986. Flora of the Great Plains. University of Kansas Press, Lawrence. 1392 pp.

Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Hulten, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA.

Idaho Native Plant Society. 1992. Federal candidate (C1 and C2) and listed rare plants of Idaho. unpaginated.

Kartesz, J.T. 1988. A flora of Nevada. Ph.D. dissertation. Univ. Nevada, Reno. 3 volumes.

Lellinger, D. B. 1985. A Field Manual of the Ferns and Fern-allies of the United States and Canada. Smithsonian Institution Press, Washington D.C.

Skinner, M.W., and B.M. Pavlik, eds. 1997 (1994). Inventory of rare and endangered vascular plants of California. 1997 Electronic Inventory Update of 1994 5th edition, California Native Plant Society, Special Publication No. 1, Sacramento.

Welsh, S. L. 1974. Anderson's Flora of Alaska and Adjacent Canada. Brigham Young University Press, Provo, UT.

Version Date: 02/16/2010

State Name: ***Cheilanthes eatonii*** **(Eaton's lip fern)**
Global Name: ***Cheilanthes eatonii*** **(Eaton's Lipfern)**

Taxonomy
Class: Filicopsida
Order: Filicales
Family: Pteridaceae

Taxonomic Comments: Includes *Cheilanthes castanea.*

Ranks and Status
Global Rank: G5?
State Rank: S1S2
Federal Protection Status: None
State Protection Status: None

Description and Phenology
Fronds 3-16 cm long, 1.5-4 cm wide; stalk reddish-brown to purplish-black, with narrow, lance shaped scales, and a few hairs; leaflets 3 pinnate with many pale reddish-brown, curly hairs along with lance shape scales on the axes, margins strongly underrolled; rhizomes short-creeping (Lellinger 1985).

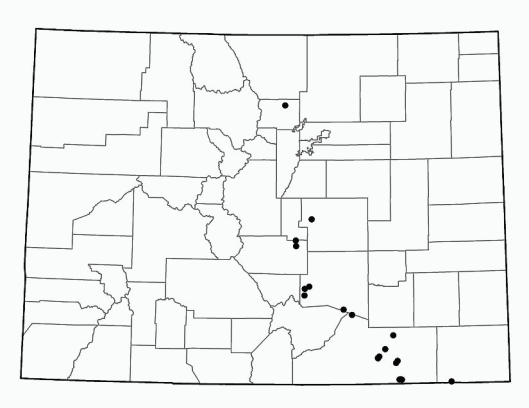
Phenology: *Cheilanthes eatonii* produces spores from June through September (Great Plains Flora 1986).

Habitat
Dry, exposed rocky ledges and hillsides (Great Plains Flora 1986). Epipetric in rock crevices of igneous or limestone rocks, on rock ledges, and terrestrial among boulders on talus slopes (Lellinger 1985). Rocky places and crevices (Harrington 1954).

Elevation Range Feet: 5,000 - 7,700
Elevation Range Meters: 1,524 - 2,346

Distribution
Global Range: Known from central Texas and western Oklahoma, New Mexico, Colorado and Utah (Lellinger 1985).

Colorado State Range: Known from Baca, Boulder, El Paso, Fremont, Las Animas, and Pueblo counties.



Threats and Management Issues

Hydrologic alterations are the primary threat to this species. Anthropogenic threats appear to be minimal. Most occurrences are in remote, steep, rocky sites in areas that are used infrequently for recreation and/or cattle grazing. Need to control invasive non-natives.

References

Cronquist, A., A.H. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A. Volume One. Hafner Publishing CO. Inc. New York and London. 270pp.

Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence, KS.

Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Lellinger, D.B. 1985. A field manual of the ferns and fern-allies of the U.S. and Canada. Smithsonian Institution Press, Washington, DC. 389 pp.

Weber, W. and R. Wittmann. 2001. Colorado Flora: Eastern Slope. Third edition.

Version Date: 02/17/2010

State Name: ***Epipactis gigantea*** **(helleborine)**
Global Name: ***Epipactis gigantea*** **(Giant Helleborine)**

Taxonomy
Class: Monocotyledoneae
Order: Orchidales
Family: Orchidaceae

Taxonomic Comments: The only native member of its genus in United States and Canada (Brunton 1986).There is a variant of *Epipactis gigantea* native to California that has wine-red leaves.

Ranks and Status
Global Rank: G4
State Rank: S2S3
Federal Protection Status: USFS Sensitive Species
State Protection Status: None

Description and Phenology
Giant Helleborine is a large perennial herb with leafy stems that are 30-100 cm tall and which arise from short rhizomes. The leaves are without petioles and up to 20 cm long; the lower are ovate, while the upper are lance-shaped. The herbage is rough to the touch or smooth and glabrous. The numerous flowers are borne singly in a long, narrow, leafy-bracted inflorescence located at the tops of the stems. The lance-shaped sepals are green with brownish stripes and approximately 15 mm long. The upper two petals are shorter and broader than the sepals. The lower petal is sac-like and longer and more reddish than the sepals. The nodding capsule is elliptic and bears many thousands of tiny seeds.

Diagnostic Characteristics: The tall stems with reddish flowers in the leaf axils make this species one of our most distinctive orchids. It is not easily confused with any other species.

Look Alikes: This is the only species of this genus occurring in Colorado; it should be readily distinguishable when in flower. Vegetatively, this species may resemble *Maianthemum stellatum*, but the leaves are "pleated" and a darker green. The flowers are conspicuous and greenish with purple-brown markings (Naumann 1990).

Phenology: Flowers in June and July, fruits August to September (Ryke et al. 1994).

Habitat

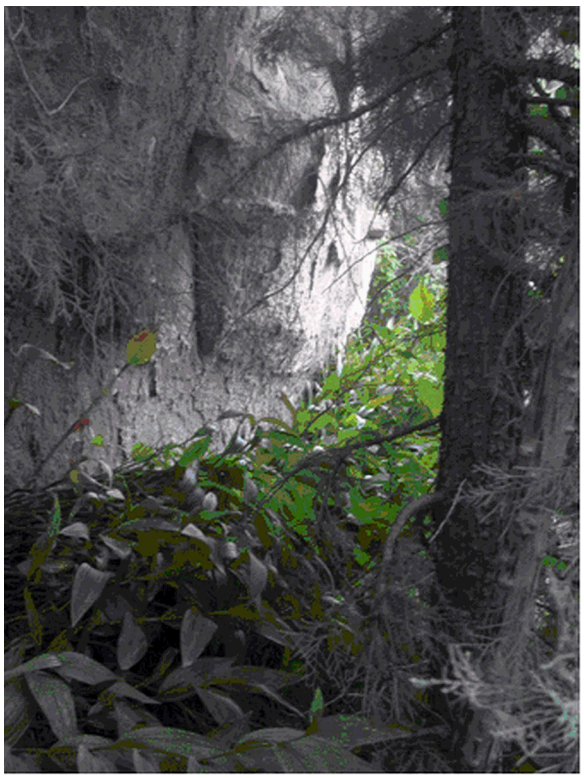
Epipactis gigantea occurs in moist situations (Harrington 1954), including streambanks, lake margins, springs and seeps, especially near thermal waters (Hitchcock and Cronquist 1973). It is frequently found within pinyon-juniper woodlands in seeps on sandstone cliffs, hillsides and springs at elevations from 4800 to 8,000 feet (Ryke et al. 1994).

