Sensitive Species and Natural Communities Known to Occur on the Picket Wire Canyonlands, Comanche National Grassland, Colorado

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EXECUTIVE SUMMARY

The Colorado Natural Heritage Program (CNHP) conducted a Natural Heritage Inventory of the Picket Wire Canyonlands portion of the Comanche National Grassland. The goal of the inventory was to systematically identify the localities of rare or imperiled species and the locations of significant natural communities (as represented by plant associations) as identified in the interim management plan for the area.

The Natural Heritage Inventory was conducted in seven steps:

1. Review aerial photographs, topographic maps, soil maps, and geological maps and other baseline data.

2. Gather existing information including previously known locations of rare and imperiled species and significant natural communities. Confirm ownership boundaries for Forest Service, State Land Board, and private holdings.

3. From information gathered in steps 1 and 2, map the "potential natural areas" (PNA).

4. Conduct reconaissance flight over area to verify PNA identification and search for additional PNAs.

5. Perform initial ground surveys.

6. Conduct a survey of the PNA's and other habitats suitable for rare or imperiled species.

7. Analyze information and compile the results into a final report.

At the completion of the inventory, the CNHP had records of 13 rare vertebrate species, 4 rare invertebrate species, 4 rare plant species, and 10 natural communities/plant associations of statewide significance (Table 2 and Figure 2). Most of the above species and communities are sensitive to some anthropogenic disturbances. In contrast, the information derived from this study allowed the CNHP to re-evaluate the degree of imperilment of several species; these species are now considered more common and not in need of immediate conservation attention.

Thirteen PNAs were identified during the preparatory and inventory stages of this study (Figure 1 and Table 3). Of these, 8 support natural heritage resources (rare or imperiled species and significant natural communities/plant associations). Using information from other sources and the results of this inventory, we have mapped 8 significant biodiversity areas which range in size from 57 to 3,500 acres (Figure 3 and 4). Each biodiversity area is identified as a Conservation Site. For each of these sites the Natural Heritage Program developed preliminary conservation planning boundaries. In developing these boundaries, a number of factors were considered including: habitat for rare species, protection of water quality, buffers from potentially detrimental land uses, and the maintenance of ecological processes necessary to

perpetuate the significant elements in the area. In addition the entire Purgatoire Canyon is identified as a landscape of ecological significance or a megasite.

The delineation of conservation planning boundaries in this report does not confer any regulatory protection on recommended areas. These boundaries are intended to be used to support wise planning and decision-making for the conservation of these significant areas. The Colorado Natural Heritage Program encourages the Comanche National Grassland to take actions that will protect these sites. CNHP offers its assistance in working with the Comanche National Grassland to ensure protection of these areas.

The report includes 10 recommendations for the Comanche National Grassland:

1. Where appropriate, consider special area designations for the conservation sites identified in this study. Any resulting designations should be included in the next forest plan revision.

2. Incorporate the information included in this report in the review of Forest Service activities in or near areas identified as significant.

3. Increase public awareness of the sensitive species and communities known from Picket Wire Canyonlands and the benefits of protecting areas determined to be significant to the Comanche National Grassland's natural diversity.

4. Promote cooperation with boundary neighbors (private individuals, Department of Defense, and the State Land Board) to the maintenance of selected sites and ecosystem integrity. Such cooperation could include mutually beneficial land consolidations.

5. Properly manage significant elements of natural diversity within Picket Wire Canyonlands.

6. Actively manage roads and trails through and to conservation sites to control invasive alien plants.

7. Continue to identify significant natural resources of the Canyonlands through inventories and other tools.

8. Investigate the fire ecology relationship with all habitats of the Picket Wire Canyonlands, particularly the juniper-dominated woodlands. Adapt management programs in response to the findings.

9. Seek state natural area status as appropriate.

10. Work to protect the hydrology and native fish community of the Purgatoire River.

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INTRODUCTION

The Colorado Natural Heritage Program was contracted by the U. S. Forest Service to conduct an inventory of the area known as Picket Wire Canyonlands. The goal of the inventory was to systematically identify the localities containing natural heritage resources. Natural heritage resources are defined as rare, threatened, endangered, or sensitive species and significant natural communities that are monitored by the Colorado Natural Heritage Program. In short, we were to identify those sites supporting unique or exemplary natural communities, rare or imperiled plants and animals, and other significant natural features. Emphasis was placed on seeking out species classified by the U. S. Forest Service's Region 2 as Sensitive Species.

This inventory has been completed, and the results of it are presented herein. A brief overview of the natural condition of the study area is presented first. This is followed by an outline of the mission and methodology of the Colorado Natural Heritage Program. The results of the inventory are briefly discussed. Finally, the areas of biodiversity significance identified during this study are described and future management actions, are introduced.

Overview of the Study Area

Picket Wire Canyonlands covers approximately 16,700 acres (6,758 hectares) in and near the Purgatoire Canyon. Embedded in the Great Plains of eastern Colorado, the canyon stands out as the longest and deepest canyon in eastern Colorado. Elevations range from nearly 4,300 to 5,300 feet. The Purgatoire River has carved a canyon into the largely sandstone deposits of the plains. Cliffs of several hundred feet rise above the river bottom and populate canyon slopes with large blocks of exfoliated material. The vegetation is typically short grass to mid-grass prairie, shrublands, and juniper woodlands. There are a few stands of aspen and ponderosa pines. The riparian communities are dominated by cottonwood and willows, but mostly tamarisk. Where ephemeral streams drop from the grasslands into canyons there are "splash pools" formed, providing rare water supplies for animals and some plants. The entire area was withdrawn from grazing when the authority was transferred to the U. S. Forest Service.

Climate. [Most of this information is summarized from Larsen et al. (1972)] The climate of the area is classified as semiarid with an average annual precipitation of less than 13 inches. Two years in ten will have less than 8 inches or more than 16 inches. May is the wettest month, but 75% of the annual precipitation falls between April and September. Hail occurs regularly and can be damaging. Tornadoes occur occasionally. Winters are cold, typical of the high plains with approximately 23 days of the year having snow cover. Temperatures are cold in the winter with a few days below zero F. Similarly, at least a few days can be expected where high temperatures are greater than 100 F.

Soils. Nakada (1994) summarized the soils of the Picket Wire Canyonlands area from work being conducted by the U. S. Natural Resources Conservation Service. The southern parcel is dominated by a single soil type, Travessilla-Rock Outcrop complex. The Rock Outcrop type is largely on the slopes of the canyon and is susceptible to very high water erosion potential.

The middle section (parcel) of the Picket Wire Canyonlands soils are dominated by two types: Travessilla-Rock Outcrop (as described in the paragraph above) and Rizozo-Rock Outcrop complex. Both types are poorly suited for uses other than passive uses.

Soils of the northern section are complex with the Travessilla-Rock Outcrop complex dominating the southeastern portions with slighter slopes than that found in the southern parcel. With the shallower slopes there is less potential for water erosion. The riparian zone is dominated by very deep and well drained soils. Fine sandy loams are also found in the floodplain where slopes are about 0-3%. Some areas have a saline silt loam. This area is noted for its distinctive vegetation (Johnston and Reed 1991).

Geology. Picket Wire Canyonlands is found entirely in the Great Plains of Colorado. Lockley and Hunt (1994) described the geological resources of the Canyonlands. In summary, the rocks are Mesozoic in age and exclusively sedimentary. Purgatoire Canyon is one of the few sites in the Great Plains of Colorado where red sandstones of the Jelm Formation are extensively exposed. Picket Wire Canyonlands are best known (geologically) for the grand exposures of dinosaur tracks from the Morrison Formation in the northern tract.

Current Vegetation. The vegetation of Picket Wire Canyonlands is nearly identical to that of the Pinon Canyon Maneuver Site (Shaw et al. 1989). Shaw et al. (1989) described the vegetation as very unique for the area, being combinations of the surrounding ecosystems. Whereas we have found the vegetation types described for Pinon Canyon to be more widespread than insinuated, the details of the vegetation descriptions are thorough and highly useful in the Purgatoire Canyon area. Johnston and Reed (1991) conducted a preliminary ecological inventory for the Picket Wire Canyonlands. Most plant associations or community types are readily cross-walked between the two reports.

In general, the relatively flat uplands are dominated by short grass and mixed grass prairie. Some grasslands are occupied by numerous Tree cholla (*Opuntia imbricata*). Grasslands that occur on benches, canyon slopes, or isolated mesas may be rich in native species. Outcrops of shale or limestone generally have a low shrubby component, mostly Soapweed (*Yucca glauca*) or Sagebrush (*Artemisia bigelovii*). Other shrublands form on canyon slopes and in riparian zones. Greasewood (*Sarcobatus vermiculatus*) stands occur on saline soils with high water tables in the floodplain. Sumac (*Rhus trilobata*) or Mountain mahogany (*Cercocarpus montanus*) shrublands dominate many hillsides, particularly within the canyon proper. Riparian shrublands were once probably common and dominated by Sandbar willow (*Salix exigua*). Now these communities are largely dominated by Tamarisk (*Tamarix ramossisina*). Woodlands are found at higher elevations and particularly on canyon rims, mesas, and slopes. The communities are generally dominated by One-seeded juniper (*Juniperus monosperma*). A few woodland patches (very rare) are dominated by Ponderosa pine (*Pinus ponderosa*). Finally, woodlands dominated by Plains cottonwood (*Populus deltoides*) are common in the floodplain of the Purgatoire River.

Wetland vegetation is uncommon and generally restricted to riparian zones. Occasional springs or seeps occur and support isolated patches of wetland vegetation. There are a few hanging gardens evident in the middle parcel where red sandstones surface (forming cliffs).

The plant species of the area are relatively well known and are covered by the excellent books by Weber (1990) and Harrington (1954). Shaw et al (1989) recorded 359 species from Pinon Canyon. Theirs is undoubtedly the best indicator of the flora to be found in the Picket Wire Canyonlands.

The vegetation of the Purgatoire Canyon probably resembles that found prior to occupation by the United States. Some communities are heavily alterred, particularly those found in riparian areas. These areas will be difficult to restore since they are now occupied by persistent non-native species. Other communities, such as canyon slopes and isolated mesas, are likely nearly pristine.

Faunal Composition. As might be expected from the preceding discussion, the fauna of Picket Wire Canyonlands is typical of the Great Plains, particularly the southern portions. The diversity of habitats within the canyon supports additional species with more montane origins. In addition, distinctive elements of eastern and southwestern faunal units are observed. For example, eastern birds such as Summer tanagers (*Piranga rubra*), Yellow-billed cuckoos (*Coccyzus americanus*), and Eastern phoebes (*Sayornis phoebe*) occupy appropriate habitats. Southwestern species such as Rufous-crowned sparrows (*Aimophila ruficeps*), Hepatic tanagers (*Piranga flava*), and Black-throated sparrows (*Amphispiza bilineata*) are found with the Picket Wire Canyonlands. The same patterns are observed for amphibians and reptiles (Hammerson 1982), mammals (Armstrong 1972, Fitzgerald et al. 1994) and insects (Boris Kondratieff, personal communication). The ichthyofauna is typical of the Great Plains/Arkansas basin (Woodling 1985, Bramblett and Fausch 1991).

It is important to note that the aquatic habitat (of the Purgatoire River), although hydrologically altered (Winters 1994, Bramblett and Fausch 1991), maintain a natural hydrological regime. This supports a native species fishery and aquatic insect community that has become very rare in the Great Plains, particularly in the Arkansas basin (Echelle et al. 1995; B. Kondratieff, pers. comm.).

The relatively recent but extensive use of the area in and around Picket Wire Canyonlands has greatly impacted the fauna. Extirpations have been largely restricted to large mammals. Grizzly bears (*Ursus arctos*)and Gray wolves (*Canis lupus*) once roamed throughout the State and Black-footed ferret (*Mustela nigripes*) were not uncommon in large prairie dog towns (Armstrong 1972, Fitzgerald et al. 1994) and were documented from Otero County. Bison (*Bison bison*) were seasonally common over this portion of the Great Plains, including the study area (Fitzgerald et al. 1994). Bison (*Bison bison*) were probably a primary ecological force in the creation and maintenance of many of the area's natural communities. All are no longer resident within the state. However, most species have not suffered so extensively, but many have been reduced in numbers -- some significantly. In fact, Elk (*Cervus elaphus*) and Bighorn sheep (*Ovis canadensis*) were probably common in the area (Fitzgerald et al. 1994). The status of Mountain lions (*Felis concolor*) and Black bears (*Ursus americanus*) is poorly known, but the species persists in the canyon. It is part of the purpose of this effort to identify the remaining sites occupied by the most impacted species.

Relating this Report to Managing Biological Diversity at the Landscape Level

The management of biological diversity must consider more than species-specific management criteria and consider the elements of human-use across Picket Wire Canyonlands. The conservation sites identified in this study may be considered as core areas for the protection of the full range of biological diversity. Some of these areas are best considered as candidates for special area designations, others as sites within a landscape that should be managed to include the maintenance of the site's integrity.

A basic premise in the landscape management approach starts with the delineation of core protected areas that can be represented by special designations. Such is the basis of the development of preliminary conservation planning boundaries. Where possible and biologically correct (Simberloff and Cox 1987, Simberloff et al. 1992), these should be connected through corridors and appropriately buffered. Buffer zones should include the ecological processes supporting the diversity of the core area. Stress and threats analyses are also critical to the development of successful ecosystem management. It is hoped that this report will assist the Comanche National Grassland in creating a landscape that permits the fruitful coexistence humans and other organisms.

METHODS

CNHP staff and volunteers initiated prioritized inventories in order to gather information on Colorado's rare species and communities in a thorough and systematic manner. The Natural Heritage staff conducts a natural heritage inventory in the following stages:

1. Gather existing information. The herbaria (the University of Colorado, Colorado State University, Denver Botanical Gardens, and Rocky Mountain Herbarium (University of Wyoming) and museums (Denver Museum of Natural History, National Biological Service, and University of Colorado) were visited by Natural Heritage scientists where label information from specimens pertaining to the study area was recorded. Additional information was gathered from collections and researchers through personal communications. Published and unpublished information for the inventory was reviewed as time allowed. This included the gathering of maps, reviewing the Biological Conservation Data System and manual Natural Heritage data, and consulting experts.

2. Review aerial photographs. Infrared aerial photographs of the entire survey area were reviewed in detail to identify Potential Natural Areas (PNA's) to be studied in the following stages. These photographs were compared with topographic maps, soil maps, and geological maps to enhance our ability to detect significant habitats.

3. Refinement of Potential Natural Area numbers and boundaries. From information gathered in steps 1 and 2, the "potential natural areas" were mapped with ecosystem boundaries.

4. Reconnaissance flight. CNHP staff scientists flew over the study area to verify map and photo interpretations, for finer resolution observations, and to identify new PNAs.

5. Perform initial ground surveys. There were several purposes of this stage. One was to identify access routes and conditions of terrain. A second purpose was to screen the PNA's to eliminate those that showed signs of substantial disturbance not visible from aerial photographs. This stage also eliminated those areas which may have been misinterpreted from aerial photograph or flight reconnaisance examinations. A third was to plan for the main survey of PNAs that still showed potential as significant biodiversity areas. Among decisions that were made were when the survey could best be conducted, which scientist(s) should be involved (i.e. what is the potential for rare plants, rare animals or exemplary communities), and how much time should be budgeted for completing the survey. Where there was a need to verify the accuracy of the photo interpretation conducted during stage 1, these stages may have overlapped.

6. Field inventory of the PNAs. Detailed information was collected on the presence and status of unique or exemplary natural communities and rare species that were present, the extent of the feature(s) that made the PNA significant, and the area that needs to be protected to protect and manage those features. Threats and past or present disturbances were also noted. For element occurrences found to be of statewide significance, these

data were transcribed onto Natural Heritage Program maps and entered into the Biological Conservation Data System.

7. Compilation of results and preparation of final report. As fieldwork was completed, Natural Heritage staff scientists reviewed the information gathered. Based on a review of all natural heritage resources present, the staff prioritized the sites in terms of their significance and the threats facing them, developed and mapped preliminary conservation planning boundaries, and drafted protection and management recommendations.

Colorado's Natural Heritage Program Methodology

The Colorado Natural Heritage Program has established a statewide repository for information on rare and imperiled species and significant ecosystems in Colorado. The multi-disciplinary team of scientists and information managers gather information and incorporate it into their continually updated databases. CNHP is part of an international network of conservation data centers that use the Biological and Conservation Databases (developed by The Nature Conservancy).

Concentrating on site-specific data for each element of natural diversity, the accurate status of each element becomes known. The mapped data illustrate sites that are important to the conservation of Colorado's natural biological diversity. By using the element ranks and the quality of each occurrence, priorities can be established for the protection of the most sensitive or imperilled sites. It is by having an updated locational database and priority-setting system that CNHP can provide its most effective, proactive land-planning tools.

The information gathered by CNHP is on species, natural communities, and ecosystems. Each of these significant natural features (species and community types) is an **element of natural diversity**, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant; **Table 1**).

The primary criterion for ranking elements is the number of occurrences, i.e. the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, population trends, and threats. However, the emphasis remains on the number of occurrences, such that ranks are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Colorado (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the rarity of the element. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species are listed as Endangered or Threatened and **Natural Heritage rarity ranks should not be interpreted as legal designations.**

Table 1. Definition of Natural Heritage state rarity ranks. Global rarity ranks are similar, but refer to a species' rarity throughout it range. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. Note that GA and G#N are not used and GX means extinct. These ranks should not be interpreted as legal designations.

S1	Critically imperilled or extremely rare: usually 5 or fewer occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
S2	Imperilled or very rare; usually between 5 and 20 occurrences; or with many individuals in fewer occurrences; often susceptible to becoming endangered.
S3	Rare; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4	Common; usually > 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.
S#B	Same rank as the numbered S-series, but refers to the breeding season rarity of migrants.
S#N	Same rank as the numbered S-series, but refers to the non-breeding season rarity of migrants; where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the state.

The spot on the landscape that supports a particular population or location of a species or a specific stand of a given community type is an **element occurrence**. The Colorado Natural Heritage Program has mapped over 6,000 element occurrences in Colorado. Information on the locations and quality of these element occurrences is also entered into the computerized Biological and Conservation Databases (BCD). This computer system, developed by The Nature Conservancy, is utilized by the international network of natural heritage programs and conservation data centers (Stein et al. 1995). All centers utilize the same methodology, allowing a unique, direct comparison of information throughout the area covered.

In addition to ranking each element in terms of rarity, natural heritage staff scientists rank each element occurrence so that protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Element occurrences are ranked in terms of the **quality** (size, vigor, etc.) of the population or community, the **condition** or naturalness of the habitat, the long-term **viability** of the population or community, and the **defensibility** (ease or difficulty of protecting) of the occurrence. Given the intimate relationship between a natural community and its environment, community occurrences are largely ranked in terms of their quality and size.

One of the strongest ways that the Colorado Natural Heritage Program uses these element and element occurrence ranks is to assess the overall significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

B1 Outstanding Significance: only site known for an element or an excellent occurrence of a G1 species.

B2 Very High Significance: one of the best examples of a community type, good occurrence of a G1 species, or excellent occurrence of a G2 or G3 species.