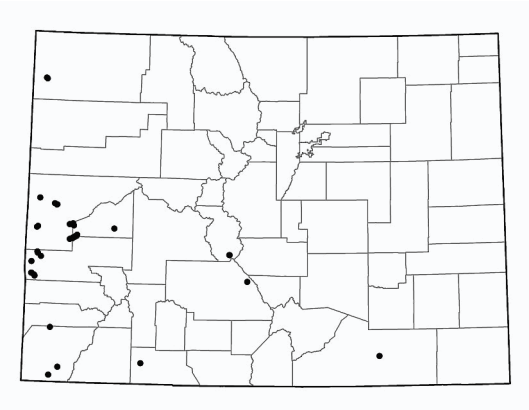
Elevation Range Feet: 4,800 - 8,000
Elevation Range Meters: 1,463 - 2,438

Distribution

Global Range: *Epipactis gigantea* grows from southern British Columbia in Canada to northern Mexico and eastwards in the United States to South Dakota and Texas. There has also been at least one collection made in central Mexico (San Luis Potosi).

Colorado State Range: Known from Archuleta, Chaffee, Delta, Las Animas, Mesa, Moffat, Montezuma, Montrose, and Saguache Counties.





Threats and Management Issues

Changes in the hydrologic regime may threaten this species. One site is potentially threatened by grazing and future development, and one is impacted by grazing and road use.

References

Berg, Ken, and Roxanne Bittman. 1988. Rediscovery of the Humboldt milk-vetch. Fremontia. 16(1):13-14.

Brunton, D. F. 1986. Status of the giant helleborine, EPIPACTIS GIGANTEA (Orchidaceae), in Canada. Canadian Field Naturalist. 100:414-417.

Burns-Balogh, P., D. L. Szlachetko, and A. Dafni. 1987. Evolution, Pollination, and systematics of the tribe NEOTTIEAE (ORCHIDACEAE). Pl. Syst. Evol. 156:91-115.

Cronquist, A., A. H. Holmgren, N. H. Holmgren, J. L. Reveal and P. K. Holmgren. 1977. Intermountain Flora Vascular Plants of the Intermountain West, USA: vol. 6. New York Botanical Garden, Bronx, NY.

Harrington, H. D. 1954. Manual of the Plants of Colorado. Sage Books, Denver, CO.

Hitchcock, C.L. and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA.

Idaho Native Plant Society. 1993. Federal candidate (C1 and C2) and listed rare plants of Idaho. unpaginated.

Mantas, M. 1993. Ecology and reproductive biology of EPIPACTIS GIGANTEA Dougl. (Orchidaceae) in northwestern Montana. M.S. thesis. University of Idaho. 73 pp.

Naumann, T. and L. Riedel. 1988. Field Survey to Dinosaur National Monument.

Naumann, T. S. 1990. Inventory of Plant Species of Special Concern and the General Flora of Dinosaur National Monument 1987-1989. Unpublished report prepared for the National Park Service Report, Denver, CO.

Ryke, N., D. Winters, L. McMartin and S. Vest. 1994. Threatened, Endangered and Sensitive Species of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands. May 25, 1994.

Schassberger, L. A . 1988. Status review of EPIPACTIS GIGANTEA, USDA Forest Service, Region 1, Flathead National Forest. Unpublished report. Montana Natural Heritage Program, Helena, MT. 42 pp.

Steele, B., F. Johnson, and S. Brunsfield, eds. 1981. Vascular plant species of concern in Idaho. Forest, Wildlife and Range Experiment Station, Moscow, ID. 161 pp.

Vanderhorst, J. and B. L. Heidel. 1995. Sensitive plant survey in the Tobacco Root Mountains, Madison County, Montana. Unpublished report to the Beaverhead and Deerlodge National Forests. Montana Natural Heritage Program. Helena, MT. 66 pp. plus appendices.

Vij, S. P. and G. C. Gupta. 1975. Cytological investigations into W. Himilayan Orchidaceae 1. Chromosome numbers and karyotypes of taxa from Kashmir. Cytologia 40:613-621.

Version Date: 04/15/2009

State Name: ***Pellaea atropurpurea*** **(purple cliff-brake)**
Global Name: ***Pellaea atropurpurea*** **(Purple-stem Cliffbrake)**

Taxonomy
Class: Filicopsida
Order: Filicales
Family: Pteridaceae

Ranks and Status
Global Rank: G5
State Rank: S2S3
Federal Protection Status: None
State Protection Status: None

Description and Phenology
Fronds green, glabrous, up to 25 cm long, 3-18 cm wide, fertile fronds longer than sterile ones; stalks purplish-black, pubescent; rhizomes much branched (Lellinger 1985, Spackman et al. 1997).

Look Alikes: Frequently confused with *Pellaea glabella* which often occurs in the same habitat but which is usually a smaller plant with a smooth shiny stipe (Coffin and Pfannmuller 1988). *Pellaea truncata* and *P. wrightiana* are similar but have glabrous stipes and rachises and sessile or short-stalked pinnae, while *P. atropurpurea* has pubescent stipes and rachises and long-stalked pinnae. *Pellaea occidentalis* (=*P. glabella* var. *occidentalis*) has sparse, spreading pubescence on stipes and rachises as opposed to the denser more appressed pubescence of *P. atropurpurea*. Also, all three other *Pellaea* species have monomorphic fronds rather than dimorphic as in *P. atropurpurea*, which has fertile fronds longer than sterile ones, and fertile pinnules narrower than the ovate to oblong sterile pinnules.

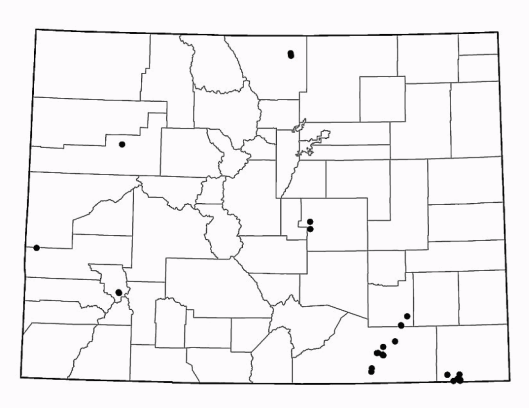
Phenology: Produces sporophytes from May to October (Great Plains Flora 1986). Herbarium records indicate that this species produces spores from July through September in Colorado.

Habitat
Reported from the mountainous part of Southern Colorado (Harrington 1950), on dry shaded ledges and crevices of limestone, sandstone, and basalt. Rare and local on limestone ledges along sides of fairly deep arroyos in *Pinus edulis* woodlands with northeast exposure (Weber 1961). Exposed or shaded rocky slopes, ledges, or cliffs, calcareous or sandy soils (Great Plains Flora 1986).

Elevation Range Feet: 4,250 - 8,800
Elevation Range Meters: 1,295 - 2,682

Distribution
Global Range: Canada south to the Gulf states, Mexico and Central America (Spackman et al. 1997).

Colorado State Range: Known from Baca, El Paso, Garfield, Larimer, Las Animas, Montrose, Otero and Ouray counties.



Threats and Management Issues

Hydrologic alterations are the primary threat to this species. Anthropogenic threats appear to be minimal. Most occurrences are in remote, steep, rocky sites in areas that are used infrequently for recreation and/or cattle grazing. Need to control invasive non-natives.

References

Coffin, B. and L. Pfannmuller. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, St. Paul, MN.

Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence, KS.

Harrington, H. D. 1950. Colorado Ferns and Fern Allies. Colorado Agricultural Research Foundation, Fort Collins, CO.

Jennings, W. F. 1995. Personal communication about Rare Plant Guide Species.

Lellinger, D.B. 1985. A field manual of the ferns and fern-allies of the U.S. and Canada. Smithsonian Institution Press, Washington, DC. 389 pp.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bureau of Land Management, U.S. Forest Service and U.S. Fish and Wildlife Service by Colorado Natural Heritage Program.

Weber, W. A. 1961. Additions to the flora of Colorado. University of Colorado Studies Series in Biology 7:1-26.

Version Date: 02/18/2010

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Bouteloua eriopoda - Bouteloua hirsuta* Herbaceous Vegetation
State Common Name Shortgrass Prairie

Global Scientific Name: *Bouteloua eriopoda - Bouteloua hirsuta* Herbaceous Vegetation
Global Common Name: Black Grama - Hairy Grama 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: G2
Global Rank Reasons: This foothill grassland has a limited distribution in the Southern Great Plains and Chihuahuan Desert ecoregions. Impacts, primarily from grazing, have led to invasion by desert shrubs, particularly honey mesquite (*Prosopis glandulosa*). There are only 12 recorded occurrences that are either protected from grazing or minimally impacted (mostly on military reserves).

Subnational Rank: SU
Subnational Rank Reasons: One element occurrence documented in Southeastern Colorado, other occurences reported from the same area. This association appears to be transitional between desert and plains grasslands. Further inventory work and data collection will clarify this and enable a rank other than SU to be assigned.

General Description: This association occurs on flat lands with ample soil depth as well as sandstone rim rock country where very little soil development exists. Aspects are predominantly northerly with increasing southern aspect as the elevation increases. This grassland is dominated by *Bouteloua hirsuta* with *Bouteloua eriopoda* as a codominant or subdominant associate. Shrubs are common but scattered. Precipitation occurs predominantly during summer months (70%) and mostly as "monsoon" thunderstorms. Late springs and early summers are typically very dry as are late falls. Overall,

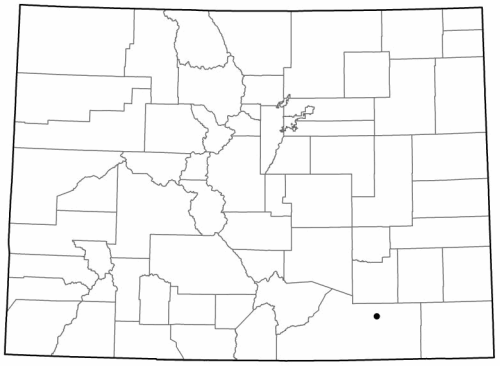
summers are hot, and winters can have periods of cold weather with occasional snows.

Vegetation: Grassland with occasional *Juniperus monosperma*. Dominant grass is *Bouteloua eriopoda* (30%, estimated) with *Bouteloua hirsuta* in the rocky areas; other species are *Bouteloua gracilis*, *Hilaria jamesii*.

Similar Communities: -

Regional Distribution: This association is found in southern and eastern New Mexico. It could potentially be found in western Texas, Oklahoma and northern Mexico.

Colorado Distribution: Documented in Las Animas County in southeastern Colorado.



Elevation Range in Colorado: 4,580.00 - 6,330.00 ft / 1,395.98 - 1,929.38 m

Site Geomorphology: Sandstone derived soils.

Soil: Soils are generally shallow and well-drained, with surface textures ranging from sandy loams to crevices in rock.

Successional and Ecological Processes: The *Juniperus monosperma* presence will ebb and flow in this association with the presence of fire. Because of this one could call this either *Juniperus monosperma* / *Bouteloua eriopoda* or *Bouteloua eriopoda* - *B. hirsuta*.

Adjacent Vegetation: -

Management: -

Literature Cited

Bourgeron, P. S., L. D. Engelking, H. C. Humphries, E. Muldavin, and W. H. Moir. 1993a. Assessing the conservation value of the Gray Ranch: Rarity, diversity and representativeness. Volume I. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 43 pp. plus appendices.

Bourgeron, P. S., L. D. Engelking, H. C. Humphries, E. Muldavin, and W. H. Moir. 1993b. Assessing the conservation value of the Gray Ranch: Rarity, diversity and representativeness. Unpublished report prepared for The Nature Conservancy by the Western Heritage Task Force, Boulder, CO. (Volume I and II).

Bourgeron, P. S., and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.

CONHP [Colorado Natural Heritage Program]. 2003. Unpublished data. List of

Elements and Elcodes converted and entered into Biotics Tracker 4.0. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Driscoll, R. S., D. L. Merkel, D. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service. Miscellaneous Publication No. 1439. Washington, DC. 56 pp.

Muldavin, E. 2001. Vegetation classification of New Mexico. New Mexico Natural Heritage Program, University of New Mexico, Albuquerque.

Muldavin, E., and P. Mehlhop. 1992. A preliminary classification and test vegetation map for White Sands Missile Range and San Andreas National Wildlife Refuge, New Mexico. University of New Mexico, New Mexico Natural Heritage Program.

NMNHP [New Mexico Natural Heritage Program]. No date. Unpublished data on file. Albuquerque, NM.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Shaw, R.B., S.L. Anderson, K.A. Schulz, and V.E. Diersing. 1989, Plant Communities, Ecological Checklist, and Species List for the U.S. Army Pinon Canyon Maneuver Site, Colorado. Colorado State University department of Range Science. Science Series No. 37. 71pp.

TNC [The Nature Conservancy]. 1985. Global Vertebrate Characterization Abstract Habitats. Unpublished document. The Nature Conservancy, Arlington, VA.

UNESCO [United Nations Educational, Scientific and Cultural Organization]. 1973. International classification and mapping of vegetation. Series 6, Ecology and Conservation. United Nations Educational, Scientific, and Cultural Organization. Paris. 93 pp.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Frankenia jamesii / Achnatherum hymenoides Shrubland*
State Common Name Foothills Shrubland

Global Scientific Name: *Frankenia jamesii / Achnatherum hymenoides Shrubland*
Global Common Name: -

Community Classification

System: Terrestrial Community - Other Classification
Class: Not determined at this time.
Subclass: -
Group: -
Subgroup: -
Formation: -
Alliance: -

Global Rank: G2
Global Rank Reasons: This association is documented from three counties in Colorado. It is not thought to be endemic, but the full global extent has not been assessed. Less than 20 occurrences globally are estimated to occur.

Subnational Rank: S2
Subnational Rank Reasons: Nine occurrences of this association have been documented from Colorado. It is estimated that up to 20 may occur. Most of the occurrences are in good condition.

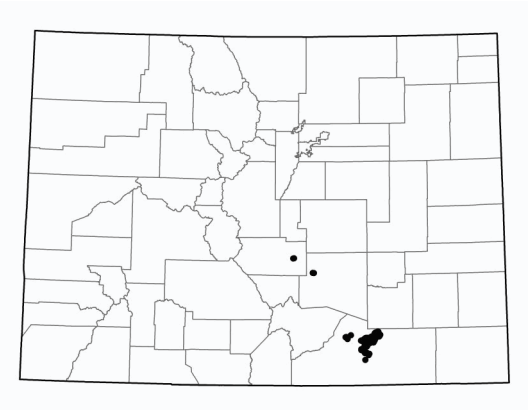
General Description: This community type is found on ridge tops and shale slopes near the mesa rim. The slopes of the shale barrens are dominated by *Frankenia jamesii / Achnatherum hymenoides*. Surrounding lands of *Juniperus monosperma / Hesperostipa neomexicana* and shortgrass prairie.

Vegetation: This association is dominated by *Frankenia jamesii* (documented with up to 100% coverage) with *Achnatherum hymenoides* present with 3-10% coverage. Other graminoids present may include *Hesperostipa neomexicana, Hilaria jamesii, Aristida purpurea, Bouteloua gracilis*. Forbs documented with 0-12% cover. Shrub cover: *Juniperus (Sabina) monosperma* may be present; *Artemisia bigelovii* may be present near the rim. *Glossopetalon planitierum* is always present with *Frankenia jamesii* (indicators) and form scattered clumps with an overall cover of less than 3%. Surrounding lands are typically shortgrass prairie and juniper savannah.