B3 High Significance: excellent example of any community type, good occurrence of a G3 species, or a large concentration of good occurrences of state rare species.

B4 Moderate Significance: good example of a community type, excellent or good occurrence of state-rare species.

B5 General Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

All of the sites presented in this report support important components of the total biological diversity of Picket Wire Canyonlands. These sites, if protected, will represent protection for genetic, species, community, and landscape diversity for the National Grassland.

Protection urgency ranks and **management urgency ranks** are two mechanisms used to prioritize conservation actions related to potential conservation areas. These two ranks summarize the urgency of the need for action and apply a timeline to focus action planning. Urgency ranks are based on current knowledge, but are not always known for a particular area. When this information is not available, every effort is made to obtain it as soon as possible.

Protection Urgency Ranks. The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land ownership or designation. The following codes are used to indicate the rating which best describes the urgency to protect the area:

P1 - Immediately threatened by severely destructive forces, within 1 year of rank date; **protect now or never!**

P2 - Threat expected within 5 years.

P3 - Definable threat but not in the next 5 years.

P4 - No threat known for forseeable future.

P5 - Land protection complete or adequate reasons exist not to protect the site; do not act on this site.

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

Threats that may require a protection action include:

1) Anthropogenic forces that threaten the existence of one or more element occurrences at a site, e.g. (a) development that would destroy, degrade or seriously compromise the long-term viability of a element occurrence; and (b) timber, range, recreational, or hydrological management that is incompatible with and element occurrence's existence;

2) The inability to undertake a management action in the absence of a protection action, e.g. obtaining a management agreement; and

3) In extraordinary circumstances, a prospective change in ownership management that will make future actions more difficult.

Management Urgency Rating. The urgency for management rating focuses on land management or land stewardship action required to maintain element occurrences at the potential conservation area. The following codes are used to indicate the action needed to be taken at the area:

M1 - (a) Management acton required immediately or element occurrences could be lost or irretrievably degraded within one year.
(b) Ongoing annual management action must continue or element occurrences could be lost or irretrievably degraded within one year.

M2 - (a) New management action will be needed within 5 years to prevent the loss of element occurrences.
(b) Ongoing, recurring management action must continue within 5 years to prevent loss of element occurrences.

M3 - (a) New management action will be needed within 5 years to maintain current quality of element occurrences.
(b) Ongoing, recurring management action must continue within 5 years to maintain the current quality of element occurrences.

M4 - Although not currently threatened, management may be needed in the future to maintain the current quality of element occurrences.

M5 - No serious management needs known or anticipated at the site.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, rerouting trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area.

RESULTS

The Natural Heritage Inventory of Picket Wire Canyonlands has been completed. The survey concentrated on the highest priority species and natural communities (steps 5 and 6 of the inventory). Based on the results of the inventory, preliminary conservation planning boundaries were developed for natural heritage resources, and these sites were prioritized in terms of their contribution to maintaining the global, regional and the Comanche National Grassland's natural diversity.

Information Collection Phase

Aerial photographs of the entire study area (dated August 1991) were reviewed in conjunction with 1:24,000 scale topographic maps. When compared with information existing in the Biological Conservation Databases (BCD), a total of 13 Potential Natural Areas (PNAs) were identified (Figures 2 and 4).

The herbarium at the University of Colorado Museum, Boulder, was searched to verify existing records and enhance search images. Information was gathered from knowledgable individuals or files of the Colorado Natural Areas Program, The Nature Conservancy, the Colorado Native Plant Society, and the Colorado Division of Wildlife. Contact with local naturalists and experts provided leads on several rare plants, animals, and significant natural communities. From the literature and expert contacts, few rare animals were identified for Picket Wire Canyonlands. Others were considered extremely difficult to survey in a single year. Animal search was confined to a few priority areas and species, with the results presumably setting the stage for locations of highest probability for rare species occurrences. The Colorado Natural Heritage Program currently has records of 15 vertebrates, 5 invertebrates, 5 plants, and 13 significant natural communities from the study area in its databases (**Table 2**).

During the course of this inventory, Natural Heritage staff used the information collected in this study to re-evaluate several species of concern. For example, Cassin's kingbird ( ), *Asclepias macrotis*, and *Bothriochloa springfieldi* and are now considered more common and do not warrant special protection. In addition, the Natural Heritage imperilment ranks were modified for several other species to reflect their more common status. These species are still believed to warrant conservation attention, but the status is not so urgent as once believed.

The illustration of recommended conservation site sites illustrates the known distribution of natural heritage resources in the study area (Figure 3).

Table 2. Natural Heritage resources known from Picket Wire Canyonlands.

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
INVERTEBRATES						
Gomphus externus	Plains clubtail	G5	S2	n.a.	n.a.	n.a.
Libellula saturata	Firecracker skimmer	G5	S1	n.a.	n.a.	n.a.
Erpetogomphus designatus	Eastern ringtail	G5	S2	n.a.	n.a.	n.a.
Sagenosoma elsa	a sphinx moth	G?	S1?	n.a.	n.a.	n.a.
Manduca sexta	Carolina sphinx moth	G5	S3?	n.a.	n.a.	n.a.
VERTEBRATES						
Coccyzus americanus americanus	Eastern yellow-billed cuckoo	G5T5	S2	n.a.	n.a.	n.a.
Vireo vicinior	Gray vireo	G5	S3B	n.a.	n.a.	n.a.
Picoides scalaris	Ladder-backed woodpecker	G5	S3	n.a.	n.a.	n.a.
Piranga rubra	Summer tanager	G5	S1	n.a.	n.a.	n.a.
Icterus parisorum	Scott's oriole	G5	S2B	n.a.	n.a.	n.a.
Amphispiza bilineata	Black-throated sparrow	G5	S3	n.a.	n.a.	n.a.
Toxostoma bendirei	Bendire's thrasher	G5	S1B	n.a.	n.a.	n.a.
Sonora semiannulata	Ground snake	G5	S2	n.a.	n.a.	n.a.
Tropidoclonium lineatum	Lined snake	G5	S3	n.a.	n.a.	n.a.
Diadophis punctatus	Ring-necked snake	G5	S2	n.a.	n.a.	n.a.
Sayornis phoebe	Eastern phoebe	G5	S3B,SZN	n.a.	n.a.	n.a.
Piranga flava	Hepatic tanager	G5	S1B	n.a.	n.a.	n.a.
Amphispiza bilineata	Black-throated sparrow	G5	S3B,SZN	n.a.	n.a.	n.a.
Aimophila ruficeps	Rufous-crowned sparrow	G5	S2B	n.a.	n.a.	n.a.
Hybopsis gracilis	Flathead chub	G5	S3	n.a.	n.a.	F.S.
PLANTS						
Cheilanthes eatonii	Eaton's lip fern	G5	S1	n.a.	n.a.	n.a.
Cheilanthes wootonii	Wooton's lip fern	G5	S1	n.a.	n.a.	n.a.

Element	Common Name	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Pellea wrightiana	Wright's cliff-break	G5	S1	n.a.	n.a.	n.a.
Asplenium platyneuron	Ebony spleenwort	G5	S1	n.a.	n.a.	n.a.
PLANT ASSOCIATIONS						
Juniperus monosperma/Bouteloua eriopoda woodland	One-seeded juniper/black grama woodland	G?	SU	n.a.	n.a.	n.a.
Juniperus monosperma/Bouteloua gracilis woodland	One-seeded juniper/Blue grama woodland	G5	S3S4	n.a.	n.a.	n.a.
Juniperus monosperma/Bouteloua curtipendula woodland	One-seeded juniper/Side oats grama woodland	G5	S3S4	n.a.	n.a.	n.a.
Sarcobatus vermiculatus/Bouteloua gracilis shrubland	Greasewood/Blue grama shrubland	G1?	S1?	n.a.	n.a.	n.a.
Sarcobatus vermiculatus/Sporobolus airoides shrubland	Greasewood/Alkali sacaton shrubland	G4	SU	n.a.	n.a.	n.a.
Bouteloua gracilis-Hilaria jamesii grassland	Blue grama-galleta grass grassland	G3G4	SU	n.a.	n.a.	n.a.
Juniperus monosperma/Stipa neomexicana woodland	One-seeded juniper/New Mexico feathergrass	G4	SU	n.a.	n.a.	n.a.
Stipa comata-Bouteloua gracilis grassland	Needle-and-thread - Blue grama grassland	G5	S3S4	n.a.	n.a.	n.a.
Stipa neomexicana grassland	New Mexico feathergrass grassland	G2	S2	n.a.	n.a.	n.a.

Field Survey Phase

Field surveys conducted as part of the Picket Wire Canyonlands natural heritage inventory have revealed substantial information on the natural history of the study area. Among the survey's highlights are:

★ Picket Wire Canyonlands is a large ecosystem cut into the sedimentary rocks of the southern Great Plains. The canyon's proximity to Bent's Fort resulted in its early exposure to a rapidly advancing United States population in the early 19th century. Most habitats that were occupied by European-derived Americans showed extensive alterations, including some areas in the Picket Wire Canyonlands (e.g. Rourke Ranch riparian habitats). In contrast, some areas within the Purgatoire Canyon remain relatively undisturbed due to their remoteness and the geomorphology of the Purgatoire Canyon. These few areas are maintained by natural ecological processes. Nowhere is this more evident than in the aquatic habitat of the Purgatoire River (Bramblett and Fausch 1991). While there is no universally used stream natural community classification, the ichthyofauna of the Purgatoire River between reservoir near Trinidad and the mouth of Purgatoire Canyon remains as one of the last remaining native fish communities in the rivers of the Great Plains. Such stream systems should receive the highest priority for protection.

★ The riparian ecosystems of the Picket Wire Canyonlands have received extensive use by livestock until the recent past. These systems have responded with functional shifts in the vegetation. For example, the invasion of saltcedar (*Tamarix ramossisina*) may cause significant, possibly permanent, changes in vegetation structure and composition in many low elevation riparian areas of the southwestern United States (Howe and Knopf 1991; Akashi 1988). The riparian ecosystem of the Purgatoire River still provides important wildlife values, but the system is highly alterred and will require extensive management and restoration efforts to return its native values.

★ Water-poor, steep, and inaccessible parts of the Purgtoire Canyon were found to retain pre-settlement vegetation characteristics. Excellent examples of plant associations were observed in these areas. For example, nearly the entire middle parcel of the Picket Wire Canyonlands was found to have a diverse, largely native vegetation. Such remnant areas should serve as reference sites and potentially as source populations for management and restoration efforts. Some of these areas qualify for special area designations (i.e. Special Interest Area, Research Natural Areas, etc.).

★ The relative high quality of the habitats in the Purgatoire Canyon combined with the geomorphology and biogeographical position provide habitats for many peripheral species of plants and animals, including the invertebrates. These species are generally common in areas to the south or east, but uncommon to Colorado (see the natural heritage rankings). Whereas there is considerable discussion as to the values in protecting peripheral populations, where numerous peripheral species occur in the same area, conservation action is warranted for reasons including genetic variation, future

speciation events, and for protection of evolutionary processes and environmental systems (Lesica and Allendorf 1995). In addition, areas with numerous peripheral species are generally areas with high regional species richness likely to be identified as hot-spots by GAP analysis (Scott et al. 1991).

★ There are at least four species of rare ferns known from the Picket Wire Canyonlands. While these ferns are known more commonly in other parts of their range, they are represented in few areas of Colorado. This is largely because the habitats in which they are found in the eastern and southern United States are poorly represented in Colorado. Small occupied areas with suitable microhabitats are found in Purgatoire Canyon.

★ A key benefit of conducting prioritized surveys in a geographic unit is that the status of species is challenged by new information. Several species thought to be of conservation significance were located in greater numbers than expected. With this new information, the natural heritage ranks for these species were adjusted. The newer ranks more accurately reflect the status of these species in Colorado and globally. Cassin's kingbird (*Tyrannus vociferans*), Eastern phoebe (*Sayornis phoebe*), Red-headed woodpecker (*Melanerpes erythrocephalus*), Rufous-crowned sparrow (*Aimophila ruficeps*), Ringneck snake (*Diadophis punctatus*), Ground snake (*Sonora semiannulata*), Firecracker skimmer (*Libellula saturata*), *Asclepis macrotis*, and *Bothriochloa springfieldi* had changes downward in element ranks that reflected the knowledge that they are more common than originally believed.

Table 3. Potential Natural Areas identified during the Picket Wire Canyonlands natural heritage inventory.

PNA#	PNA NAME
1	Head of Canyon
2	Small Gulch
3	South Black Hills Grassland
4	South Black Hills Basin
5	Bravo Canyon
6	Rourke Canyon South
7	Rourke Ranch Hill
8	Beaty Canyon South
9	Withers Canyon
10	Purgatoire River at Minnie Canyon
11	Purgatoire River at Withers Canyon
12	Purgatoire River at Taylor Arroyo
13	Head of Minnie Canyon

Figure 1. The locations of the 13 Potential Natural Areas identified during the survey of Picket Wire Canyonlands.

Figure 1 is not available.

Figure 2. Locations of rare or imperilled species and significant occurrences of natural communities on and around the Picket Wire Canyonlands.

Figure 2 is not available.

Figure 3. The locations of the eight standard conservation sites identified during this inventory.

Figure 3 is not available.

Identification and protection of rare or imperiled and wide-ranging species.

Relatively small site level protection is not adequate for some natural features. For example, to conserve some populations of common birds, particularly those that occur over large geographical areas, the best approach may be to establish complementary management practices over occupied large areas or landscapes. We believe that this same principle applies to many wide-ranging rare species and to similarly distributed species in most other groups of organisms. For much of our natural diversity it is now considered just as important to maintain a landscape pattern that is compatible with the life histories of the constituent species. The most apparent recommendation arising from a recognition of landscape pattern is the maintenance of habitat linkages (Hudson 1991). But even these tools are probably inadequate adequate to preserve natural diversity.

Even within managed landscapes, we will still need preserves for diversity. Of course preserves for rare species may be critical, but even common species derive essential benefits. Among those benefits are the establisment of reference areas, areas that are considered of excellent quality for the natural community(ies) that exist there. Not only do such areas protect the organisms within them, but they are of utmost importance as monitoring stations. Other sites of equal importance are those designated as research sites. Such sites are important for the testing of hypotheses about impacts of land use practices as well as basic science. Of course, isolated preserves are generally undesirable if they are separated from the ecological processes that support the natural community(ies). So, smaller scale protection efforts are insufficient but critical in protecting even wide-ranging or common species.

Examples of wide-ranging species known from Picket Wire Canyonlands and that will benefit from landscape management include Golden eagles, Prairie falcons, Ferruginous hawks, Lark buntings, Yellow-billed cuckoos, many other bird species, Black bear, bats, dragonflies, and fish. All of these species need preserves, but must have a compatible matrix surrounding such protected areas for long term survival. Habitat or landscape types that should be considered particularly important because of known declining diversity include wetlands, grasslands and riparian areas.

Wetlands and biodiversity.

Wetlands and riparian habitats are known to be of significance to wildlife (Windell et al. 1986 and references cited within). The diversity of plants and animals is higher in such areas due to the high productivity, diversity of structural habitat, and simply the availability of water. In the dry western United States, most life forms congregate around water. Humans are no exception. Water is needed for consumption, agriculture, livestock, and the support of industry. It is because of the necessity of water combined with its scarcity that the wetlands and riparian habitats, particularly in the western United States have suffered serious ecological degradation or losses (Busch and Scott 1995).

It is estimated that more than 50% of the original wetlands of the coterminous United States have been lost (Dahl 1990). Much of the remaining habitat is heavily altered. Therefore,

it can be expected that in a survey such as a natural heritage inventory, where naturalness and imperilment are used as key factors establishing priorities, wetlands may not appear strongly represented. We do not argue with the need to protect wetlands for their extremely important ecological contributions. Such areas are considered a high priority in the Picket Wire Canyonlands Interim Management Plan. But other tools are available for the identification of all wetland types. The location of wetlands is best done through use of infrared aerial photographs. The U. S. Fish and Wildlife Service's Wetland Inventory Maps provide a good first level analysis. We would stress that using these maps this study used wetland and riparian habitats as a major criteria in searching for Potential Natural Areas. More than half of the PNAs were in fact associated with wetlands.

The significance of wetlands to large numbers of species is an important consideration in land use planning. To protect the natural diversity of an area, wetlands must take a high priority. The approach we have taken will assist in the protection of those wetlands that are the rarest, those with the natural characteristics and species. Often these have rare or endangered species associated with them. Again, we agree that there should be no loss of wetlands and that every government or private entity should do whatever is possible to assure that there are no further losses, or even better, significant gains. We believe that this study will provide scientifically-based priorities to guide the protection and disposition of the most significant wetlands for rare or imperiled species. These areas also support a robust suite of common species. Also of great significance is the fact that wetlands that contain rare species or rare natural communities, once lost, cannot be regained. This is the basis for the results presented herein.

We encourage Picket Wire Canyonlands to take a proactive stand on wetland protection and management. While visiting the many riparian and wetland sites in Picket Wire Canyonlands we viewed the degradation of many wetland and riparian sites. But we have also been able to find some sites that despite intensive human activity, remain largely natural in their function, structure, and species composition. It is these sites that we believe are of the highest priority in wetland protection.

PROTECTION OF SIGNIFICANT BIODIVERSITY AREAS

Of the thirteen Potential Natural Areas (PNAs) identified during the study (Figure 2), four were dropped from consideration because they were found not to have rare or imperiled species or the natural communities were extensively disturbed (**Appendix A**). The remaining nine sites were found to support rare or imperiled species or significant natural communities. Of these several were merged to form a total of eight Conservation Sites (Figure 3). In addition, we have recommended the entire ecosystem of the Purgatoire Canyon as a highly significant area for landscape level conservation efforts. These sites are recommended to Picket Wire Canyonlands as areas in need of special protection. The CNHP in no way implies that areas that were studied but not considered conservation sites are not of importance for conservation purposes. The ranking system used merely ranks sites for protection relative to the rarity of known significant features. Therefore, the sites identified herein comprise the highest priority sites, based on known information, for the conservation of the study area's natural diversity.

Other sites are worthy of conservation, but in those sites, species and natural communities that might be lost are found in many additional sites.

Once a Conservation Site has been identified, the first step in protecting the sensitive species or communities is to delineate a preliminary conservation planning boundary for the site. In developing these boundaries, Natural Heritage Program staff considered a number of factors. These included, but were not limited to:

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

The final 8 conservation sites found to support natural heritage resources range in size from 35 to 3,500 acres (Table 4).

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels. Maps showing these preliminary boundaries are included with each conservation site description in the text to follow.

Table 4. Conservation sites identified during the Picket Wire Canyonlands natural areas inventory.

CONSERVATION SITE	BIODIVERSITY RANK	PNA #	USGS QUADRANGLE
Dinosaur Track Greasewood Flat	B2	10 (in part)	Beaty Canyon
Minnie Canyon	B5	13	Packers Gap
Purgatoire Canyon Megasite	B3	all	n.a.
Purgatoire River at Little Pine Canyon	B2	12	Doss Canyon North
Rourke Canyon	B2	6, 8	O V Mesa Packers Gap
Rourke Ranch Hill	B3	7	O V Mesa
South Black Hills	B4	1, 3, 4	O V Mesa
Welsh Canyon	B5	n.a.	O V Mesa
Withers Canyon	B5	9 (in part)	Riley Canyon

Conservation Sites Identified During the Inventory

The 13 PNAs identified during this Natural Heritage Inventory (Figure 1; Appendix A) were surveyed and subsequently categorized as: (1) Omitted from further consideration; (2) Designated as a Conservation Site. A Conservation Site is a natural heritage designation for any site which contains one or more occurrences, believed to be viable, of a rare/imperiled species or significant natural community. Therefore, conservation sites have known values for conserving the natural biological diversity of Picket Wire Canyonlands.