Similar Communities: -

Regional Distribution: This association has been documented from southeastern Colorado and is expected to occur into New Mexico along the shale barrens.

Colorado Distribution: Occurs along the shale barrens of southeastern Colorado. Documented from Pueblo, Fremont, and Las Animas Counties.



Elevation Range in Colorado: 4,500.00 - 6,000.00 ft / 1,371.60 - 1,828.80 m

Site Geomorphology: Geologic substrate derived from shale/limestone, often with shale flakes.

Soil: Soils are typically shallow calciferous and well drained clay derived from shale/limestone (Greenhorn and Niobrara), often with shale flakes. Soils may also be silty clay.

Successional and Ecological Processes: -

Adjacent Vegetation: Surrounding lands of *Juniperus monosperma / Hesperostipa neomexicana* and shortgrass prairie.

Management: Cattle grazing should be monitored within this association.

Literature Cited

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Juniperus monosperma / Artemisia bigelovii* Woodland
State Common Name Juniper / Sagebrush Woodland

Global Scientific Name: *Juniperus monosperma / Artemisia bigelovii* Woodland
Global Common Name: One-seed Juniper/Bigelow Sagebrush Woodland

Community Classification

System: International Vegetation Classification
Class: Woodland
Subclass: Evergreen woodland
Group: Temperate or subpolar needle-leaved evergreen woodland
Subgroup: Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
Alliance: One-seed Juniper Woodland Alliance

Global Rank: G3?
Global Rank Reasons: This juniper woodland association occurs in Colorado, northeastern Arizona, northern New Mexico and possibly extreme southern Utah. Stuever and Hayden (1997a) suggest that this association may occur in southern Utah; however, Welsh et al. (1993) states that all identifications of *Juniperus monosperma* in Utah are tentative.

Subnational Rank: S2
Subnational Rank Reasons: Three occurrences have been documented by CNHP. Several more most likely occur in the state, thus giving the state imperilment rank of S2.

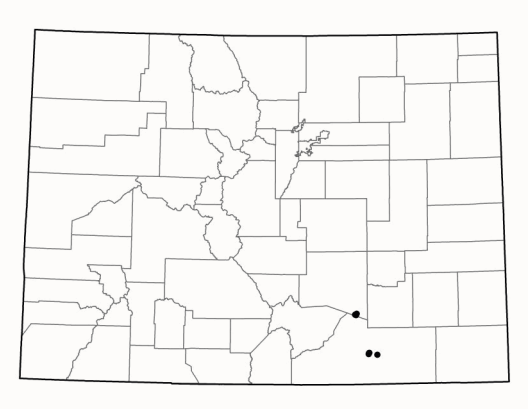
General Description: Stands occur in the mesas and hillslopes, piedmonts, canyons, escarpments, and other geographic breaks. Sites are on nearly level surfaces to steep, rocky slopes in canyons and on hillsides. Stands occur on all aspects except in elevational extremes where low-elevation stands are restricted to the more mesic north slopes, and high-elevation stands occur on southern aspects. Sites are typically dry with shallow, rocky, calcareous, alkaline soils. Soil textures range from sandy loam to clay soils typically derived from limestone, sandstone or shale. The vegetation is characterized by a typically open to occasionally moderately dense evergreen, scale-leaved tree canopy composed of *Juniperus monosperma*. Sparse canopy stands have trees distributed in patches, resembling a savanna, whereas the tree crowns touch in the moderately dense stands. The understory is typically a sparse and patchy dwarf-shrub layer dominated by *Artemisia bigelovii*. Other shrubs and dwarf-shrubs may be present. A sparse to moderately dense herbaceous layer dominated by perennial grasses may be

present. Many forb species can occur, but few have much cover.

Vegetation: The vegetation is characterized by a typically open (3-15% cover) to occasionally moderately dense evergreen, scale-leaved tree canopy 2-7 m tall composed of *Juniperus monosperma*. Sparse canopy stands have trees distributed in patches, resembling a savanna, whereas the tree crowns touch in the moderately dense stands. Occasional *Pinus edulis* trees may also be present. At higher elevations *Juniperus scopulorum* may be present. The understory is typically a sparse and patchy dwarf-shrub layer dominated by *Artemisia bigelovii*. Other shrubs and dwarf-shrubs may be present such as *Atriplex canescens, Ephedra* spp., *Gutierrezia sarothrae*, *Glossopetalon planitierum*, *Krascheninnikovia lanata*, *Opuntia* spp., *Parryella filifolia, Purshia stansburiana, Yucca* spp. A sparse to moderately dense herbaceous layer dominated by perennial grasses may be present. The most abundant species are *Bouteloua eriopoda, Bouteloua gracilis, Aristida* spp., *Dasyochloa pulchella, Pleuraphis jamesii* (= *Hilaria jamesii*), *Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Piptatherum micranthum* (= *Oryzopsis micrantha*), *Sporobolus* spp., *Hesperostipa comata*, *Hesperostipa neomexicana*, and the introduced annual grass *Bromus tectorum*. Many forb species can occur, but few have much cover. Cushion plants can be numerous in some areas. Common forbs include *Chaetopappa ericoides, Chamaesyce fendleri, Cryptantha* sp., *Chaetopappa ericoides, Eriogonum corymbosum, Eriogonum jamesii, Lesquerella fendler*i, and *Zinnia grandiflora*.

Similar Communities: -

Regional Distribution: This juniper woodland association occurs in the southern Colorado Plateau, foothills of the southern Rocky Mountains, and extends out on limestone and sandstone breaks in the southwestern Great Plains ranging from northeastern Arizona and northern New Mexico into southeastern Colorado, and possibly extreme southern Utah.



Colorado Distribution: This association occurs in southeastern Colorado in Pueblo and Las Animas counties.

Elevation Range in Colorado: 5,100.00 - 5,500.00 ft / 1,554.48 - 1,676.40 m

Site Geomorphology: This association is a shortgrass prairie landscape punctuated by shale/limestone hills. The shale/limestone hills are full of fossilized seabeds, concretions, geodes, and cones within cones making for an interesting geologic area in addition to an important botanical area. The shale barrens or breaks are important rare plant habitat in addition to providing refuge for cattle during winter storms. The bird community is different on these juniper breaks (shale barrens) as well because of the woody structure. These highly erodable hills effect the soil qualities of the nearby grasslands and several rare plants do exceptionally well on these toe slopes and associated grasslands, especially *Lesquerella calcicola* and *Oenothera harringtonii. Asclepias uncialis*, a rare milkweed was also located within this association in Colorado.

Soil: The soils are shallow, well drained calcareous clay loams derived from shale.

Successional and Ecological Processes: -

Adjacent Vegetation: *Juniperus monosperma* / *Hesperostipa neomexicana* was recorded intermixed with this association, although it occurred on the slopes as well as the mesa flats.

Management: -

Literature Cited

Bourgeron, P. S., and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Dick-Peddie, W. A. 1993. New Mexico vegetation: Past, present, and future. University of New Mexico Press, Albuquerque. 244 pp.

Driscoll, R. S., D. L. Merkel, D. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service. Miscellaneous Publication No. 1439. Washington, DC. 56 pp.

Larson, M., and W. H. Moir. 1987. Forest and woodland habitat types of northern New Mexico and northern Arizona. Edition 2. USDA Forest Service, Southwestern Region, Albuquerque, NM.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Shaw, R.B., S.L. Anderson, K.A. Schulz, and V.E. Diersing. 1989, Plant Communities, Ecological Checklist, and Species List for the U.S. Army Pinon Canyon Maneuver Site, Colorado. Colorado State University department of Range Science. Science Series No. 37. 71pp.