The conservation sites are described in standard site reports and appear in alphabetical order by site name. The sections of these reports and their contents are outlined and explained below.

SIZE: The approximate acreage (and hectares) included within the conservation planning boundary for the conservation site.

BIODIVERSITY RANK: The overall significance of the conservation site in terms of imperilment of the natural heritage resources and the quality (health, abundance, etc.) of their occurrences. As discussed on page 8, these ranks range from B1 (Outstanding Significance) to B5 (General Biodiversity Significance).

PROTECTION URGENCY RANK: An indication of the time frame in which protection needs to be accomplished. Protection includes changes in ownership or primary authority over the land. It also includes actions such as registry, designation, easements, etc.

MANAGEMENT URGENCY RANK: An indication of the time frame in which specific management actions must occur to maintain or improve the condition of the occurrence.

LOCATION: The county and USGS 7.5' quadrangles that include the Conservation Site. The Natural Heritage Program code for the quadrangle is noted in parentheses (e.g. 3710365 is the Riley Canyon quadrangle). Directions to the site are also provided.

GENERAL DESCRIPTION: A brief narrative picture of the topography, vegetation, and current use of the conservation site. Common names are used along with the scientific names.

HISTORICAL LAND USE: Where known, we provide a brief synopsis of human land use of the area of concern.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: We provide a synopsis of the rare species and significant natural communities that occur on the conservation site. Many rare species and some natural communities are sensitive to disturbance or may be sought out by collectors; therefore, the exact locations of each element are not shown on the maps. Requests for additional information should be addressed to the Colorado Natural Heritage Program.

CURRENT STATUS: A summary of the ownership, degree of protection currently afforded the conservation site, and threats to the site or natural heritage resources as determined to date.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary delineated in this report includes all known occurrences of natural heritage resources and the adjacent lands required for their protection. A discussion of the major factors that were considered is on pages 23-24.

PROTECTION AND MANAGEMENT CONSIDERATIONS: A summary of the major issues and factors that are known or likely to affect the protection and management of the conservation site.

DINOSAUR TRACK GREASEWOOD FLAT CONSERVATION SITE

SIZE: ca. 125 acres (51 ha)

BIODIVERSITY RANK: B2

The presence of a critically imperilled natural community and supported state-rare bird species indicate the significance of this area.

PROTECTION URGENCY RANK: P4

Ownership is simple and under special management by the USFS. The designation of 10C is through the Picket Wire Canyonlands Management Plan (U. S. Forest Service 1994).

MANAGEMENT URGENCY RANK: M2

Management plans for the entire Picket Wire Canyonlands area are currently being developed. This site is adjacent to the major public attraction to the area, the dinosaur tracks and shows signs of further degradation from existing uses.

LOCATION: **Directions**: Las Animas County: 25.5 miles south and 3.25 miles west of La Junta, or 10.5 mi south and 7.0 mi west of Higbee. **USGS Quadrangle**: Beaty Canyon (3710355). **Legal Description**: T28S, R55W, sec 8:se4, sec 9:nw4. **Elevation**: 4,382 ft (1,773 m).

GENERAL DESCRIPTION: This site lies in the floodplain and adjacent to the banks of the Purgatoire River. It is nearly level and elevated approximately three meters above the river by undercut banks. The vegetation at this site is dominated by *Sarcobatus vermiculatus* (Greasewood), and is apprarently typical of plant communities found on the Limon series silty clay loam soils of this site (Larsen et al. 1972). The understory generally contains a mosaic of *Sporobolus airoides* (Alkali sacaton), *Bouteloua gracilis* (Blue grama), *Muhlenbergia torreyi* (Ring muhly), and a few *Opuntia* sp. There is a significant percentage of bare ground. The slopes above the site are covered by *Juniperus monosperma* (One-seeded juniper) woodlands. This community supports a bird community that is distinct within the canyon in that it includes typical grassland species and those that prefer semi-desert shrublands. This area contained a relatively dense colony of Black-throated sparrows (*Amphispiza bilineata*). Superficial sampling indicates a low mammal density. Butterflies and tiger beetles are surprisingly few (at least in 1994).

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in the what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and the Spanish Mexican territory, largely along the Santa Fe Trail (Lavender 1954). Spanish citizens inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land adjacent to the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

The vicinity of the Dinosaur Tracks Greasewood Flats Site was undoubtedly used by all of the groups mentioned above. It is likely that pre-American peoples had relatively little impact on the vegetation; however, the role of fire that originated from indigenous people is not well documented for this area and may have been significant. Use of Purgatoire Canyon riparian zone by native ungulates may have been extensive, especially in the vicinity of water.

Spanish settlers of the area were largely subsistence farmers and their impacts were probably localized. With the advent of large scale ranching activity, significant changes to the vegetation occurred, at least in the lower elevations nearer the Purgatoire River. Sheep were once grazed extensively in the area, but their impacts are poorly known. Vegetation patterns in much of the area surrounding this conservation site indicate extensive overgrazing for a long period of time (Johnston and Reed 1991). Grazing of the entire Picket Wire Canyonlands area has been discontinued until a management plan can be generated.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Dinosaur Track Greasewood Flat Site contains two significant examples of plant associations and two breeding occurrences of state-rare bird species. The Greasewood-dominated shrublands are actually somewhat widespread in occurrence, but most have been alterred so much that they are difficult to recognize and certainly of questionable viability. Remnant patches in adjacent reaches of the valley suggest a much more widespread occurrence in the past. Other occurrences of these communities are known from the Pinon Canyon Maneuver Site (Shaw et al. 1989). The occurrences identified at this site are large and probably viable with management. These Greasewood plant associations are locally restricted to a particular soil formation, Limon silty clay and loam, which is an alluvian soil derived from shale (Larsen et al. 1972).

The state-rare or imperiled bird species are evidence of the zoogeographic significance of the Purgatoire Canyon area. Black-throated sparrows and Bendire's thrashers are birds of southern desert and semi-desert shrublands which reach the northern limits of their ranges in Colorado (Andrews and Righter 1992).

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Sarcobatus vermiculatus/Bouteloua gracilis	Greasewood/Blue grama shrubland	C	G1?	S1?	n.a.	n.a.	n.a.
Sarcobatus vermiculatus/Sporobolus airoides	Greasewood/Alkali sacaton shrubland	C	G4	SU	n.a.	n.a.	n.a.
Amphispiza bilineata	Black-throated sparrow	B	G5	S3	n.a.	n.a.	n.a.
Toxostoma bendirei	Bendire's thrasher	C	G5	S1B	n.a.	n.a.	n.a.

CURRENT STATUS: The entire area is owned by the U. S. Forest Service and under the jurisdiction of the Comanche National Grassland (part of the Pike-San Isabel National Forests and Comanche National Grassland). The entire area is categorized as 10C under the Picket Wire Canyonlands interim management plan (U. S. Forest Service 1994). This recognizes the area as a special interest area. This site currently receives no special attention as an ecological unit, but occurs adjacent to globally significant paleontological resources.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary presented here is intended to designate an area within which threats to the identified elements should be managed and within which the local ecological processes necessary to the long-term viability of the identified elements are contained. This boundary encompasses the identified high quality greasewood communities and associated rare/imperiled birds also found here. A buffer has been added that includes the remainder of the contiguous greasewood habitat. This buffer is meant to protect the occurrences, especially from weedy invasion, and to prevent further fragmentation of the habitat. Local processes that may be especially important to maintaining the greasewood communities include the depth and fluctuation of the local watertable. The nearby existence of *Tamarix ramossisina* (Tamarisk) along the banks of the river may be of concern due to their tendency to locally deplete water tables.

The long term viability of this site is dependent upon a natural hydrological regime in the Purgatoire River. Since this ecological process extends beyond this site boundary, it is important to use ecosystem management principles to manage at the watershed level.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Future management of the Comanche National Grassland may promote visitation. This site is dissected by an existing two-track roadway that provides access to the dinosaur tracks. A primitive parking area and toilet are present adjacent to the river.

Consideration should be given to a road closure and development of a less intrusive access. Should this not be feasible we would recommend that the access road be managed to prevent off-road use. The parking area should be similarly controlled. Finally, the two-track road is a loop, although the easternmost portion is uncommonly used. We believe that the loop should be closed, restricting access to the main roadway.

Some site management may be necessary to prevent the expansion of weeds in the area. Although these communities are resistant to change, there are patches of weeds throughout that are vestiges of past management. Most of the exotic plants occur near roads and trails. Other nearby areas that originally supported this community have been replaced by exotic monocultures or heavily degraded by invading grasses in the understory. Johnston and Reed (1991) suggested that short, intensive grazing be used as a management tool for the area. We are not sure of the direct impacts this may have on the Greasewood shrublands. This should be addressed in the development of management strategies for the riparian zone.

The existence of abundant Tamarisk (*Tamarix ramossisina*) in the adjacent riparian areas may be of concern. Tamarisk is a "thirsty" species, known to draw down local water tables. If the water table under the Greasewood dominated communities is lowered significantly, we would expect changes in the composition and structure of the vegetation. Tamarisk is difficult to manage and will present long-term challenges to land managers (Johnston and Reed 1991).

Off-site management considerations will be essential to the long term viability of this community type. 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 regularly eliminating portions of the floodplain. Maintaining this natural dynamic is equivocal to the long term maintenance of this natural community. In short, the maintenance of the natural hydrological regime of the Purgatoire River is critical to the maintenance of this and other floodplain communities.

Research needs to assure the long-term viability of the site include ground water hyrological patterns, potential impacts of Tamarisk on the local water table, and the role of fire and grazing in management of the natural communities of this site.

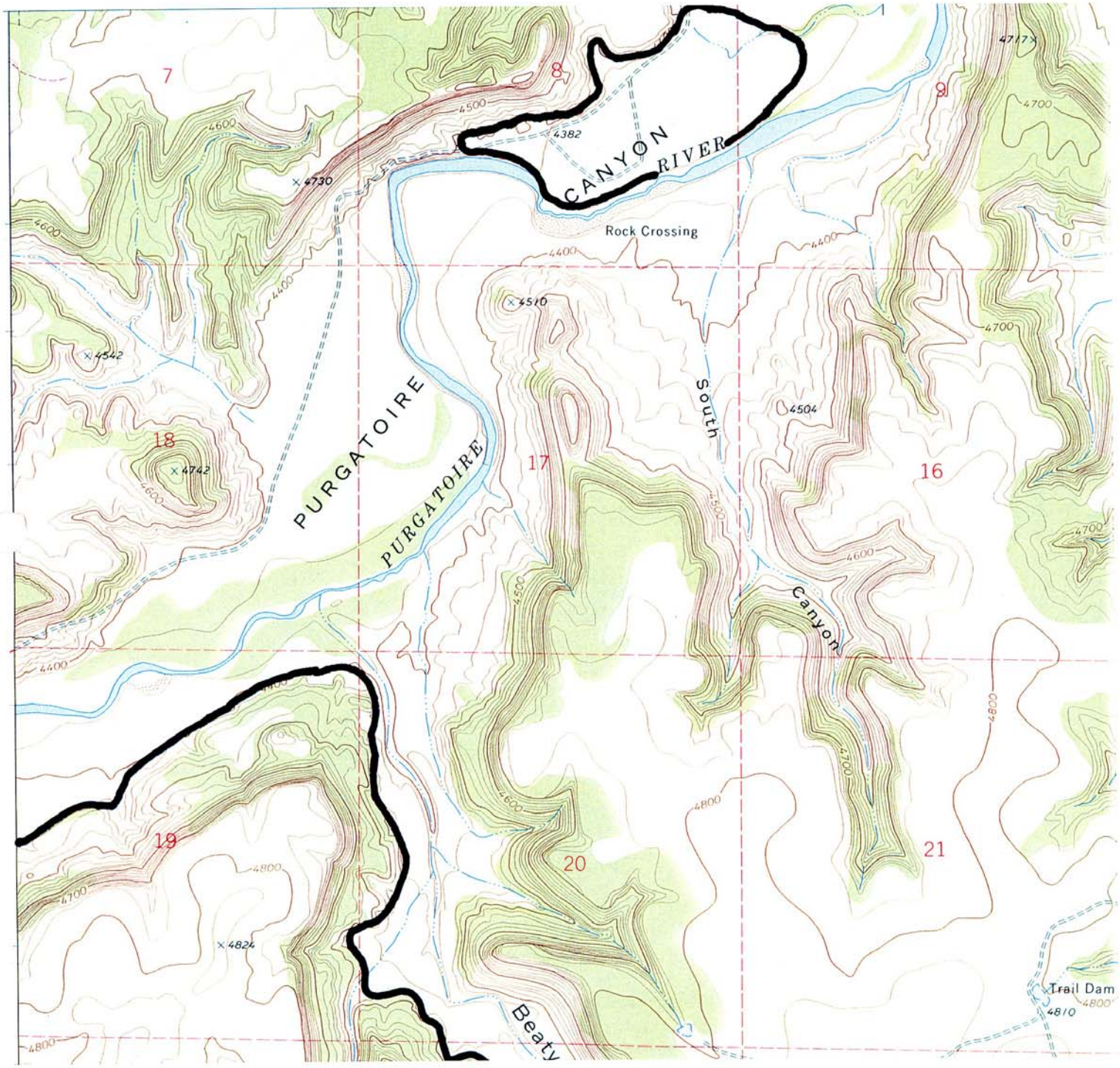

Figure 4. The proposed boundaries for the Dinosaur Track Greasewood Flat site. The figure was taken from the Beaty Canyon Quadrangle.

MINNIE CANYON CONSERVATION SITE

SIZE: ca. 350 acres (142 hectares)

BIODIVERSITY RANK: B5

This site contains two state rare/imperiled elements representative of the northern extent of the Chihuahuan faunal element.

PROTECTION URGENCY RANK: P5

We consider the existing protection adequate since the entire site is owned by the U. S. Department of Agriculture, U. S. Forest Service, Comanche National Grassland. The entire area is designated as 10C in the forest service management plan. Such a designation recognizes the area as a special interest area.

We note that the survey did not include areas beyond the Comanche National Grassland's boundary. It is likely that this site should continue down the canyon. If this is so, the area falls within the Pinyon Canyon Maneauver Site of the Department of Defense.

MANAGEMENT URGENCY RANK: M4

While there is little use of the area presently, an increase in recreational use is anticipated (USFS 1993). Well informed planning and the careful placement of trails or roads may avoid potential impacts to the elements and their supporting ecosystem.

Should grazing ever be considered as a management option, we recommend winter grazing or activity which minimizes the impacts on breeding birds and warm season grasses and forbs.

LOCATION: **Directions**: Otero County: 18 mi. S and 6 mi. W of La Junta: head of Minnie Canyon just east of Rourke Road at the Otero/Las Animas county line. **USGS Quadrangle**: Packers Gap (3710366); **Legal Description**: T27S R56W sec. 34, T28S R56W sec. 2; **Elevation**: 4,500' - 4,700' (1,372 m - 1,417 m)

GENERAL DESCRIPTION: The area is at the head of Minnie Canyon within a mosaic of Juniperus monosperma woodlands and short to midgrass grasslands. Exposed sandstone forms the canyon walls with many overhangs. The ephermeral drainage flows to the east. There are signs of human activity that include old stone dwellings, an abundance of forbs known as "increasers", and a 2-track roadway.

The slopes and rock outcrops of the area are rich in grasses and forbs. It is these areas that support the rare bird species.

HISTORICAL LAND USE: The area of Purgatoire Canyon has been occupied by humans for at least 5,000 years. Apparently many native tribes lived in or visited the area. By the early 1800's trade began along the Santa Fe Trail and Spanish emigres first colonized the canyons as early as the 1840's. They buildt small settlements and ranches and rasied small herds of sheep, goats, and cattle. The Purgatoire Canyon itself became an alternate trade route and American settlement increased to a peak of about 400 people by the late 1880's. The "empire ranching" that dominated the area from the 1880's ended by 1909 with the increase in dry-land farming and fence-buildling by homesteaders. Old and degraded structures or foundations from this period were observed in Minnie Canyon. A severe flood in 1904 and droughts in the 1920's and 1930's caused abandonment of the land and again, leaving the land to sheep and cattle ranchers once again. The apparent lack of water in this canyon must have kept it remote to many land use activities. Ranching remains the major land use of the area's inhabitants today. However, major changes in the landscape came about with the procurement of much of the area by the Department of Defense in forming the Pinyon Canyon Maneuver Site.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Two state rare/imperiled bird species were found in Minnie Canyon. *Aimophila ruficeps* (Rufous-crowned sparrow) inhabit the juniper-dominated slopes and rims of the canyon. This species is at the northernmost edge of its range in the Purgatoire Canyon (CNHP unpublished data).

Sayornis phoebe (Eastern phoebe) inhabits the canyon where rock walls provide steep enough slopes and protection from ground predators. One pair were observed in the canyon. Another male was observed calling nearby.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Sayornis phoebe	Eastern phoebe	B	G5	S3B, SZN	n.a.	n.a.	n.a.
Aimophila ruficeps	Rufous-crowned sparrow	C	G5	S2	n.a.	n.a.	n.a.

Other wildlife values of Minnie Canyon include a good representation of area birds. The diversity of habitats within the site provides for the high diversity. Other bird species observed included: Chihuahuan ravens (nesting), Brown towhee, Rock wren, Bewick's wren, Canyon wren, Says Phoebe, Mourning dove, Red-tailed hawk, Blue grosbeak, Bushtit, Ash-throated flycatcher, Chipping sparrow, House finches, and Bullocks oriole. Lizards of the area are numerous. A single individual of the night snake (Hypsiglena torquata) was found under a rock in the riparian zone.

CURRENT STATUS: The entire area is managed under the interim management plan as 10C. This designation makes the site a Special Interest Area, adequate to protect known significant elements of diversity. Current regulation provides for day use of a primitive nature. The two bird species of significance identified in Minnie Canyon appear to be limited only by natural processes. Few exotic species were observed, but increasers (e.g. Guteresia) are common.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary is intended to designate an area which, given the available data regarding the ecological processes that support these elements, is believed necessary to support the elements. Unfortunately, little is understood regarding the dynamics of the juniper woodland habitats. At this time, we suggest that the boundary should encompass all of the local breeding habitat for the birds being considered. Therefore, the boundary is drawn by following the edge of the juniper woodland around the head of the canyon. The lower boundary is undefined since similar habitat extends down the canyon all the way to the Purgatoire River, but this area was not surveyed for natural heritage resources.

PROTECTION AND MANAGEMENT CONSIDERATIONS: The protection provided by the existing management plan (USFS 1993) is adequate to maintain the identified rare/imperiled species. In the final management plan, we recommend that Minnie Canyon be maintained as a Special Interest Area. Consideration should be given to expanding the area into the Pinyon Canyon Maneuver Site.