Stuever, M. C., and J. S. Hayden. 1997a. Plant associations of Arizona and New Mexico. Edition 3. Volume 2: Woodlands. USDA Forest Service, Southwestern Region, Habitat Typing Guides. 196 pp.

Welsh, S.L, N.D. Atwood, S. Goodrich, and L.C. Higgins. 1993. A Utah Flora, second edition, revised. Brigham Young University, Provo, UT.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Juniperus scopulorum / Cercocarpus montanus* Woodland
State Common Name Foothills Pinyon-Juniper Woodlands/Scarp Woodlands

Global Scientific Name: *Juniperus scopulorum / Cercocarpus montanus* Woodland
Global Common Name: Rocky Mountain Juniper / Mountain-mahogany Woodland

Community Classification

System: International Vegetation Classification
Class: Woodland
Subclass: Evergreen woodland
Group: Temperate or subpolar needle-leaved evergreen woodland
Subgroup: Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland
Formation: Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
Alliance: Rocky Mountain Juniper Woodland Alliance

Global Rank: G2
Global Rank Reasons: This woodland is regionally endemic, occurring on granitic outcrops and on Fountain Formation exposures in the Front Range of Colorado, and probably extending into Wyoming, and possibly Montana. Very few documented sites exist for this association. Total known area for this association is approximately 200 acres, although there is a fair amount of U.S. Forest Service land in both northern Colorado and southern Wyoming that may provide habitat for this association. The known occurrences are small and generally degraded. Rangewide threats are related to the continuing rapid development of the foothills and lower montane area where it occurs. It is also threatened by mining, heavy livestock grazing, fragmentation, and fire suppression.

Subnational Rank: S2
Subnational Rank Reasons: In Colorado there are 12 documented occurrences of this association type with CNHP. Less than 20 occurrences are estimated to occur.

General Description: This *Juniperus scopulorum*-dominated open woodland has been described from exposed, dry, rocky ridges and upper slopes in the foothills and lower montane zone of the Front Range. Stands occur on moderate to steep slopes with a variety of exposures, but are primarily found on northern exposures. This association is characterized by a relatively sparse tree canopy of *Juniperus scopulorum* with scattered *Pseudotsuga menziesii* and a moderately sparse short-shrub layer. The herbaceous layer is

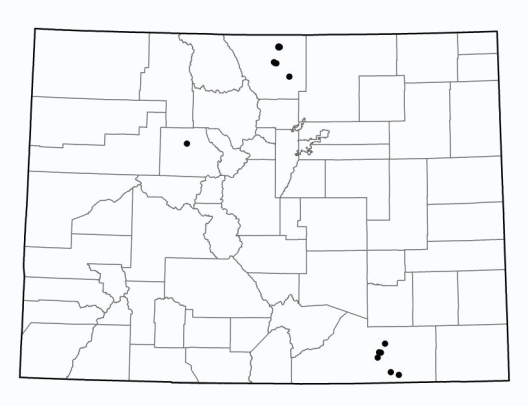
sparsely dominated by graminoids. The forb layer is generally sparse but may be diverse.

Vegetation: This association is characterized by a relatively sparse tree canopy (10-15% cover) of *Juniperus scopulorum* less than 5 m tall with scattered *Pseudotsuga menziesii* and a moderately sparse short-shrub layer (20-25% cover) that is dominated by *Cercocarpus montanus*. Scattered *Ribes cereum*, *Rubus deliciosus*, *Rhus trilobata*, *Purshia tridentata*, and the sub-shrub *Artemisia frigida* may also be present. The sparse herbaceous layer (<25% cover) is dominated by the graminoids *Hesperostipa comata* (= *Stipa comata*), *Elymus lanceolatus, Poa secunda*, and *Bouteloua gracilis*. Forb cover is generally very sparse (<10%) but may be relatively diverse. Common species include *Potentilla fissa*, *Heuchera bracteata, Helianthus pumilus, Eriogonum umbellatum*, and the cactus *Opuntia polyacantha*. Stands included in this association may be separated from other *Juniperus scopulorum*-dominated woodlands by an understory dominated by *Cercocarpus montanus*.

Similar Communities: -

Regional Distribution: This regionally endemic association has been documented along the Front Range of Colorado.

Colorado Distribution: This association is documented from Eagle, Larimer and Las Animas counties in Colorado.



Elevation Range in Colorado: 5,000.00 - 7,500.00 ft / 1,524.00 - 2,286.00 m

Site Geomorphology: Ocurring on granitic outcrops, Dakota sandstone and Fountain Formation exposures in the Front Range of north-central and south-eastern Colorado.

Soil: Sites have shallow, rocky, coarse-textured soils derived from granitic or Fountain Formation parent materials.

Successional and Ecological Processes: -

Adjacent Vegetation: Adjacent communities have included cottonwood dominated riparian and sagebrush.

Management: -

Literature Cited

Bourgeron, P. S., and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.

CONHP [Colorado Natural Heritage Program]. 2003. Unpublished data. List of Elements and Elcodes converted and entered into Biotics Tracker 4.0. Colorado Natural

Heritage Program, Colorado State University, Fort Collins, CO.

CONHP [Colorado Natural Heritage Program]. No date. Biological and Conservation Data (BCD) System. Unpublished data from field surveys. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Hess, K. 1981. Phyto-edaphic study of habitat types of the Arapaho-Roosevelt National Forest, Colorado. Unpublished dissertation, Colorado State University, Fort Collins. 558 pp.

Hess, K., and R. R. Alexander. 1986. Forest vegetation of the Arapaho and Roosevelt national forests in northcentral Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-266. Fort Collins, CO. 48 pp.

Johnston, B. C. 1987. Plant associations of Region Two: Potential plant communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region. Lakewood, CO. 429 pp.

MTNHP [Montana Natural Heritage Program]. 2002b. List of ecological communities for Montana. Montana Natural Heritage Program, Montana State Library, Helena, MT.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

USDA-NRCS PLANTS Database / Herman, D.E., et al. 1996. *North Dakota tree handbook*. USDA NRCS ND State Soil Conservation Committee; NDSU Extension and Western Area Power Administration, Bismarck. Photograph of *Juniperus scopulorum*. [Website accessed: February 2010. www.plants.usda.gov]

Wasowski, Sally and Andy. Lady Bird Johnson Wildflower Center. Photographs provided for: *Nolina texana, Cercocarpus montanus.* [Website accessed: February 2010. www.wildflower.org/plants/]

Wasser, C. H., and K. Hess. 1982. The habitat types of Region II. USDA Forest Service: A synthesis. Final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 140 pp.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Muhlenbergia asperifolia* Herbaceous Vegetation
State Common Name Great Plains Salt Meadows

Global Scientific Name: *Muhlenbergia asperifolia* Herbaceous Vegetation
Global Common Name: Alkali Muhly Herbaceous Vegetation

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: Intermittently flooded temperate or subpolar grassland
Alliance: Alkali Muhly Intermittently Flooded Herbaceous Alliance

Global Rank: GU
Global Rank Reasons: The community is documented on the western slope and in the eastern Great Plains of Colorado, and it is expected to occur in Nevada. It is probably not uncommon to find this alkali tolerant community in and adjacent to arroyos throughout the Great Basin desert of Nevada and Utah, the four-corners region of New Mexico, Utah, Colorado and Arizona, and in the dry, short-grass region of the western Great Plains. There is information from Colorado, but more data is needed from other states to assign a global rank other than GU.