Maintaining the native birds of this area will require limitations to the disturbance of nesting species. Equally important is the maintenance of the juniper woodlands structure. Since heavy grazing activity is known to impact the structure of this community, caution should be exhibited in using grazing as a management tool for the area. Winter grazing and fire management could be investigated as potential management tools.

A few tamarisk are present in the riparian zone of the canyon. This species has the potential to spread during wet periods and should be controlled. Immediate removal of existing individuals is recommended to prevent spreading.

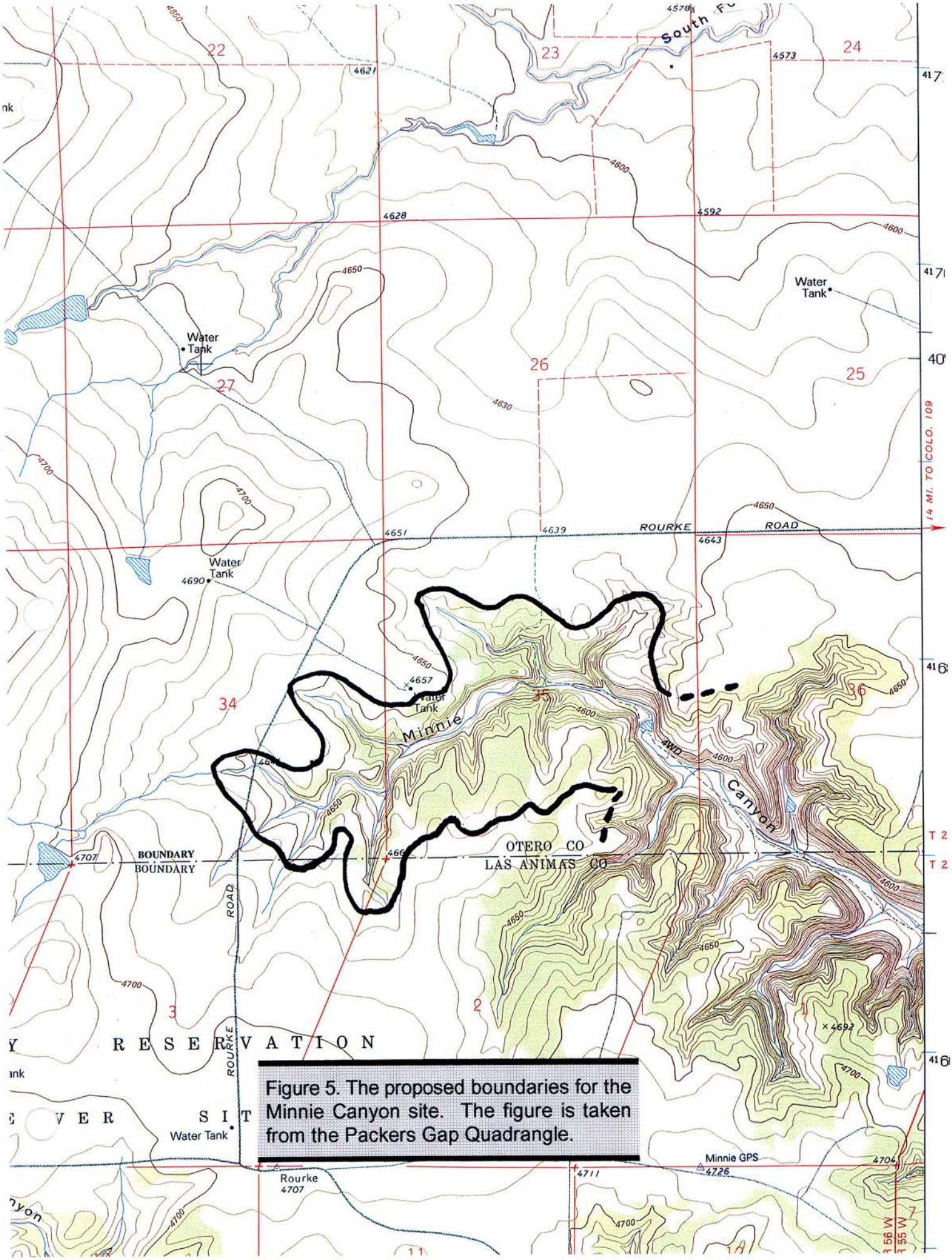

Figure 5. The proposed boundaries for the Minnie Canyon site. The figure is taken from the Packers Gap Quadrangle.

PURGATOIRE AT LITTLE PINE CANYON

SIZE: 400 acres (162 ha)

BIODIVERSITY RANK: B2

The canyon slopes contain excellent examples of the extant plant associations. These are considered representative examples.

PROTECTION URGENCY RANK: P3

The ownership in this area is mixed between the U. S. Forest Service and private property. While the natural community is not directly threatened (due to its difficult accessibility), the existing use of the adjacent habitats is a real threat.

MANAGEMENT URGENCY RANK: M3

Management of the slopes is passive with few direct threats. However, the management of adjacent habitats is posing a serious threat through the introduction of weeds.

LOCATION: **Description**: Las Animas County; 39.8 mi (64.1 km) S and 15.9 mi (25.6 km) W of La Junta. This site encompasses the entire canyon slope between Doss Canyon and Little Pine Canyon. **Legal Description**: T30S R57W sec. 19 and 30; T30S R58W sec. 25 and 36. **USGS Quandrangle**: Doss Canyon North (3710347); **Elevation**: 4,700' - 5,000' (1,901 m - 2,023 m).

GENERAL DESCRIPTION: The site is part of the upper Purgatoire Canyon in the area most remote and difficult to access. The area of identified interest is the east wall of the canyon and its adjacent rim which exhibits and exemplary occurrence of One-seeded juniper/blue grama woodland (*Juniperus monosperma/Bouteloua gracilis*). These steep canyon slopes appear nearly pristine. Riparian and canyon bottom communities are generally more disturbed and affected by heavy livestock grazing. Whereas there are some remnants of native natural communities, there are many exotic and invasive plant species. The flat plateau above the site contains additional one-seeded juniper woodlands which grade into prairie grasslands within several miles of the canyon rim.

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and the Spanish Mexican territory, largely along the Santa Fe Trail (Lavender 1954). Spanish citizens inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail, at least to Bent Canyon, especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land adjacent to the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

The area around Doss Canyon and Taylor Canyon have no doubt been similarly used, but perhaps to a lesser extent than farther down canyon. Indigenous peoples used the area but probably had little effect on the vegetation. However, we do not have a good understanding of the role of fire and indigenous people's life styles on the canyon slope woodlands. In general, even the degraded natural communities of the canyon bottoms appear in higher quality in this remote reach. We expect that grazing pressure was highest in Taylor Canyon and less so in Doss Canyon, which appears more difficult terrain (as determined through aerial photograph analysis). The steep

canyon slopes have remained largely inaccessible to cattle and modern human inhabitants. The ecological condition of these slopes is excellent.

Spanish settlers of the area were largely subsistence farmers and their impacts were probably localized. With the advent of large scale ranching activity, significant changes to the vegetation occurred, at least in the lower elevations nearer the Purgatoire River. Sheep were once grazed extensively in the area, but their impacts are poorly known. Vegetation patterns in much of the area surrounding this conservation site indicate extensive overgrazing for a long period of time (Johnston and Reed 1991). Grazing of the entire Picket Wire Canyonlands area has been discontinued until a management plan can be generated.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The canyon slopes on the eastern wall of the canyon are in exemplary condition. The difficult access has no doubt preserved the condition of these commnities. Exemplary communities, including common types, should be considered as representative. While we did not observe other rare resources specifically tied to this community, the large size of this remote area suggests that many associated plant and wildlife species occur in occurrences of equally high quality.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Juniperus monosperma/Bouteloua curtipendula	One-seeded juniper/Side oats grama woodland	A	G5	S3S4	n.a.	n.a.	n.a.

CURRENT STATUS: The area included in this conservation site is owned largely by the USFS, but significant areas are privately owned. The USFS property is currently designated with a 10C status, effectively identifying the area as a special interest area. There is little available information to suggest the extent of buffer needed on the canyon rim. The slope community grades into rim communities, suggesting that they are ecologically integrated. We recommend that management within at least 1,000 ft of the rim be compatible with protection and management goals of the identified natural values.

BOUNDARY JUSTIFICATION: The recommended site boundary incorporates that part of the occurrence that we visited or could observe directly. No doubt this occurrence is much more extensive, continuing up- and downstream. Further inventory is warranted to verify the occurrence and condition of these community types.

PROTECTION AND MANAGEMENT CONSIDERATIONS: We believe that this site could represent its plant association as a Special Interest Area. However, management considerations are complex due to the ownership patterns and potentially conflicting management goals. Management of the canyon slopes can be largely passive except for the monitoring (perhaps every five years) of community condition. There is considerable concern for the continuing degradation of adjacent communities and the potential for introduction of exotic and invasive species. It is unlikely that these invasions will occur without some ground disturbance of the canyon slopes; however, even naturally occurring fire can cause such disturbance. Therefore, we believe that management of adjacent lands must be compatible with the management goals of the site.

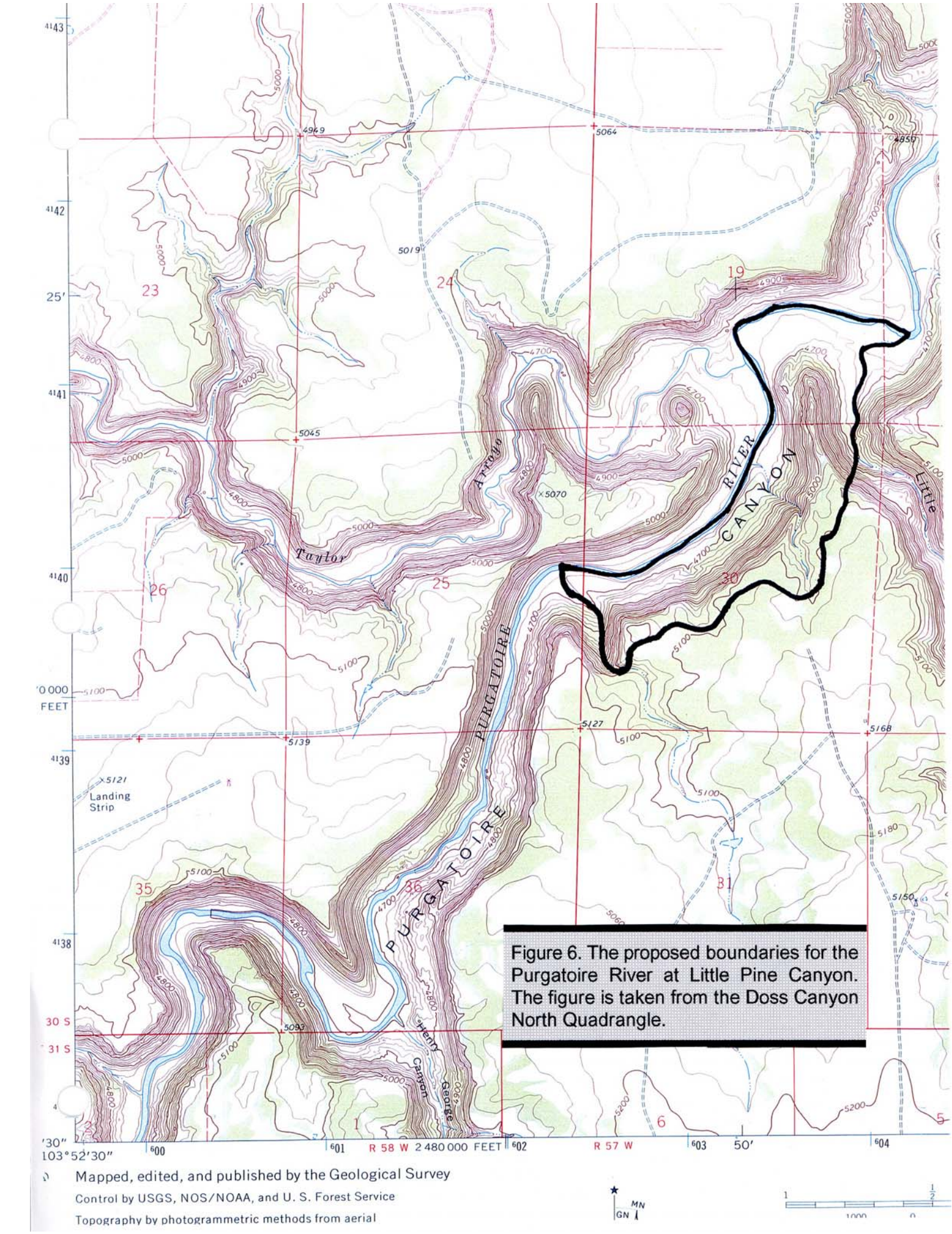

Figure 6. The proposed boundaries for the Purgatoire River at Little Pine Canyon. The figure is taken from the Doss Canyon North Quadrangle.

ROURKE CANYON CONSERVATION SITE

SIZE: 3,500 acres (1,416 ha)

BIODIVERSITY RANK: B2

Rourke Canyon Conservation Site supports ten occurrences of rare/imperiled species or significant natural communities. An excellent example of a New Mexico feathergrass grassland (*Stipa neomexicana* grassland) and good examples of *Bouteloua gracilis-Hilaria jamesii* grasslands (Blue grama-Galleta grass grassland) are present and represent the most significant elements.

PROTECTION URGENCY RANK: P4

Approximately one half of this site is owned by the U. S. Forest Service. The remainder is largely State Land Board property currently being leased by the U. S. Forest Service. There are small areas of private lands included in the eastern edge of the ecological site. There are no immediate concerns for the status of this site, but at some time in the future the State Land Board may be considering options for alternative land uses.

MANAGEMENT URGENCY RANK: M4

The current management provides for an excellent example of these communities. The species that are supported in such habitats occur in good populations. Management options, particularly for the State Land Board parcels may have considerable impact on this site.

LOCATION: **Directions**: Las Animas County: 28 mi S and 5 mi W of La Junta on the SE side of the Purgatoire River; 16 mi SSW Higbee. The site lies directly across the river from the Rourke Ranch headquarters. **USGS Quadrangle**: OV Mesa quadrangle (3710356), Beaty Canyon quadrangle (3710355). **Legal Description**: T28S R55W sec. 19, 29, 30, 31 and 32; T29S R55W sec. 5 and 6; T28S R56W sec. 24, 25 and 26. **Elevation**: 4,400' - 5,000' (1,341 m - 1,524 m).

GENERAL DESCRIPTION: The Rourke Canyon Site includes steep canyon walls just above the Purgatoire River floodplain, a series of mesas, and steep, narrow canyons dissecting the mesas. In general, the steep slopes above the river and the smaller drainages are characterized by open shrublands dominated by One-seeded juniper (*Juniperus monosperma*), Mountain mahogany (*Cercocarpus montanus*), and Skunkbush (*Rhus trilobata*). The lower reaches of Rourke Canyon are generally weedy grasslands with a significant amount of Cholla (*Opuntia imbricata*). The mesa tops are open shrubland dominated by one-seeded juniper with various graminoid understories, and more open grasslands with some cholla. Elevations range from about 4,400' near the river to slightly over 5,000 feet in elevation at the southern end of the mesa. Several parts of the mesas are naturally somewhat isolated and appear to have received little recent disturbance from grazing or human activity. Areas that show high concentrations of weeds are generally associated with intensive past land use such as stock ponds. The bird communities of the site are excellent representations for the habitat.

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in the what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and Spanish Mexican territory largely along the Santa Fe Trail (Lavender 1954). Spanish citizens have inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land that is not part of the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of

this summary is taken from U. S. Forest Service 1994].

The vicinity of Rourke Canyon was undoubtedly used by all groups mentioned above. It is likely that pre-Euroamerican peoples had relatively little impact on the vegetation; however, the role of fire that originated from indigenous people is not well documented for this area and may have been significant. It is not clear how much native ungulate use of the mesas occurred, but we suspect that the natural geomorphology of this site restricted the use of the mesas by large herds of bison. This does not preclude bison use by smaller groups as was common in similar landscapes of more western parts of the range (Meaney and Van Vuren 1993).

Spanish settlers of the area were largely subsistence farmers and their impacts were probably localized. With the advent of large scale ranching activity by Americans, significant changes to the vegetation occurred, at least in the lower elevations nearer the Purgatoire River. Sheep were once grazed extensively in the area, but their impacts are poorly known. We suggest that extensive use of the site was restricted because of limited water. Conditions have probably not changed drastically at this site for long periods of time due to its isolated nature.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A concentration of significant natural heritage resources was located at the site. The site supports a number of bird and plant species considered rare or imperiled in Colorado (Colorado Natural Heritage Program 1995). There are also several high quality examples of imperiled or significant plant communities.

Element	**Common Name**	**Occurrence Rank**	**Global Rank**	**State Rank**	**Federal Status**	**State Status**	**USFS Sensitive**
Aimophila ruficeps	Rufous-crowned sparrow	A	G5	S2	n.a.	n.a.	n.a.
Aimophila ruficeps	Rufous-crowned sparrow	C	G5	S2	n.a.	n.a.	n.a.
Piranga flava	Hepatic tanager	D	G5	S1B	n.a.	n.a.	n.a.
Vireo vicinior	Gray vireo	C	G5	S2B	n.a.	n.a.	n.a.
Cheilanthes wootonii	Wooton's lip fern	C	G5	S1	n.a.	n.a.	n.a.
Bouteloua gracilis-Hilaria jamesii	Blue grama-galleta grass grassland	B	G3G4	SU	n.a.	n.a.	n.a.
Bouteloua gracilis-Hilaria jamesii	Blue grama-galleta grass grassland	C	G3G4	SU	n.a.	n.a.	n.a.
Juniperus monosperma/Stipa neomexicana	One-seeded juniper/New Mexico feathergrass	B	G4	SU	n.a.	n.a.	n.a.
Stipa comata-Bouteloua gracilis	Needle-and-thread - Blue grama grassland	C	G5	S2S3	n.a.	n.a.	n.a.
Stipa neomexicana	New Mexico feathergrass grassland	B	G2	S2	n.a.	n.a.	n.a.

The area is large enough to support viable populations of numerous common plants and animals as well as several natural communities.

CURRENT STATUS: Approximately one half of the site is owned by the U. S. Forest Service and managed by

the Comanche National Grassland. Current management by the USFS is strictly controlled until management plans can be finalized (designated as a 10C management area [USFS 1993]). Most of the remainder is owned by the State of Colorado (State Land Board) and leased by the USFS. The site is naturally protected by its remoteness and difficulty of access.

BOUNDARY JUSTIFICATION: The preliminary conservation boundaries mostly follow natural features, encompassing the tops of the mesas, the shrub-dominated slopes, Rourke Canyon, and several other smaller canyons. The boundary is intended to protect the occurrences of the elements of concern and the ecological processes affecting these elements. The most significant natural processes are believed to be rainfall (including snowfall), herbivory, and fire. Buffers to the site are narrow and generally occur naturally as steep slopes and geological formations. Additional information may alter the conservation boundaries.

PROTECTION AND MANAGEMENT CONSIDERATIONS: We recommend that the USFS recognize the significance of this conservation site with a special area designation (e.g. Research Natural Area or Special Interest Area). This can be done through the Forest Management Plan process or through the development of special management direction by the Comanche National Grassland. Maintenance of the high quality of the natural communities will require consistent management across the boundaries of state and federal lands. Options include the USFS maintaining the lease of State Land Board lands or the development of a joint management agreement.

Exotic grasses (especially Japanese brome [*Bromus japonicus*]) dominate disturbed areas on the Rourke Canyon floor and a few small areas on the mesas. For example, an artificial stock pond on the top of one of the mesas is overgown with Japanese brom (*B. japonicus*) and a single tamarisk (*Tamarix ramossisina*). Kochia and other herbaceous weeds are found near the canyon mouth. The surrounding landscape, particularly on the Purgatoire River floodplain, is also dominated by native and exotic weeds. The spread of the weeds from the adjacent landscape is a serious threat to the existing ecosystems of the site (Primack 1993, Soulė 1990, Coblentz 1990, Cheater 1992). Management should include control of existing weedy patches within the conservation site and management of weed immigration into the area.

Fire undoubtedly played an important role in the vicinity (Johnston and Reed 1991); however, the role and impacts of fire, especially in the One-seeded juniper woodlands (*Juniperus monosperma* woodlands) are poorly known. There is a need to understand the local history of native ungulates and their relationship to the natural communities prior to considering management options for domestic livestock (Plumb and Dodd 1993).

There are likely minimal impacts to this site from the military maneuver activities on the Pinon Canyon Maneuver Site lands, although there is some concern about the impacts of military-originated noise (largely air traffic) on nesting raptorial birds of the area (Lee Carlson, USFWS, pers. comm.). The anticipated future threat of increased recreation and its associated impacts create some concern for the long term management of the site. However, we suspect that it is possible to manage the area for controlled primitive recreational activities.

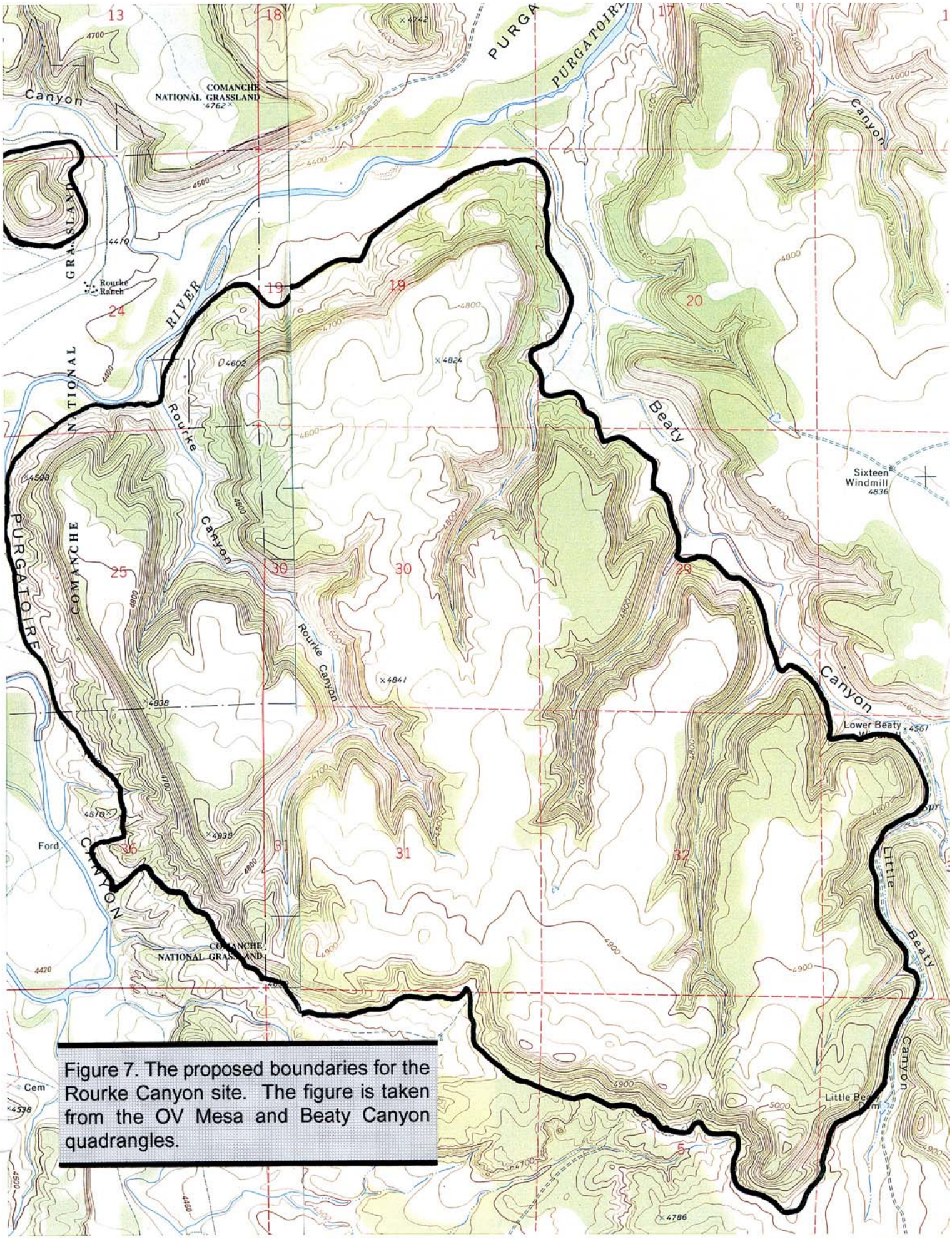

Figure 7. The proposed boundaries for the Rourke Canyon site. The figure is taken from the OV Mesa and Beaty Canyon quadrangles.

ROURKE RANCH HILL CONSERVATION SITE

SIZE: ca. 57 acres (23 hectares)

BIODIVERSITY RANK: B3.
The site contains a c-ranked occurrence of a globally imperiled, G2, natural community.

PROTECTION URGENCY RANK: P5.
Ownership is simple, entirely owned by the U. S. Forest Service (USFS).

MANAGEMENT URGENCY RANK: M4.
The site is within a 10C designation of the Forest Service. Most threats have been ameliorated through such a designation. An anticipated increase in recreational use may pose a threat if not properly anticipated and mitigated.

LOCATION: **USGS Quadrangle**: OV Mesa (Quadcode = 3710356);
Legal Description: T28S R56W sec. 13; **Directions**: 21 miles S and 6 miles west of La Junta in the Purgatoire Canyon. Located immediately NNW of the Rourke Ranch headquarters.

GENERAL DESCRIPTION: This small conservation site encompasses a small butte on the western edge of the Purgatoire River flood plain. The summit and upper slopes of this small butte are in excellent condition with an almost total lack of exotic vegetation. This is remarkable since the vegetation of the surrounding areas is largely composed of exotic and adventive plant species. The elevation ranges from 4,500 to 4,750 feet (1,372 to 1,448 m). The butte's slopes are dominated by One-seed juniper (*Juniperus monosperma*) and a variety of native grasses. The grasses include: several species of grama (*Bouteloua* spp.) and *Oryzopsis hymenoides* (Indian ricegrass). Scattered Cholla or Candelabra cactus (*Opuntia imbricata*) and prickly-pear cactus (mostly *Opuntia polyacantha*) were present as were other less common cacti. Cacti were most numerous on the slopes of the butte. The summit's vegetation is composed of patches of high quality grasslands with sparse One-seed juniper (*Juniperus monosperma*) on the edges or rim. The graminoid-dominated patches which consisted of New Mexico feathergrass (*Stipa neomexicana*) or Blue grama - Galleta grass (*Bouteloua gracilis* - *Hilaria jamesii*) are the focus of this conservation site. The entire area is small, but of high quality due to lack of exotic or adventive vegetation, lack of visible artificial disturbance, and relatively high potential viability (due to the natural isolation from disturbance).

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and Spanish Mexican territory largely along the Santa Fe Trail (Lavender 1954). Spanish citizens have inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyonlands was an alternate route to that of the Santa Fe Trail especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land that is not part of the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

More specifically to this site, the vicinity of Rourke Ranch Hill was used by indigenous peoples as evidenced by the rich archaeological resources in the vicinity. It is likely that these peoples had relatively little impact on the vegetation (at least its composition). No doubt, individuals climbed the butte to provide an excellent

observation post or for enjoyment. Trappers may have visited the area prior to Spanish occupation. If so, the removal of beaver probably had significant impacts on the riparian and aquatic habitats with less ponding, potentially maturing riparian forests, and alterations of erosion and sedimentation rates (Parker 1986, Knight 1994). Beaver also would have slowed the seasonal lowering of ground water (Fitzgerald et al. 1994; Naiman et al. 1988).

Spanish settlers of the area likely had more impact with their need to farm and maintain grazing animals. These people were subsistence farmers and their impacts were probably localized. Livestock were almost certainly not allowed to wander to protect them from cougars, wolves, and bears.

The Rourke Ranch was settled in the 1870's and undoubtedly had a major impact on the adjacent landscape. The extensive alteration of the native vegetation in the adjacent flood plain of the Purgatoire River probably began at this time. Due to the cliffs and difficult slopes around the butte, the top, and to a lesser extent the slopes, were protected from extensive livestock damage. As with the indigenous peoples, the ranch inhabitants undoubtedly used the Rourke Ranch butte as a lookout and recreational site.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The Rourke Ranch butte is covered with vegetation remnants that probably covered much of the similar landscape of the area prior to extensive human-caused alterations. The steep slopes and relatively inaccessible top provided natural protection. Such remnants have important values as reference areas for ecological management. The most significant plant association of the natural community is recognized as *Bouteloua gracilis* - *Hilaria jamesii* (Blue grama - Galleta grass). High quality examples of these grasslands have not been reported or observed commonly. Shaw et al. (1989) described this community from Pinon Canyon Maneuver Site and noted that it covered extensive areas on the installation. In addition, there is a small occurrence of *Stipa neomexicana* grasslands in good condition.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Bouteloua gracilis - Hilaria jamesii plant association	blue grama - galleta grass grassland	BC	G3G4	S2	n.a.	n.a.	n.a.
Stipa neomexicana plant association	New Mexican needlegrass grassland	BC	G2	S2	n.a.	n.a.	n.a.

CURRENT STATUS: The entire site is owned by the U. S. Forest Service and managed by the Comanche National Grassland. The management is identified as 10C, or as a special interest area (U. S. Forest Service 1994). The threats that exist are due to the potential for a slow invasion of wees into the existing high quality vegetation.

BOUNDARY JUSTIFICATION: The boundary around the significant elements includes the top of the butte and the adjacent slopes. We believe that the management of adjacent slopes will be important for the long term viability of the grassland community on the top by preventing slow encroachment of exotic vegetation. Management within this boundary is likely to have a high probability of success.

PROTECTION AND MANAGEMENT CONSIDERATIONS: The status of Special Interest Area provides an adequate level of protection for the area.

To maintain the current quality of this site it will be necessary to prevent the disruption of the natural community on the summit. The slopes of the butte should be considered a buffer and managed to their best condition. Potential threats include the invasion of the surrounding exotic plants and the direct destruction or fragmentation of the communities. If recreational use of the area increases we suspect that significant numbers of people that visit

the Rourke Ranch may want to climb this butte. Such activity may degrade the natural condition of the vegetation. Trails, whether formal or casual, could pose a threat by providing a dispersal corridor for invasive plants.

We recommend the following management actions: 1) Monitor grasslands on the top of the butte using a standardized transect or plot method. Visual sampling could occur at short intervals while quantitative assessment should be made at intervals not longer than three years apart. Include photographic records.
2) Monitor the slopes of the butte as in #1 above. 3) With the large number of non-native species in the adjacent floodplain, even natural disturbances may allow the invasion and/or increase of exotics. Physical control of these species may be warranted in the future. 4) The best ecological decision would be to restrict access to the butte. If access to the butte's summit is permitted, construct a trail and manage aggressively for weed control. 5) The impacts of livestock grazing on these communities are not well known. We believe that until there is a better understanding of potential impacts, any livestock should be restricted from the site.

Research needs for long term management of this community: 1) A better understanding of the ecological dynamics of juniper woodlands and slope grasslands is needed. 2) The possible role of grazing ungulates on the maintenance of the slope grasslands is poorly understood. We do not believe this is pertinent to the summit plant associations. 3) Prominent hills such as this site often attract numerous species of butterflies. The 1994 field season was a poor year for lepidoptera; therefore, we recommend that additional sampling occur at this site and throughout the area.

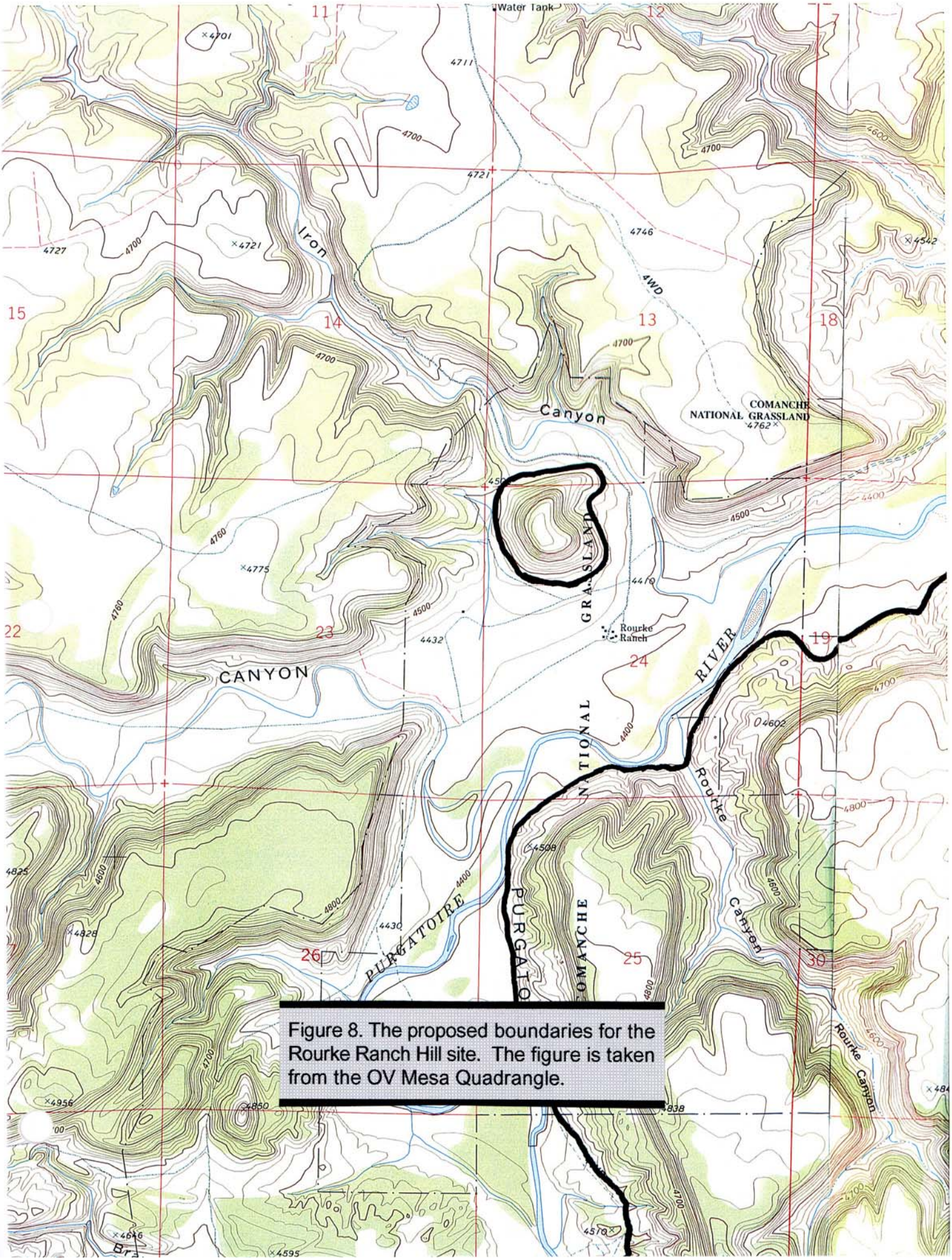

Figure 8. The proposed boundaries for the Rourke Ranch Hill site. The figure is taken from the OV Mesa Quadrangle.

SOUTH BLACK HILLS CONSERVATION SITE

SIZE: ca. 1,000 acres (405 ha)

BIODIVERSITY RANK: B4

The site contains several state rare species and good examples of a natural community which are unranked and one that is of state concern.

PROTECTION URGENCY RANK: P4

Most of the area is owned by the U. S. Forest Service and is part of the Picket Wire Canyonlands management area. We do not believe that there are current threats; however, a small portion of the land is privately owned with unknown management goals.

MANAGEMENT URGENCY RANK: M4

Current management under the U. S. Forest Service is adequate for the present; however, threats from adjacent land uses and potential heavy recreational uses could develop.

LOCATION: **Description**: Las Animas County; 2 mi NNE of O V Mesa at south end of the Black Hills. **USGS Quadrangle**: O V Mesa (3710356). **Legal Description**: T29S R56W sec. 4,5; **Elevation**: 4,600 - 5,340 ft (1,861 - 2,160 m).

GENERAL DESCRIPTION: This site encompasses nearly the entire Middle Parcel of the Picket Wire Canyonlands. The canyon here has formed a terrace that lies 200 ft above the Purgatoire River. Vertical, nearly impassable cliffs of Dakota sandstone designate the lower boundary. A large portion of the terrace is relatively flat and dominated by cryptogamic soils and midgrass grasslands with sparse one-seeded juniper (*Juniperus monosperma*). The moderate slopes above are dominated by one-seeded juniper woodlands. These woodlands are diverse, variable, and of high quality. The upper boundary is formed by the distinct rim of the plateaus to the north known as the Black Hills.

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and the Spanish Mexican territory, largely along the Santa Fe Trail (Lavender 1954). Spanish citizens inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail, at least to Bent Canyon, especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land adjacent to the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

No doubt the area around the South Black Hills Conservation Site has been similarly used, but perhaps to a lesser extent than farther down canyon. Indigenous peoples clearly used the area but probably had little effect on the vegetation. However, we do not have a good understanding of the role of fire and indigenous life styles on the canyon vegetation. The observed patterns of vegetation suggest that this remote area is less impacted than most other areas in the Picket Wire Canyonlands. The area has remained largely inaccessible to cattle and modern human inhabitants. The ecological condition of the constituent grasslands and woodlands is very good.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: A concentration of significant natural heritage

resources has been identified at this site. The presence of high quality plant communities and a number of state-rare/imperiled animals and plants is responsible for elevating the biodiversity rank of this site to B4.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Juniperus monosperma/Bouteloua eriopoda	One-seeded juniper/Black grama woodland	B	G?	SU	n.a.	n.a.	n.a.
Juniperus monosperma/Bouteloua gracilis	One-seeded juniper/Blue grama woodland	B	G5	S3S4	n.a.	n.a.	n.a.
Vireo vicinior	Gray vireo	C	G5	S3B	n.a.	n.a.	n.a.
Icterus parisorum	Scott's oriole	C	G5	S2B	n.a.	n.a.	n.a.
Aimophila ruficeps	Rufous-crowned sparrow	C	G5	S2B	n.a.	n.a.	n.a.
Cheilanthes eatonii	Eaton's lip fern	B	G5	S1	n.a.	n.a.	n.a.
Pellea wrightiana	Wright's cliff-break	A	G5	S1	n.a.	n.a.	n.a.