Subnational Rank: S3
Subnational Rank Reasons: This association is documented by 5 occurrences in Colorado. All of the occurrences are small and in degraded conditions. More than 20 occurrences are estimated to occur in Colorado, but they are restricted to poorly drained low lands and alkaline soils.

General Description: The *Muhlenbergia asperifolia* plant association occurs as small, patchy meadows or strips of grass along stream courses and low-lying swales associated with alkaline soils. It occurs in nearly pure stands in saline or alkaline bottomlands where the water table is high. Stands are characterized by sparse cover of *Muhlenbergia asperifolia* and *Spartina gracilis*.

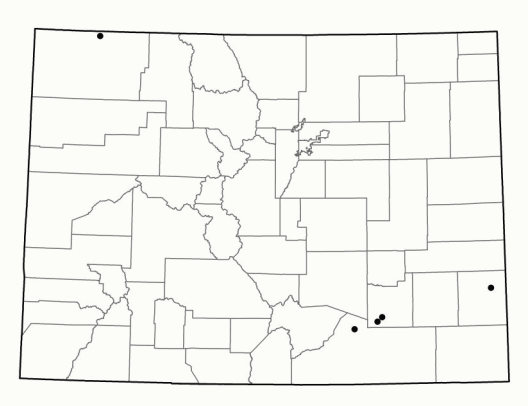
Vegetation: Stands of this grassland are small and open, with a generally patchy nature. *Muhlenbergia asperifolia* is the dominant graminoid with 20-70% cover. Other graminoids that may be present include *Spartina gracilis* (10%), *Eleocharis palustris* (16%), *Elymus canadensis* (2-7%). *Bromus tectorum* (20%) and *Iva axillaris* (0.5%) may also be present,

indicating the site has been disturbed in the recent past. Forb cover is low.

Similar Communities: -

Regional Distribution: This association is documented from Colorado, Nevada, New Mexico, and Wyoming.

Colorado Distribution: Documented in Colorado from Las Animas, Moffat, Otero and Prowers counties.



Elevation Range in Colorado: 4,500.00 - 5,600.00 ft / 1,371.60 - 1,706.88 m

Site Geomorphology: This association has been observed only as narrow bands along the stream banks and low terraces. Streams were classified according to the Rosgen Classification of Natural Rivers (Rosgen 1996). Stream channels were sandy, braided systems (Rosgen Channel Type: D5) and meandering, low gradient, broad rivers (Rosgen Channel Type: C5, C6). This association also occurs in low swales away from riparian areas, and can be found in brackish marshes and roadside ditches.

Soil: Soils are deep (50-60 cm) silty clays and sand over sandy loams. One profile had abundant, faint mottles at 25 cm, another had 80% gravel at 50 cm.

Successional and Ecological Processes: Little information is available on the successional status of this plant association. It appears to be an early-seral community as it occurs in moist alkaline meadows, margins of playa lakes and streams. It invades newly disturbed roadsides and alluvial deposits.

Adjacent Vegetation: *Scirpus* (bulrush) marshes, *Salix exigua* (coyote willow) or *Tamarix ramosissima* (tamarisk) shrublands, young *Populus deltoides* (cottonwood) thickets on lower terraces and stream banks, and older, widely spaced, mature cottonwoods on upper terraces, may occur within the surrounding riparian area. *Artemisia tridentata* (big sagebrush) and *Sarcobatus vermiculatus* (greasewood) shrublands, and shortgrass grasslands may occur on adjacent hill slopes.

Management: Tamarisk and cheatgrass invasion can be a problem with this assocation. *Muhlenbergia asperifolia* (scratchgrass) is an indicator of saline or alkaline soil conditions.

Literature Cited

Bolen, E. G. 1964. Plant ecology of spring-fed salt marshes in western Utah. Ecological Monographs 34(2):143-166.

Bourgeron, P. S., and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.

CONHP [Colorado Natural Heritage Program]. 2003. Unpublished data. List of Elements and Elcodes converted and entered into Biotics Tracker 4.0. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Carsey, K., G. Kittel, K. Decker, D. J. Cooper, and D. Culver. 2003a. Field guide to the wetland and riparian plant associations of Colorado. Colorado Natural Heritage Program, Fort Collins, CO.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Donnelly, P., D. Lindsey, E. Muldavin, Y. Chauvin, and A. Browder. 2006. Vegetation communities of Bosque del Apache National Wildlife Refuge. Prepared by U.S. Fish and Wildlife Service, National Wildlife Refuge Remote Sensing Lab, Albuquerque, NM, and Natural Heritage New Mexico, University of New Mexico, Albuquerque. Final report submitted to U.S. Fish and Wildlife Service, Southwest Region (R2), National Wildlife Refuge System (NWR), NWR Remote Sensing Lab, Division of Planning. 27 pp. [http://www.fws.gov/data/documents/BDA%20NVCS%20Veg%20Community%20Report%20Example.pdf]

Kittel, G. M., and N. D. Lederer. 1993. A preliminary classification of the riparian vegetation of the Yampa and San Miguel/Dolores river basins. Unpublished report prepared for Colorado Department of Health and the Environmental Protection Agency by The Nature Conservancy, Colorado Field Office, Boulder.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, A. McMullen, and J. Sanderson. 1999b. A classification of riparian and wetland plant associations of Colorado: A user's guide to the classification project. Colorado Natural Heritage Program, Colorado State University, Fort Collins CO. 70 pp. plus appendices.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

U.S. Bureau of Reclamation. 1976. Flora and terrestrial vertebrate studies of the Grand Valley, Colorado. Pages 56-85 and 283-354 in: Final report to the U.S. Bureau of Reclamation by Ecology Consultants, Inc., Fort Collins, CO.

USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Miscellaneous Publication No. 200. Plant drawings used: *Muhlenbergia asperifolia*, *Panicum obtusum*. Washington, DC. [Website accessed: February 2010. www.plants.usda.gov]

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Nolina texana Shrubland*
State Common Name Desert Shrubland

Global Scientific Name: *Nolina texana Shrubland*
Global Common Name: -

Community Classification

System: Terrestrial Community - Other Classification
Class: Not determined at this time.
Subclass: -
Group: -
Subgroup: -
Formation: -
Alliance: -

Global Rank: GU
Global Rank Reasons: Unable to assign a rank due to a lack of available information on this association's global range.

Subnational Rank: S1
Subnational Rank Reasons: Less than 10 occurrences are expected as much of the potential habitat has been searched. Only two occurrences are documented in south-eastern Colorado. Although both were in excellent condition the combined acreage of these occurrences is only approximately 135 acres.

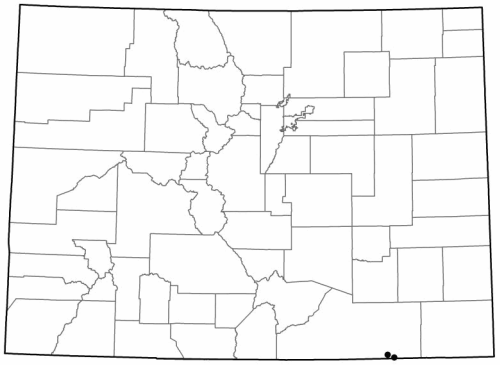
General Description: This association is found on rocky, steep slopes with mixed sandstone and basalt. A mosaic of grass understories occur under the *Nolina*. Along the mesa rims *Quercus, Rhus* and other shrubs occur. Benches below association may be patchy *Juniperus monosperma*. Observed in Colorado between 5300 and 5700 feet.

Vegetation: The two occurrences in Colorado were composed of *Nolina texana* at 10%. *Bothriochloa* sp. 30% and *Bouteloua eriopoda* 20% were also recorded at the site. Dominant plant species: oak, mixed graminoid, yucca and cholla.

Similar Communities: -

Regional Distribution: This association has been documented from Colorado, however the full global extent has not been assessed.

Colorado Distribution: This association has been documented from Las Animas County in south-eastern Colorado.



Elevation Range in Colorado: 5,300.00 - 5,700.00 ft / 1,615.44 - 1,737.36 m

Site Geomorphology: This community type is found on rocky steep slopes. It dominates south facing slopes.

Soil: Steep rocky slopes with sandstone and basalt.

Successional and Ecological Processes: -

Adjacent Vegetation: -

Management: -

Literature Cited

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

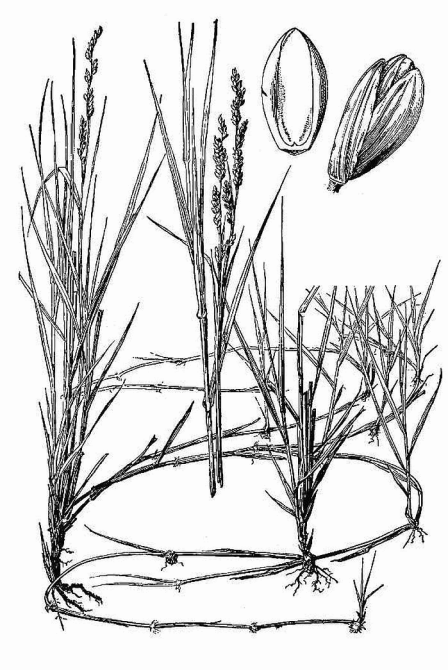
Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Panicum obtusum* Herbaceous Vegetation
State Common Name Vine-mesquite Herbaceous Vegetation
Global Scientific Name: *Panicum obtusum* Herbaceous Vegetation
Global Common Name: Vine-mesquite Herbaceous Vegetation

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: Vine-mesquite Herbaceous Alliance



Global Rank: G3?
Global Rank Reasons: Documented in Texas and New Mexico by NatureServe. Colorado Natural Heritage Program also has this association documented with three fair to good occurrences. There is still some uncertainty with the assigned global rank and more information is needed to update this association globally.

Subnational Rank: S2
Subnational Rank Reasons: Documented by CNHP from 2 counties in south-eastern Colorado. It is estimated that between 6 and 20 occurrences exist in Colorado. The current occurrences in Colorado are small and patchy - none being of excellent condition.

General Description: This is an alkali tolerant grassland association. It is typically found in small patches around stream bottoms, arroyos and plunge pools. *Panicum obtusum* is an indicator of moist sites in an arid climate. Surrounding habitat is often shortgrass prairie with juniper uplands. It has been documented in Colorado between 4520-5760 feet.

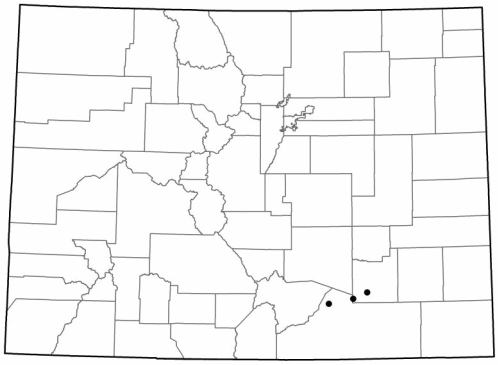
Vegetation: This association is dominated by *Panicum obtusum* with other native grass

species present. Documented in Colorado with 30-80% cover of *Panicum obtusum*, 20% cover of *Sporobolus cryptandrus*, 10% cover of *Sporobolus airoides*. Other graminoids included *Bouteloua gracilis, Hilaria jamesii, Distichlis spicata*, and *Lycurus setosus*. Surrounding trees and shrubs may include *Populus deltoides, Salix exigua, Juniperus monosperma* and sometimes the invasive tamarisk.

Similar Communities: -

Regional Distribution: This association is found in Texas, New Mexico, and southeastern Colorado.

Colorado Distribution: Documented occurrences in southeastern Colorado in Otero and Las Animas counties.



Elevation Range in Colorado: 4,500.00 - 5,800.00 ft / 1,371.60 - 1,767.84 m

Site Geomorphology: -

Soil: -

Successional and Ecological Processes: -

Adjacent Vegetation: -

Management: Salsola and tamarisk should be monitored and controlled within this association type.

Literature Cited

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

NMNHP [New Mexico Natural Heritage Program]. No date. Unpublished data on file. Albuquerque, NM.

USDA-NRCS PLANTS Database / Hitchcock, A.S. (rev. A. Chase). 1950. *Manual of the grasses of the United States*. USDA Miscellaneous Publication No. 200. Plant drawings used: *Muhlenbergia asperifolia*, *Panicum obtusum*. Washington, DC. [Website accessed: February 2010. www.plants.usda.gov]

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Populus deltoides / Panicum virgatum - Schizachyrium scoparium* Woodland

State Common Name Plains Cottonwood Riparian Forests

Global Scientific Name: *Populus deltoides / Panicum virgatum - Schizachyrium scoparium* Woodland

Global Common Name: Cottonwood / Switchgrass 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: G2

Global Rank Reasons: The distribution and extent of this community are limited. Sites are prone to invasion by brush and exotic weeds in the absence of flooding or as a result of overgrazing.

Subnational Rank: S2

Subnational Rank Reasons: Known only from the eastern plains of Colorado, on the Arikaree River in the northeast, on the Big Sandy, in central-eastern Colorado and on the Purgatoire in south-eastern Colorado.

General Description: This community occurs in eastern Colorado on low floodplain ridges and stream banks. It is found along strongly meandering rivers with moderate to low gradients. Stands occur in floodplains and along banks of permanent rivers or streams that flood periodically. Soils are deep and somewhat poorly drained to moderately well-drained and range from fine, sandy loams to silty clay. A sparse to locally dense canopy of *Populus deltoides* dominates the open tree canopy, with *Salix amygdaloides* also present at many sites. The shrub layer is also poorly developed to nearly absent, with at most a sparse layer of *Shepherdia argentea* and *Symphoricarpos occidentalis*. The herbaceous understory is dominated by tall grasses 1-2 m tall, primarily *Panicum virgatum* and *Spartina pectinata*.

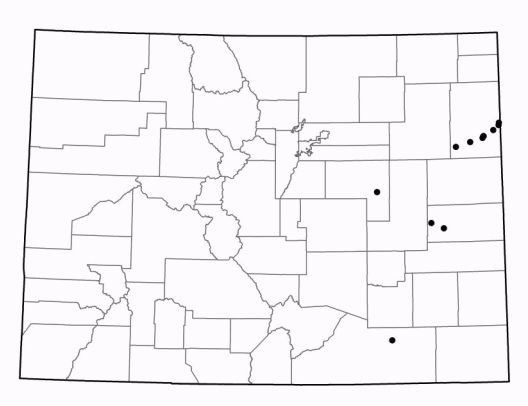
Vegetation: This community is dominated by sparse (15-35%) cover of *Populus deltoides* and often also *Salix amygdaloides*, which is less common than *Populus deltoides* when both are present. Locally, overall canopy coverage may be slightly greater than 25%. The

woody subcanopy is poorly developed, though in some sites scattered individuals of *Elaeagnus angustifolia* and *Fraxinus pennsylvanica* may be present in northern stands and *Celtis laevigata* in southern stands. The shrub layer is also poorly developed to nearly absent. The herbaceous understory is dominated by tall grasses 1-2 m tall, primarily *Panicum virgatum* and *Spartina pectinata*. Other graminoids frequently present include *Carex, Scirpus, Muhlenbergia asperifolia, Sorghastrum nutans, Elymus canadensis, Andropogon gerardii, Bouteloua gracilis* and *Bouteloua curtipendula.* In drier sites, the mid grasses *Bouteloua curtipendula, Pascopyrum smithii*, and *Schizachyrium scoparium* may be common. Forb species present and varied. Exotic species are present. Overall species diversity is low.