The Gray vireo (*Vireo vicinior*) is an uncommon summer resident on the mesas of southeastern Colorado. It is typically found in open and very dry pinon-juniper woodlands (Andrews and Righter 1992) and especially juniper woodlands (Kingery, pers. comm.). Although this type of habitat covers a large area around the Purgatoire Canyon, this bird is apparently quite local in its distribution (Andrews and Righter 1992; Aaron Ellingson, pers. obs.). Indeed, this site is one of only two known occurrences of this species in the canyon. We observed three individuals at this site, and then again observed a single individual several days later. Breeding is probable at the site as evidenced by several singing males, but could not be confirmed.

The occurrence of Scott's orioles (*Icterus parisorum*) at this site was a surprise and represents a significant extension of the known range of the species in Colorado (Andrews and Righter 1992). Breeding was confirmed by the observation of a family group of a male and female accompanied by two fledglings [Note: This observation will be reviewed by the Colorado Field Ornithologists Records Committee]. Previous records in Colorado have been exclusively from the western slope. The habitat here is typical of those the orioles occupy in western Colorado, primarily pinon-juniper and juniper groves in semidesert shrublands (Andrews and Righter 1992). It has been suggested that this species is increasing across its range (Sauer and Droege 1992). All Colorado records are later than 1975 (Andrews and Righter 1992).

The Rufous-crowned sparrows (*Aimophila ruficeps*) was also documented at this site. Although the reported northern extent of this bird in Colorado is around Mesa de Maya (Andrews and Righter 1992; Colorado Natural Heritage Program, unpublished data), this species is common in hillside juniper woodlands throughout Picket Wire Canyonlands. This occurrence is based on a single observation of a pair of birds, but given the relatively homogeneous distribution of this bird, it is likely that several other individuals also occur here. The status of this species in Colorado, like those above, is not well understood.

Eaton's lipfern (*Cheilanthes eatonii*), more common in states to the south, is only known from six locations in Colorado. Very few individuals were located at this site, although it is possible that larger populations exist on sections of the cliffs that are more difficult to access.

Wright's cliff-brake (*Pellea wrightiana*), also more common in states to the south, is only known in

Colorado from seven locations. This occurrence is by far the highest quality site known to Colorado. Hundreds of individuals were found in a pristine setting.

In addition to these rare species, an individual of the Eastern ringtail (*Erpetogomphus designatus*) was observed foraging on this site. This species reproduces in the permanent streams of the area, but uses terrestrial habitats extensively for foraging. Although this observation does not warrant consideration as an occurrence, it indicates that the greater ecosystem of the Purgatoire Canyon is utilized by this highly mobile and rare species.

CURRENT STATUS: Nearly all of this site is within the boundaries of the Picket Wire Canyonlands, U. S. Forest Service. All Picket Wire Canyonlands holdings are currently designated as 10C, which considers the area as a Special Interest Area (USFS 1994). A small area in the southeast corner of the site is in private ownership.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary for this site follows the distinct topographic features that form the geomorphological terrace. We believe that this boundary should provide adequate protection from direct threats such as weed invasion, nest disturbance, botanical collecting, or habitat alteration. Undoubtedly, some of these occurrences rely upon larger populations not contained in the site. Therefore, the surrounding landscape should be managed with consideration for the management goals of the South Black Hills Site. (See the Purgatoire River Megasite.) Similarly, certain large scale processes such as fire cannot be easily incorporated into a site of this size. Such considerations should be taken into account in the design and management of the landscape within which this site is nested.

PROTECTION AND MANAGEMENT CONSIDERATIONS: This site has value as a reference area as well as for protecting rare/imperiled species occurrences. Identified values qualify the area as a potential special interest area. The small area in private ownership is not obviously indicated on the ground and does not differ in ecological condition. Compatible management of the private portion should be a site goal.

Present threats to the site are minimal and very little land use has occurred here at least since the early 1980's. The site is very difficult to access and apparently visited by very few people. However, it is anticipated that visitor use will increase in the Picket Wire Canyonlands area. Similarly, management of some lands may change presenting new pressures.

Fire management of many parts of Picket Wire Canyonlands has been recommended by Johnston and Reed (1991). We agree, but note that the impacts of fire on these specific plant assocations are poorly known. We expect that the disturbance resulting from a particularly hot fire in these grasslands may provide opportunities for weedy species to invade.

We observed cryptogamic soils on this site. Such soils are known to be sensitive to trampling and indicate that this area has been relatively undisturbed, at least in patches, for some time. Maintenance of these soil communities, and the control of exotics, will require the minimization of soil disturbance and the careful design and maintenance of trails.

Monitoring plans should be implemented for all rare/imperiled species and significant natural communities. We have recommended bird monitoring for the Withers Canyon site, but also recommend it for the South Black Hills site. The sampled avifauna will differ somewhat from that of Withers Canyon.

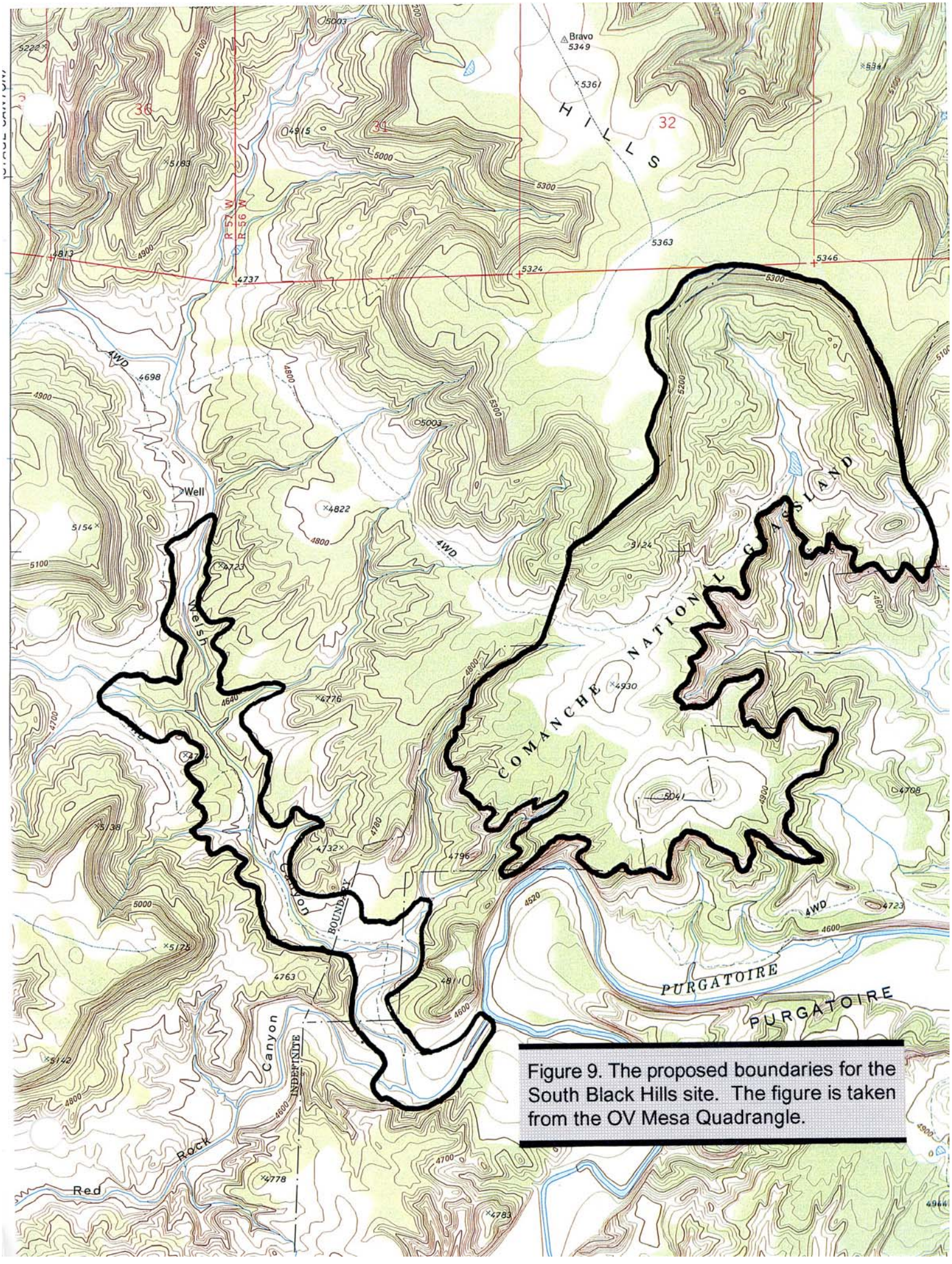

Figure 9. The proposed boundaries for the South Black Hills site. The figure is taken from the OV Mesa Quadrangle.

WELSH CANYON

SIZE: ca. 100 acres (40 hectares)

BIODIVERSITY RANK: B5.

This site contains at least three state-imperiled species, one of which is only known to occur here. Insufficient data regarding reproductive success and population size prevents these occurrences from receiving higher element occurrence ranks.

PROTECTION URGENCY RANK: P4.

The current ownership for the site can provide adequate protection of the elements and their habitats.

MANAGEMENT URGENCY RANK: M4.

Current management throughout the site is largely passive, but restricted access has removed most threats. The hydrological processes of the canyon should be protected for the long term viability of the riparian community. Management actions may be necessary (e.g. removal and control of tamarisk) in the future.

LOCATION: **Directions**: Las Animas County: 33 miles S and 12 miles W of La Junta; 7 miles SW of the Rourke Ranch; Welsh Canyon drains into the Purgatoire River from the NW. **USGS Quadrangle**: OV Mesa (Quadcode = 3710356). **Legal Description**: T29S R56W section 7; T29S R56W section 12. **Elevation**: 4,500'-5,300' (1,822-2,147 ha).

GENERAL DESCRIPTION: This dry canyon with vertical Dakota Sandstone walls descends over 400 ft (122 m) in about 5 mi (8 km) as it drains southeast towards its confluence with the Purgatoire River. The broad floodplain is dominated by *Bromus japonicus* (Japanese brome) for the length of the canyon. Thick stands of Cottonwoods (*Populus deltoides*) occur in patches along the ephemeral drainage. The largest of these stands is about 1/2 mi. long. In mid-July, several stagnant pools existed with emergent aquatic vegetation including cattails (*Typha*). Surrounding slopes and canyon walls are either barren sandstone or *Juniperus monosperma* (One-seeded juniper) woodlands. At the Purgatoire River, riparian vegetation is dominated by Sandbar willow (*Salix exigua*) and the invasive, exotic shrub Tamarisk (*Tamarix ramossisina*) with scattered Cottonwood (*Populus deltoides*) stands.

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in the what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and Spanish Mexican territory largely along the Santa Fe Trail (Lavender 1954). Spanish citizens have inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land that is not part of the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

More specifically to this site, the vicinity of Welsh Canyon was undoubtedly used by all groups mentioned above. It is likely that pre-American peoples had relatively little impact on the vegetation. Spanish settlers of the area were largely subsistence farmers and their impacts were probably localized. With the advent of large scale ranching activity, significant changes to the vegetation occurred. Such changes were probably most extensive near water sources. The structure of the riparian communities that we observed are apparently being

maintained by hydrological processes and are probably not unlike communities from pre-Euroamerican habitation of the area.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: Three state-rare/imperiled species of birds were located in the Welsh Canyon cottonwood stands.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Picoides scalaris	Ladder-backed woodpecker	D	G5	S3	n.a.	n.a.	n.a.
Piranga rubra	Summer tanager	D	G5	S1	n.a.	n.a.	n.a.
Coccyzus americanus americanus	Eastern yellow-billed cuckoo	C	G5TU	S3B	n.a.	n.a.	n.a.

The riparian ecosystem of Welsh Canyon supports an intact bird community. Although narrow and developed around an ephemeral stream, the extent and structure of the riparian zone is complete. That we observed three state-rare bird species in the relatively short period of examination suggests that more data should be collected.

The Ladder-backed woodpecker (*Picoides scalaris*) is restricted to southeastern Colorado in a variety of habitats including riparian zones and old juniper stands. The species is apparently not imperiled, but is representative of the Chihuahuan biogeographic zone, reaching the northern limits of its range in Colorado. We observed a single male in Welsh Canyon. Although breeding could not be confirmed, nesting cavities and foraging sites are abundant in the area. The quality of this occurrence was not estimated due to the sparse information. The status of this species in the entire study area (Picket Wire Canyonlands) is warranted. Ladder-backed woodpeckers do not seem highly sensitive to human activity as long as nesting and foraging sites are available.

The Summer tanager (*Piranga rubra*) was not recognized as a breeding bird in Colorado by Andrews and Righter (1992). They classified summer tanagers as accidental in mid-summer on the eastern plains. We believe that this species is a rare breeder in Colorado, supporting Andrews and Righter's suspicions. Richard Bunn (1995, pers. comm.) reported seeing this species in Welsh Canyon as well. It should be noted that while observations of this species under less than optimal conditions may result in difficult identifications, the vocalizations are diagnostic. This record is also under review by the Colorado Field Ornithologist Records Committee.

The Yellow-billed cuckoo (*Coccyzus americanus*) was located in the riparian woodland patches of Welsh Canyon on two occasions. On 10 July 1994 we observed two individuals, one almost certainly a juvenile. This species is restricted to the cottonwood woodlands in the Purgatoire Canyon area. Yellow-billed cuckoos are declining significantly in the United States (Robbins et al. 1989), largely due, in the western states, to the loss of closed-canopy riparian forests (Laymon and Halterman 1987).

CURRENT STATUS: The site is partially owned by the U. S. Forest Service and managed by the Comanche National Grassland. The management is identified as 10C, or as a Special Interest Area (U. S. Forest Service 1994). The remainder of the site as identified by CNHP occurs on the Pinon Canyon Maneuver Site. There are no destructive activities permitted by the Army in Welsh Canyon.

BOUNDARY JUSTIFICATION: The preliminary conservation boundary is intended to designate a minimum area to be managed for the maintenance of the elements known to be present. Critical to the site is the riparian ecosystem, especially the stands of cottonwoods. Even the riparian species are known to move among cottonwood

stands and often utilize the adjacent habitats for foraging. Therefore, we have included a buffer to the riparian habitat of as much as 328 ft (100 m) on either side.

The ladder-backed woodpecker uses habitats other than riparian, especially for foraging. Nonetheless, we have not included adjacent habitats within the site boundary since the species is somewhat tolerant to habitat disturbances (see management comments below).
Since the long term viability of this habitat largely depends on hydrological factors including water table depth and flood regime, full protection will require the maintenance of processes and habitats beyond the boundaries of the designated site boundaries.

PROTECTION AND MANAGEMENT CONSIDERATIONS: We recommend that this site continue its status as a Special Interest Area. An agreement with the Department of Defense to designate their portion of the site with a similar special area designation should be sought.

Management considerations include the maintenance of the canyon hydrology. With a natural flooding regime, the cottonwood plant community should maintain itself indefinitely. Since this site is presently degraded by the presence of an understory dominated by exotic species, protection and management should focus on maintaining the structural habitat utilized by the rare birds present. This will require the prevention of direct degradation of the cottonwood stands and adjacent habitats within a boundary that includes all four cottonwood stands, the connecting streambed, and a narrow buffer. Potential and realized impacts of the access road should be minimized through management activities.

Adjacent slopes with appropriate habitat for the Ladder-backed woodpecker, dominated by *Juniperus monosperma* (One-seeded juniper), should be managed for maintenance of this species in variable age/size classes. All pertinent communities are described in Shaw et al (1989).

Finally, whereas the structural characters of the habitat are the most immediate conservation need (for the rare birds), in the longer term, the composition of the area should also be considered. This riparian ecosystem no doubt harbors remnants of the lesser known elements of natural diversity (e.g. insects) and could be considered as a reference area for plains riparian ecosystem management. Management of the site should favor the success of native species. For example, tamarisk (*Tamarix ramossisina*) is prevalent along the Purgatoire River but has not yet invaded the upper reaches of Welsh Canyon. Tamarisk uses large amounts of ground water and can greatly alter species composition at a site. Its spread into Welsh Canyon should be prevented in order to maintain the cottonwood stands. Partnerships with the Pinon Canyon Maneuver Site ecologists, Colorado Native Plant Society, Colorado Riparian Task Force, Colorado Riparian Association, Colorado Natural Areas Program, and the Colorado Natural Heritage Program may prove helpful in this challenging task.

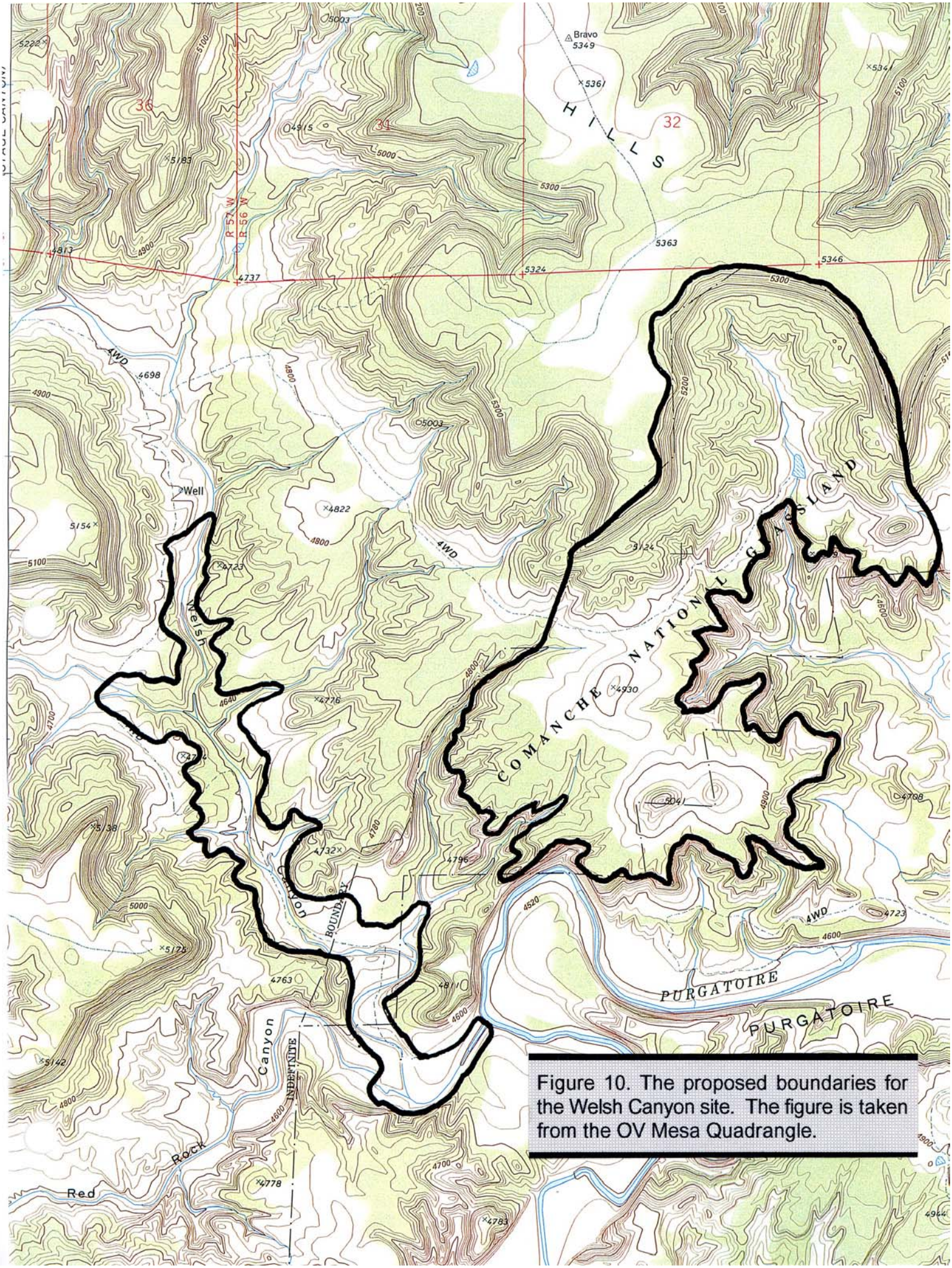

Figure 10. The proposed boundaries for the Welsh Canyon site. The figure is taken from the OV Mesa Quadrangle.