Similar Communities: -

Regional Distribution: This community is found in floodplains of the central and southern Great Plains of the United States, ranging from Nebraska and possibly South Dakota south to Texas.

Colorado Distribution: This association is documented from eastern Colorado in Yuma (60% of occurrences), Elbert, Cheyenne and Las Animas counties.



Elevation Range in Colorado: 3,370.00 - 4,700.00 ft / 1,027.18 - 1,432.56 m

Site Geomorphology: Occurs on floodplain ridges and stream banks. Alluvial parent materials.

Soil: Soils are deep and somewhat poorly drained to moderately well-drained and range from fine, sandy loams to silty clay.

Successional and Ecological Processes: -

Adjacent Vegetation: -

Management: This association needs a natural flood regime. Limiting grazing to winter season may reduce exotic species invasion within the association.

Literature Cited

CONHP [Colorado Natural Heritage Program]. 2003. Unpublished data. List of Elements and Elcodes converted and entered into Biotics Tracker 4.0. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

Carsey, K., G. Kittel, K. Decker, D. J. Cooper, and D. Culver. 2003a. Field guide to the wetland and riparian plant associations of Colorado. Colorado Natural Heritage Program, Fort Collins, CO.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort

Collins.

Currier, P. J. 1982. The floodplain vegetation of the Platte River: Phytosociology, forest development, and seedling establishment (Nebraska).

Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.

Driscoll, R. S., D. L. Merkel, D. L. Radloff, D. E. Snyder, and J. S. Hagihara. 1984. An ecological land classification framework for the United States. USDA Forest Service. Miscellaneous Publication No. 1439. Washington, DC. 56 pp.

Hefley, H. M. 1937. Ecological studies on the Canadian River floodplain in Cleveland County, Oklahoma. Ecological Monographs 7:347-402.

Jones, G. P., and G. M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Submitted to Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database, Laramie, WY. 245 pp.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson. 1999a. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. The Southwestern Naturalist 44:421-443.

Midwestern Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Minneapolis, MN.

Moulton, M. P., J. R. Choate, S. J. Bissell, and R. A. Nicholson. 1981. Associations of small mammals on the central high plains of eastern Colorado. Southwestern Naturalist 26(1):53-57.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Van Wie, E., and M. Damm. 1997. Colorado state community abstract - *Populus deltoides ssp. monilifera / Panicum virgatum* community. Colorado Natural Heritage Program, Fort Collins.

Colorado Natural Heritage Program
Community Characterization Abstract

State Scientific Name *Rhus trilobata - Philadelphus microphyllus Shrubland*
State Common Name Shrubland

Global Scientific Name: *Rhus trilobata - Philadelphus microphyllus Shrubland*
Global Common Name: Skunkbush - Littleleaf Mock Orange Shrubland

Community Classification

System: Terrestrial Community - Other Classification
Class: Not determined at this time.
Subclass: -
Group: -
Subgroup: -
Formation: -
Alliance: -

Global Rank: GU
Global Rank Reasons: Documented from Colorado. However, the full global extent of this association has not been asessed. More information is needed to assign an element occurrence rank other than GU.

Subnational Rank: S1
Subnational Rank Reasons: Documented from two occurrences in Las Animas County. Less than 5 occurrences are estimated to occur in Colorado.

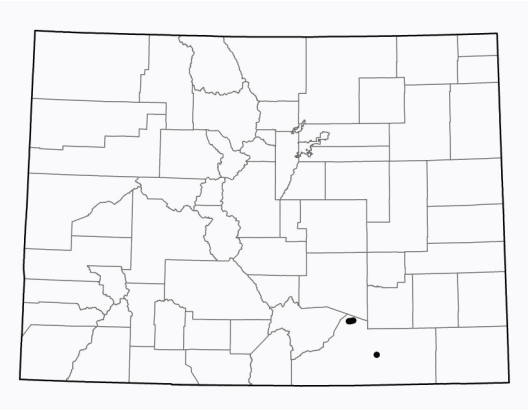
General Description: This association occurs in the canyon country of southeastern Colorado along canyon streams, walls and slopes. *Rhus trilobata*, *Philadelphus microphyllus*, and occasionally *Ribes leptanthum* are common. Not all may be present and other shrubs may be locally common. *Bouteloua curtipendula* is the most common graminoid. This community often grades into the *Cercocarpus montanus / Bouteloua curtipendula* type. Surrounding upslopes are often dominated by pinyon-juniper.

Vegetation: Shaw et al. (1989) state that this is a common shrub community found on the slopes of canyons leading to the Purgatoire River in southeast Colorado. Average cover is moderate with bare ground and rock exposed. The overstory is dominated by *Rhus trilobata* with *Philadelphus microphyllus* and/or *Ribes leptanthus* also common. A moderately dense graminoid layer of *Bouteloua curtipendula* is the characteristic understory species.

Similar Communities: -

Regional Distribution: Documented from southeastern Colorado. This plant community is not thought to be an endemic association, but documentation from other states is lacking.

Colorado Distribution: Two occurrences documened from southeastern Colorado in Las Animas County.



Elevation Range in Colorado: 5,100.00 - ? ft / 1,554.48 - ? m

Site Geomorphology: This association is found along the south side of canyons facing north. Very rocky and rugged canyon walls and slopes. Geology is sandstone.

Soil: The soils are shallow and rocky and may be sandy loam, loamy sand, or loam.

Successional and Ecological Processes: *Rhus trilobata* sprouts vigorously from rhizomes or from the root crown when aboveground vegetation is burned (Mueggler and Stewart 1980). Vegetative reproduction is the primary mode of re-establishment after fire, however, *Rhus trilobata* may also reproduce through seed. Fire has variable effects on *Pseudoroegneria spicata* bunch grasses. Plants usually survive burning and growth is often stimulated, except when fire occurs in the driest month when the crowns will burn because of low moisture in the vegetation and the meristems are damaged (Johnson and Simon 1987).

Adjacent Vegetation: This community often grades into the *Cercocarpus montanus* / *Bouteloua curtipendula* type. Surrounding upslopes are often dominated by pinyon-juniper.

Management: Livestock grazing does not impact stands on the steeper slopes, but where stands are more accessible, heavy summer use will reduce the abundance of the more palatable species such as *Pseudoroegneria spicata, Festuca idahoensis* and *Hesperostipa comata*. Less palatable species such as *Artemisia frigida, Heterotheca villosa* and *Achillea millefolium* will increase. *Rhus trilobata* may also be favored by continued overgrazing (Mueggler and Stewart 1980). The exotic species *Bromus tectorum* often occurs in these stands and contributes significant cover on sites disturbed by livestock or small mammals (Mueggler and Stewart 1980).

Literature Cited

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Johnson, C. G., Jr., and S. A. Simon. 1987. Plant associations of the Wallowa-Snake Province Wallowa-Whitman National Forest. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. Technical Paper R6-ECOL-TP-255A-86. 399 pp. plus appendices.

Mueggler, W. F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service, General Technical Report INT-66. Intermountain Forest and Range Experiment Station. Ogden, UT. 154 pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Shaw, R.B., S.L. Anderson, K.A. Schulz, and V.E. Diersing. 1989, Plant Communities, Ecological Checklist, and Species List for the U.S. Army Pinon Canyon Maneuver Site, Colorado. Colorado State University department of Range Science. Science Series No. 37. 71pp.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.