WITHERS CANYON CONSERVATION SITE

SIZE: ca. 2,230 acres (902 ha)

BIODIVERSITY RANK: B5

This site contains nine state-rare/imperiled species. The natural communities are not rare, but represent high quality examples.

PROTECTION URGENCY RANK: P3

The site is owned by the U. S. Forest Service, the Colorado State Land Board, and private individuals. The protection status of elements within the State Land Board and private sections is unknown. Because of the uncertain status of the non-federal lands, the urgency is ranked "P3".

MANAGEMENT URGENCY RANK: M3

The Forest Service portion of the site is currently considered as 10C status, i.e. identified as a special interest area. Management of all parcels needs to be compatible with the elements present. Since the management of the private parcel is unknown, we believe that a M3 rank is appropriate.

LOCATION: **Directions**: Otero County: 22 mi S of La Junta and 1 mile east of Rourke Road. This site contains the whole of Withers Canyon which flows east into the Purgatoire River. **USGS Quadrangle**: Riley Canyon (3710365). **Legal Description**: T29S R55W sec. 20, 21, 22, 27, 28, 29, 30, 31, 32, 33 and 34. **Elevation**: 4,320' - 4,600' (1,317 m - 1,402 m).

GENERAL DESCRIPTION: The site includes two canyons draining into the Purgatoire River. The northernmost canyon is Withers and the southern canyon is unnamed. The two canyons drop approximately 300 feet (91 meters) east to the Purgatoire River. The slopes and adjacent flat uplands harbor One-seeded juniper (*Juniperus monosperma*) woodlands of varying understory composition. This habitat was found to locally support several state-rare bird species. The canyon bottoms contain non-continuous stands of deciduous riparian woodlands or patches, particularly in the upper reaches. The largest stand of cottonwoods occurs about half the canyon length from either end, and it too was found to support rare birds. In wider lower reaches of the canyon the floor becomes flat and dominated by grasses and some invasive and increasing forbs. In the lower reaches of the canyon the stream is entrenched. The headwaters of each canyon harbor mesic microhabitats that support several significant species of amphibians, birds, ferns and dragonflies. In Withers Canyon itself, a series of large splash pools occur in the sandstone bedrock near the headwaters. These are probably permanent pools and form a scarce microhabitat. The head of the unnamed canyon, also included in this site, similarly contains relatively moist habitats, but no permanent pools. Still, four significant species of reptiles and amphibians were found here. The upper reaches of the unnamed canyon, particularly the side slopes are in good ecological condition and represent natural conditions. The slopes are vegetationally complex with patches of several different vegetation types. Junipers dominate the shrub or small tree layers and are occasionally interspersed with other shrubs (e.g. *Cercocarpus* and *Ribes*).

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons. Spanish soldiers and associates almost certainly visited the area, particularly after the settlement of Santa Fe in the what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and Spanish Mexican territory largely along the Santa Fe Trail (Lavender 1954). Spanish citizens have inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents

to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land that is not part of the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

The vicinity of Withers Canyon was undoubtedly used by all of the groups mentioned above. It is likely that pre-Euroamerican peoples had relatively little impact on the vegetation; however, the role of fire that originated from indigenous people is not well documented for this area and may have been significant. Use of Withers Canyon by native ungulates may have been extensive, especially in the vicinity of water. However, the upper canyon reaches are probably not favored habitat for any large herding animals.

Spanish settlers of the area were largely subsistence farmers and their impacts were probably localized. With the advent of large scale ranching activity, significant changes to the vegetation occurred, at least in the lower elevations nearer the Purgatoire River. Sheep were once grazed extensively in the area, but their impacts are poorly known. Vegetation patterns in the wide, lower reaches of the canyon indicate extensive overgrazing for a long period of time. Grazing of the area has been discontinued until a management plan can be generated. The vegetation that has been released from livestock is dominated by weedy species.

NATURAL HERITAGE RESOURCE SIGNIFICANCE: The diversity and good ecological condition of these canyons was found to support at least nine state rare species. Such remote canyon habitats are likely representative of conditions that prevailed throughout much of the Purgatoire Canyon area.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Sonora semiannulata	Ground snake	unranked	G5	S2	n.a.	n.a.	n.a.
Tropidoclonium lineatum	Lined snake	B	G5	S3	n.a.	n.a.	n.a.
Libellula saturata	Firecracker skimmer	A	G5	S1	n.a.	n.a.	n.a.
Diadophis punctatus	Ring-necked snake	unranked	G5	S2	n.a.	n.a.	n.a.
Aimophila ruficeps	Rufous-crowned sparrow	C	G5	S2	n.a.	n.a.	n.a.
Sayornis phoebe	Eastern phoebe	D	G5	S3B,SZN	n.a.	n.a.	n.a.
Sayornis phoebe	Eastern phoebe	D	G5	S3B,SZN	n.a.	n.a.	n.a.
Amphispiza bilineata	Black-throated sparrow	C	G5	S3B,SZN	n.a.	n.a.	n.a.
Coccyzus americana	Yellow-billed cuckoo	D	G5TU	S3B	n.a.	n.a.	n.a.
Asplenium platyneuron	Ebony spleenwort	B	G5	S1	n.a.	n.a.	n.a.

The Ground snake (*Sonora semiannulata*) is a secretive species at the northern periphery of its range in southeastern Colorado. The rocky canyon slopes in the upper canyons are good habitat for the species and several other rare snake species (Hammerson 1982). The Lined snake (*Tropidoclonion lineatum*) is also at the northern

edge of its range and was found in similar habitat to the Ground snake. Several individuals were found and we believe that a larger scale effort would have found numerous individuals at this site. Another small semi-fossorial snake species found in the upper canyons was the Ring-necked snake (*Diadophis punctatus*). This species inhabits areas near water sources (Hammerson 1982), making it particularly susceptible to disturbance from water intensive management.

The canyons, slopes and portions of the bottoms provide large areas of habitat for representative bird communities. Among those species found at the site are several state-rare and declining species. The Eastern phoebe (*Sayornis phoebe*) is at its western periphery in the Great Plains of Colorado. The main nesting area for the state is the canyonlands of southeastern Colorado (Andrews and Righter 1992). The upper reaches of Withers Canyon provide excellent habitat where rock outcrops exist over water. At least two pairs of Eastern phoebes were found at this site in two separate locations.

Rufous-crowned sparrows (*Aimophila ruficeps*) inhabit the slopes of canyons in the area. Two pairs were observed near the mouth of Withers Canyon. Our search pattern did not extensively cover the available habitat, so the two pairs is expected to be a underestimate of the birds present.

Black-throated sparrows (*Amphispiza bilineata*) are representative of semidesert shrublands and Cholla grasslands (Andrews and Righter 1992). This species was located near the mouth of Withers Canyon in a greasewood habitat.

Large numbers of cottonwoods occur at the mouth of Withers Canyon at the Purgatoire River. In this area we located several Yellow-billed cuckoo (*Coccyzus americanus*). This declining species (Robbins et al 1989) is located at the western extreme of their range in eastern Colorado. Whereas the cottonwood habitat has increased along the Arkansas and South Platte drainages, the Purgatoire River riparian zone remains dominated by natural patterns of hydrological processes (Bramblett and Fausch 1991). Such processes have maintained the natural patterns of vegetation along the Purgatoire River (although species composition is greatly altered), conditions that support the Yellow-billed cuckoo.

Not surprisingly, the splash pool and other permanent to semi-permanent aquatic habitats support a diverse and uncommon insect fauna. Among those insects is the Firecracker skimmer (*Libellula saturata*), a dragonfly at the edge of its range. This species thrives in the splash pools of this site.

Among the north-facing Dakota sandstone cliffs of Withers Canyon, the Ebony spleenwort (*Asplenium platyneuron*) exists in a small population. The natural protection of the cliffs provides a highly defensible location for the species.

Finally, it is important to note that a single occurrence of a species at the edge of its range may not establish a high conservation priority. However, the combination of so many species at or near the limits of their ranges should serve as a sign that this area is an unusual assemblage of ecological and historical conditions. The Withers Canyon Conservation Site should be considered as an important site representing the a portion of the range of natural variation in North America.

CURRENT STATUS: Ownership of the site is mixed among the U. S. Forest Service, the Colorado State Land Board, and private individuals. Protective status is provided only by the Forest Service through its interim designation of the Picket Wire area as 10C. This designation treats the area as a special interest area. The State Land Board parcels are currently being leased by the Forest Service.

BOUNDARY JUSTIFICATION: The recommended site boundary includes all of Withers Canyon except the lower one half mile of canyon bottom (which is heavily alterred) and all of the unnamed canyon to the south of Withers Canyon. The boundary also includes the canyon walls, slopes, rims and the *Juniperus*-dominated ecotone between the upland grasslands and the canyon. All of the rare or imperiled species identified within the site are

included within the site boundary along with adjacent similar habitat. We believe that this includes sufficient habitat and local ecological processes to maintain all observed species and the representation of canyon vegetation. The primary ecological processes that support this site include hydrology, fire, and herbivory. Areas outside of this boundary may have some impacts on the canyon ecosystem, but represent the adjacent grassland ecosystem, not that of the canyons.

PROTECTION AND MANAGEMENT CONSIDERATIONS: The U. S. Forest Service owns the majority of the area within our recommended site boundaries. The remainder of the area is devided between State Land Board and private ownership. Current management of all parcels appears compatible with the protection of identified rare or imperiled species; however, this perception should be verified. In lieu of consolidated ownership, a management plan for the entire area should be sought which includes protective measures for all parcels. We believe that the Withers Canyon site contains significant zoological, botanical, and ecological resources to qualify for designation as a special interest area.

Management of the area should consider the identified elements, their habitat needs, and existing patterns of disturbance (past and present). The highest reaches of the canyon show some signs of overgrazing with exposed soil and all wet areas being heavily trampeled. Controlled access to watering areas may be warranted. The steep slopes and remote side canyons are in excellent condition.

The existing trail into the Purgatoire Canyon and the dinosaur tracks shows some evidence of weed transport and causes some local erosion. Management of the trail/road should include weed monitoring and control. We believe that development of other parts of this site should be carefully controlled to protect the vegetation. Any trail development in the area could be restricted to areas of highest disturbance, but should include minimizing disturbance to the soil and carefully designing and maintaining trails. Remote canyon reaches should be avoided. To the extent possible, prevent the spread of exotic plants (e.g. *Bromus japonicus* (Japanese brome), *Kochia scoparia* (Kochia), and *Salsola iberica* (Russian thistle), and others).

The lower reaches of both canyons exhibit heavily disturbed vegetation. Patterns indicate that this was the result of heavy grazing pressures (Johnston and Reed 1991). Restoration measures would be beneficial, although costly.

The role of fire in this ecosystem is poorly understood and should be studied. It is likely that fire will be found necessary for the long term maintenance of the area; therefore, development and use of the area should consider the need for fire management (Johnston and Reed 1991). Flash flooding is an important ecological process. We observed a minor flash-flooding event in the upper reaches of Withers Canyon after a short, hard rain. The geomorphology of the canyon suggests that flash-flooding could be a significant hazard to humans, but essential for maintenance of the ecosystem.

A thorough inventory of the canyon was not possible given this study's time frame. Additional studies are warranted to have a greater appreciation of the diversity of this site. We would also recommend that permanent vegetation plots be established and monitored at least every five years. The results of such monitoring would be invaluable to understanding successional patterns, particularly as they relate to fire. Should a fire occur in the area, it would be important to study the vegetation and faunal responses. Withers Canyon would provide an excellent area for monitoring breeding birds. A suite of permanent point counts would provide essential information for management of the bird community, particularly the rare/imperiled species.

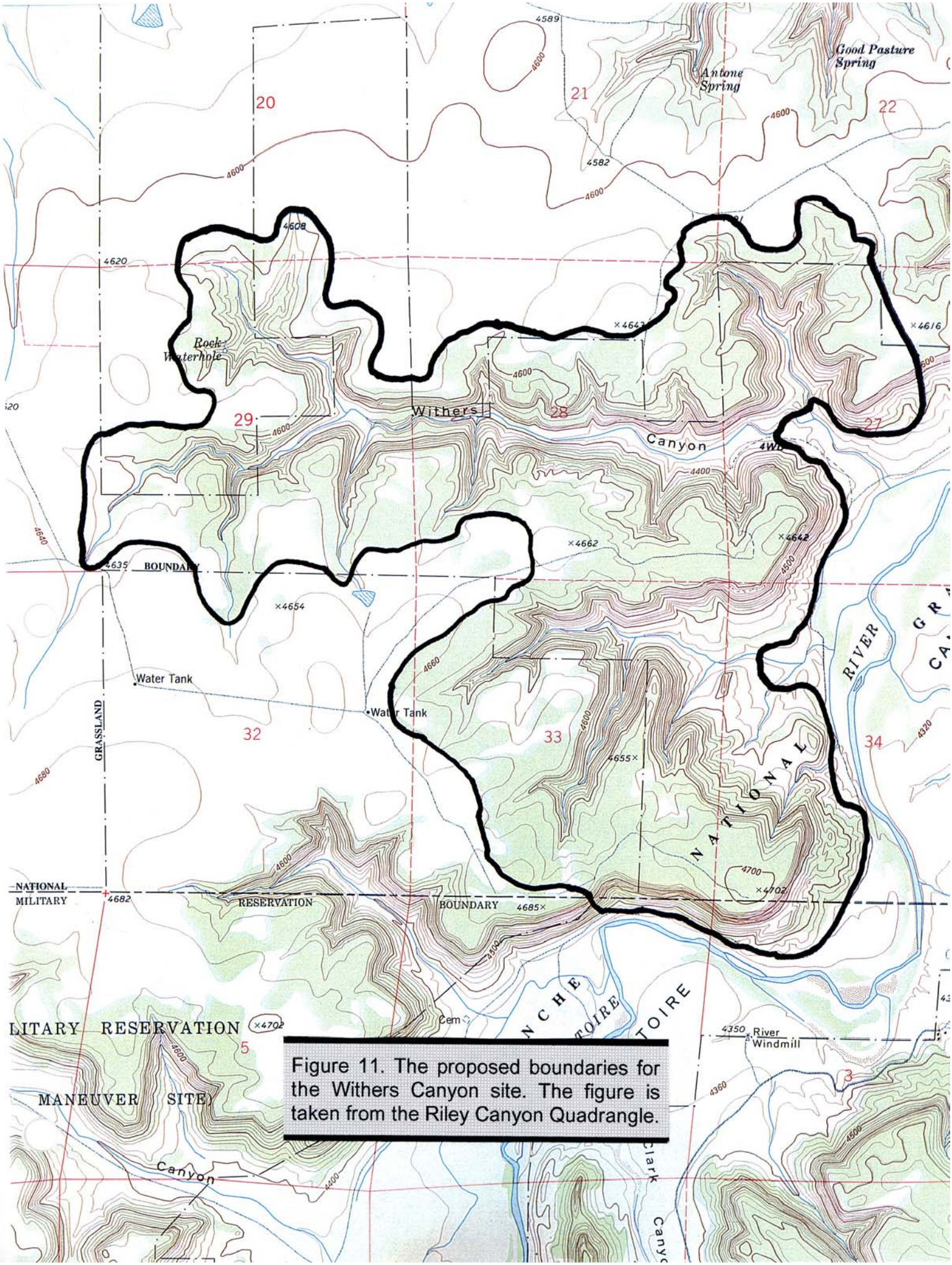

Figure 11. The proposed boundaries for the Withers Canyon site. The figure is taken from the Riley Canyon Quadrangle.

PURGATOIRE CANYON CONSERVATION MEGASITE

SIZE: ca. 900,000 acres (364,230 ha)

BIODIVERSITY RANK: B2

The area contains numerous state-imperiled species and excellent representations of natural communities, including one of the last remaining plains native fish communities. Eight conservation sites (currently known) are located within the megasite boundaries. Not only will this landscape provide for rare vegetation types, but adequately represent common vegetation patterns and processes. The landscape will also provide conservation corridors from the Arkansas River to the Mesa de Maya region (and consequently to the Front Range of the Rocky Mountains).

PROTECTION URGENCY RANK: P3

The private lands do not appear threatened at this time; however, little is known about private land management throughout the area. Public lands are in a dynamic state. Special area designations are being considered through the develop of a management plan for the area.

MANAGEMENT URGENCY RANK: M3

Observed land conditions were highly variable in the megasite. The observed ecological conditions suggested that real long term threats exist to the megasite's integrity.

LOCATION: **Description:** The megasite is the extent of Purgatoire Canyon and adjacent uplands that are believed to be ecologically important at small and large scales. The site encompasses an area from approximately 5 miles downstream of Higbee in Otero County, upstream to approximately two miles north of U.S. route 160. Much of the watershed is incorporated into the landscape.
USGS Quadrangles: Higbee (3710374), Turkey Canyon (3710373), Rock Canyon (3710363), Corbin Canyon (3710364), Riley Canyon (3710365), Packers Gap (3710366), Sheep Canyon (3710367), Stage Canyon (3710357), O V Mesa (3710356), Beaty Canyon (3710355), Lost Canyon (3710354), Brown Canyon (3710353), Robber's Roost Canyon (3710343), Icehouse Canyon (3710344), Plum Canyon (3710345), Johnson Canyon (3710346), Doss Canyon North (3710347), Rock Crossing (3710346), Brown Sheep Camp (3710441), Lambing Spring (3710431), Painted Canyon (3710338), Doss Canyon South (3710337), Humbar Spring (3710336), Miner's Peak (3710326), Box Ranch (3710327), Trementina Canyon (3710328), Trinchera Cave (3710421), and Patterson Crossing (3710422).
Legal Description: n.a. Elevation: ca. 4,100 ft – 6,100 ft.

GENERAL DESCRIPTION: The Purgatoire Canyon is an uplifted region of the Great Plains that has been heavily dissected by the Purgatoire River. The canyon is generally narrow with walls of varying height. The steepest canyon walls are nearly all rock, often in high cliffs. The more gentle slopes are often vegetated. The uplands in this site are those of the uplift which are vegetated similarly to the canyon slopes (e.g. juniper woodlands) or areas intimately associated with the ecology of the canyon.

HISTORICAL LAND USE: The Purgatoire River area has been inhabited by people for at least 5,000 years. Many indigenous people and their tribes visited or dwelled in the canyons and the surrounding woodlands and grasslands. Spanish soldiers and associates visited the area, particularly after the settlement of Santa Fe in what was to be New Mexico. By the early 1800's trade began in earnest between the young United States and the Spanish Mexican territory, largely along the Santa Fe Trail (Lavender 1954). Spanish citizens inhabited the area since at least the 1840's, building small settlements and ranches. Picket Wire Canyon was an alternate route to that of the Santa Fe Trail, at least to Bent Canyon, especially when there was potential conflict with indigenous peoples. With the trade of the area centered around Bent's Fort, European-American infiltration of the area was common. After Mexico gained its independence, American settlement of the area increased to a maximum population of about 400 by the 1880's. Empire ranching dominated the area's economy until 1909 when small

farms and homesteaders fenced the land. The land was difficult to farm and floods (such as in 1904) and the drought period of the late 1920's and 1930's forced most of the area's residents to leave. Once again, sheep and cattle ranching controlled the landscape. Livestock operations are today the primary use of land adjacent to the Pinon Canyon Maneuver Site or the Picket Wire Canyonlands. [Much of this summary is taken from U. S. Forest Service 1994].

NATURAL HERITAGE RESOURCE SIGNIFICANCE: This megasite is based on the occurrence of numerous conservation sites within a single ecological unit and for several elements that are not assigned to a single conservation site. These elements are typically wide-ranging species that require large ecosystems or landscapes for their perpetuance. For example, several odonate species known to occur on the Purgatoire River may patrol and oviposit over long reaches of the river. In addition, since the habitat is nearly continuous, there are no obvious ecological boundaries that separate separate locations where the species was observed. Similarly, the fishes of the Purgatoire River are found throughout the canyon and will benefit from landscape-scale conservation efforts. We have designated the stream reach of the Purgatoire Canyon as an excellent example of an aquatic community. In the Great Plains, this is truly a site of global significance.

Element	Common Name	Occurrence Rank	Global Rank	State Rank	Federal Status	State Status	USFS Sensitive
Central Great Plains stream	Central Great Plains stream community	A	G?	S1	n.a.	n.a.	n.a.
Gomphus externus	Plains clubtail		G5	S2	n.a.	n.a.	n.a.
Erpetogomphus designatus	Eastern ringtail	B	G5	S2	n.a.	n.a.	n.a.
Erpetogomphus designatus	Eastern ringtail	B	G5	S2	n.a.	n.a.	n.a.
Sagenosoma elsa	a sphinx moth		G?	S1?	n.a.	n.a.	n.a.
Manduca sexta	Carolina sphinx moth		G5	S3?	n.a.	n.a.	n.a.
Gomphus externus	Plains clubtail	A	G5	S2	n.a.	n.a.	n.a.
Coccyzus americanus americanus	Eastern yellow-billed cuckoo	A	G5T5	S2	n.a.	n.a.	n.a.
Erpetogomphus designatus	Eastern clubtail	B	G5	S2	n.a.	n.a.	n.a.
Hybopsis gracilis	Flathead chub	A	G5	S3	n.a.	n.a.	F.S.

The following Colorado Natural Heritage Program-designated conservation sites are included within the preliminary conservation planning boundary for the Purgatoire Canyon Megasite. The natural heritage elements that drive the designation of these as conservation sites can be found in the individual site descriptions.

Site Name	Biodiversity Rank	Protection Urgency	Management Urgency	Ownership

Dinosaur Track Greasewood Flat	B2	P4	M2	USFS
Rourke Canyon	B2	P4	M4	USFS, CSLB, private
Purgatoire at Little Pine Canyon	B3	P3	M2	USFS, PCMS, private
Rourke Ranch Hill	B3	P5	M4	USFS
South Black Hills	B4	P5	M4	USFS, private
Withers Canyon	B5	P4	M3	USFS, private, CSLB
Welsh Canyon	B5	P4	M4	USFS, PCMS
Minnie Canyon	B5	P5	M4	USFS, CSLB, PCMS

Purgatoire Canyon is of interest ecologically (Johnston and Reed 1991), historically (Kane 1994), archaeologically (Collins 1992; Kane 1994), and geologically (Lockley and Prince 1988). In addition to these unique values, the area is important to the ranching community as a significant grazing resource. Geologically, the canyon and mesas represent a highly interesting landform within the Great Plains. Geological representation within the area is exceptional and the paleontological expressions of the area of truly of global significance (particularly the dinosaur track exposures). Archaeologically the area represents some of the finest early Indian sites on the Great Plains. Historically and archaeologically the canyon and surrounding landscape are associated with the first American settlements in Colorado and much of the western Great Plains. The Santa Fe Trail, Bent's Fort, Rourke Ranch, and Picket Wire Canyon were key elements in the American development of the area. Excellent examples of modern western ranch operations continue on the vast grasslands surrounding the Purgatoire Canyon. The ecosystems that occur in this area supported (and continue to support) the current land uses.

Purgatoire Canyon and the surrounding landscape represent the largest of its type in the Colorado Great Plains. At a time when most river systems of eastern Colorado have been heavily altered, the Purgatoire River continues to flow nearly at historical levels (Bramblett and Fausch 1991). The downward cutting action of the river has exposed much of the geological base of the area. The canyon also creates a complex of smaller habitats from cliffs, splash pools, limestone hills, grasslands, and extensive juniper woodlands. Together, these geomorphological expressions support the fauna and flora of the Purgatoire Canyon landscape.

The fauna and flora of the area represent several biogeographic units, none more apparent than the Great Plains fauna and flora. Bramblett and Fausch (1991) described the ichthyofauna of the Purgatoire River in the vicinity of Pinon Canyon. The aforementioned authors found the fishes of the river to be composed entirely of native species. They further noted that this is one of the few remaining relatively undisturbed Great Plains stream ecosystems. In addition, a state-rare fish species *Hybopsis gracilis* (Flathead chub) occurs broadly throughout the river in the canyon. This species is broadly distributed throughout the Missouri River basin and the upper Arkansas, but also well into Canada (Page and Burr 1991). However, in Colorado the fish is uncommon in the Arkansas River drainage.

The Purgatoire Canyon area also represents a northernmost example of plants and animals found farther south. Characteristic species of the southern elements include Cholla (*Opuntia imbricata*), Big free-tailed bat (*Nyctinomops macrotis*), Rufous-crowned sparrows (*Aimophila ruficeps*), and numerous reptiles. Many of the habitats that support these and other species remain in high quality condition.

The remoteness of the Purgatoire Canyon area and its local soils and climate have created the existing land uses. The same factors have protected some areas from the alterring forces affecting most of Colorado's Great Plains. Some of these examples are among the best remaining for the natural communities. There are several species of global significance known from the area: *Frasera coloradensis* (Colorado green gentian), *Asclepias uncialis* (Dwarf milkweed), and *Oonopsis foliosa* var *monocephala* (Single-head goldenweed).

A landscape approach to the conservation of the Purgatoire Canyon Megasite also provides for an important set of linkages. Landscape linkages are believed to be critical to long-range conservation planning (Noss 1991), although not without its controversies (Simberloff and Cox 1987, Noss 1987, Harris and Gallagher 1989). We recommend consideration of multiple scales for the conservation of southern Great Plains natural diversity. Therefore, we recognize the need for a proactive recognition of the Purgatoire Canyon as a regional corridor from just south of the Arkansas River to the Mesa de Maya area and hence to the Front Range of the Rocky Mountains. While not without some serious filters (e.g. U.S. 160 and Interstate 25), the integrity of the node, the Purgatoire Canyon area, is identified in this report. The fact that mountain lions and black bears occupy the region further indicates a high degree of ecological integrity. Similarly, the Colorado Natural Heritage Program has confirmed the Mesa de Maya's regional significance (unpublished data). Therefore, in recognition of the need to provide connectivity for large scale and long term conservation goals, it is important to consider the Purgatoire Canyon Megasite as a conservation linkage.

Over most of the Picket Wire Canyonlands we observed birds that are known to be short or long distance migrants. Recent evaluations of long term trends in birds Sauer and Droege 1992) revealed that many species are showing declines over large areas. Further investigation showed that some of the most significant declines (for western species) were in grassland and permanent resident species (Peterjohn et al 1995; Knopf 1995). Grassland species observed in this study that remain common and widespread, but that are declining significantly include Cassin's sparrow, Lark bunting, and Lark sparrow. Other species that we observed in the study that are known to be in significant decline include Yellow-billed cuckoo, Red-headed woodpecker, Black-billed magpie, Plain titmouse, Rock wren, Northern mockingbird, Loggerhead shrike, Rufous-sided towhee, Brown towhee, Black-throated sparrow, White-crowned sparrow, Red-winged blackbird, Common grackle, and American goldfinch (Peterjohn et al., 1995). This list includes residents, migrants, and species from all habitat types, which illustrates broad changes in most ecosystems. However, particular attention should be paid to grassland and permanent resident species. Conservation efforts for these species will by necessity be land management considerations. Emerging plans based on principles of ecosystem management should assure that national grasslands management seeks to reverse the negative trends shown in bird populations.

CURRENT STATUS: The entire area of the megasite incorporates U. S. Forest Service lands, Colorado State Land Board lands, Pinyon Canyon Maneuver Site lands, and private lands. Management of the area is variable by ownership.

BOUNDARY JUSTIFICATION: The boundary for this extensive area includes the Purgatoire Canyon portion of the Purgatoire River basin. We believe that this river reach includes five of the six criteria for fish reserves as identified by Moyle and Sato (1991). Moyle and Sato's criteria #5 is wanting simply because the Purgatoire fish community is not elsewhere replicable (Bramblett and Fausch 1991). The adjacent juniper-covered hills are also included. The numerous small side drainages are included up to the place where the ecosystem has changed from canyons or gulches to grasslands. Clearly, there are no exact boundaries for this landscape; however, we believe that the most significant ecological processes necessary to sustain this ecosystem are included in the indicated boundary.

PROTECTION AND MANAGEMENT CONSIDERATIONS: Protection of such a vast and diverse area will require the best that we know of ecosystem management. While this is imposing, this landscape retains all of the natural ecological processes that impact the area. Such conditions make the possibility of success high. We recommend that protection of significant resources on public lands include special area designations (e.g. research natural areas and special interest areas). Such designations are within the authority of the U. S. Forest Service and the Department of Defense. The Forest Service currently recognizes all lands of the Picket Wire Canyonlands as a special interest area. The U. S. Army has protected their part of the canyonlands by setting the areas off limits to tracked vehicles (Shaw et al. 1989). The reach of the Purgatoire River between Trinidad and its confluence with the Arkansas was identified on the National Rivers Inventory as eligible for inclusion in the National Wild and Scenic Rivers system.

Protection on private lands must be led by the landowners and be economically viable. Where landowners are willing, certain especially significant areas could be designated as such. Incentives for management of sensitive areas should be used where appropriate and developed where not. Ideas could be adapted from the biosphere reserve program (Gregg et al. 1989) and The Nature Conservancy's bioreserve program where conservation goals include the integration of human activities. Both programs identify graded zones of cooperation (Gregg et al. 1989). Clearly, to provide for sustainable sustainable use of the Purgatoire Canyon megasite will require an unprecedented cooperation between public and private entities (Cooperrider 1991).

Management of the Purgatoire Canyon megasite should include protection of the river's hydrology, application of best land use practices (modified to include information on significant natural resources), and landscape level ecological processes (e.g. fire and ungulate grazing of appropriate areas). Good land management should be applied broadly within the landscape to assure that ecologically viable natural communities persist.

We recommend that the U. S. Forest Service continue partnership approaches that monitor the trends of rare and common species of plants and animals as well as natural communities. The trends revealed from these indicators will be important measures of success. We particularly note the leadership efforts of the Colorado Bird Observatory, the Colorado Partners in Flight, the Colorado Natural Areas Program, and The Nature Conservancy.

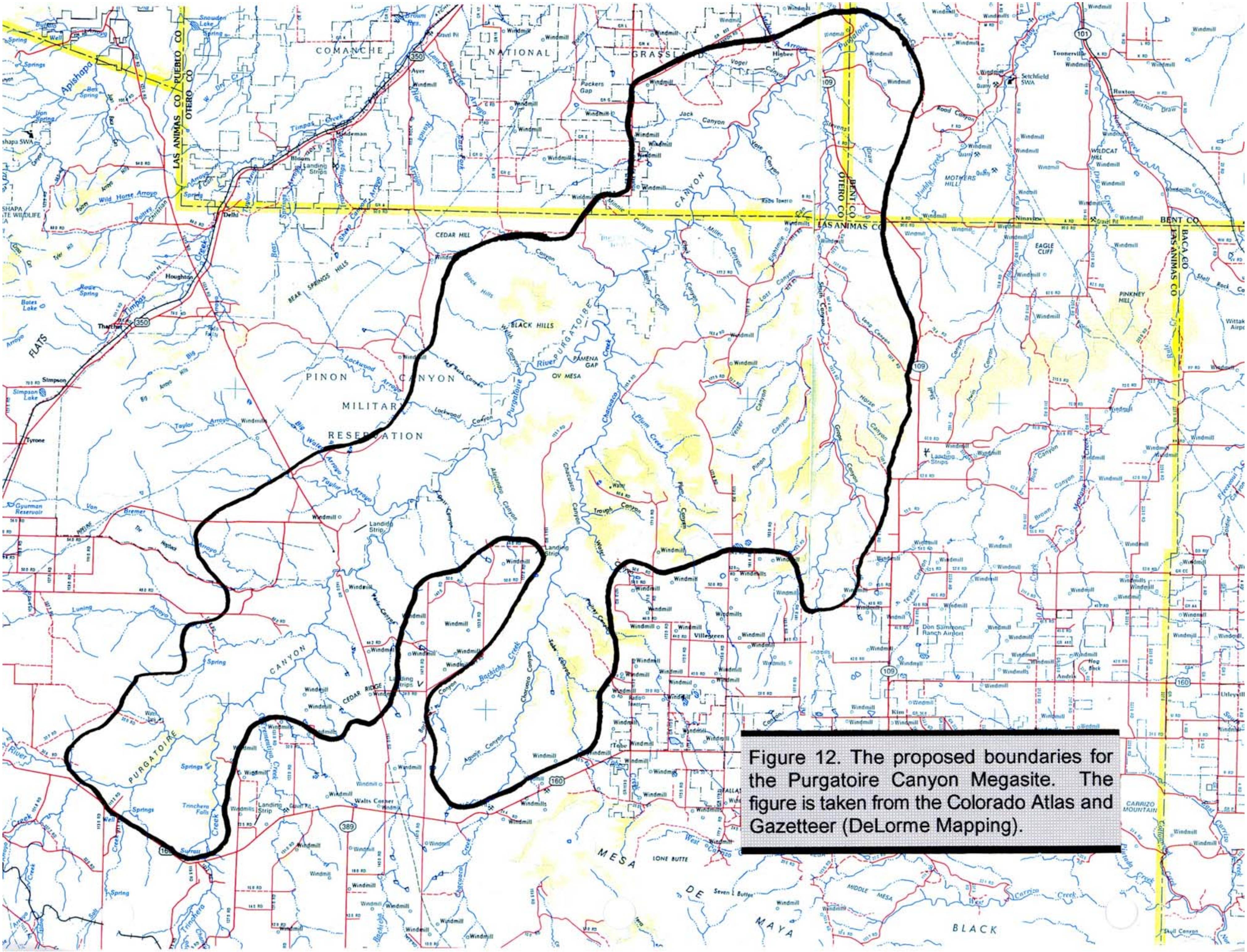

Figure 12. The proposed boundaries for the Purgatoire Canyon Megasite. The figure is taken from the Colorado Atlas and Gazetteer (DeLorme Mapping).

Protection Tools

Intensive land use in Colorado and multiple demands for many areas contribute to the continual degradation of many natural communities, imperiled species habitats, and other types of natural areas. Best management practices can help protect critical buffers, but they may not be adequate for the protection of sensitive species and sites. This is in part due to their development from a static view of the habitat, but also without a ecosystem and long term perspective. The first and most significant and proactive tool for protection is the identification of locations of rare species, natural communities, and the ecosystems that support them. Only with this information can informed decision-making occur.

The Comanche National Grassland has several important conservation tools that can be applied to conservation of the most sensitive features of the Picket Wire Canyon area: 1) special area designations, 2) management plans, 3) management prescriptions, 4) recreation/education plans, 5) forest management plans, 6) rules and regulations, and 7) oversight. All of these tools are applicable to accomplish protection goals that would support the findings of this report. External conservation tools may also be appropriate.

Partnerships that can effectively conserve sensitive natural values include state natural areas designations through the Colorado Natural Areas Program, joint management actions with the Department of Defense, and public-private activities as identified in various ecosystem management presentations. We visualize a public/private education/interpretive program as a possibility for enhancing the long term benefits of protection.

RECOMMENDATIONS

1. **Where appropriate, consider special area designations for the conservation sites identified in this study. Any resulting designations should be included in the next forest plan revision.**

   This inventory has documented the existence of 8 sites and one landscape determined to be significant for the protection of Colorado's and Picket Wire Canyonlands's natural diversity (Figure 3). The Comanche National Grassland should consider including this report's recommendations in the Forest Plan through amendment or revision. These same recommendations should be incorporated into a final management plan for the Picket Wire Canyonlands.

2. **Incorporate the information included in this report in the review of Forest Service activities in or near areas identified as significant**.

   The areas identified in this study are known to support unique or exemplary natural communities and rare species. As proposed activities within the Comanche National Grassland are considered, they may be compared to the maps presented herein. Should the proposed project potentially impact one of these areas, Comanche National Grasslands staff can decide if it is desirable to contact persons, organizations, or agencies with additional expertise. The Colorado Division of Wildlife, Colorado Natural Areas

Program, and Colorado Natural Heritage Program routinely conduct environmental reviews statewide and should be considered as a resource available to the Comanche National Grasslands.

3. **Increase public awareness of the benefits of protecting areas determined to be significant to the Comanche National Grassland's natural diversity**.

Trends over the last twenty years strongly suggest that rare or imperiled species and significant natural areas will continue to decline if not given appropriate protective measures. Increasing the public's knowledge of the remaining significant areas will build support for the programmatic initiatives necessary to protect them. Such activities could be done through interpretive facilities, conferences or meetings to stimulate public involvement, and information pamphlets. Finally, it would be desirable for the Comanche National Grassland to promote any protective designations to the public and scientific community to build awareness of the commitment to the protection of natural areas within the scope of Forest Service activities.

4. **Promote cooperation with boundary neighbors (private individuals, Department of Defense, and the State Land Board) to the maintenance of selected sites and ecosystem integrity.**

The long-term protection of the Picket Wire Canyonlands area will be facilitated with the cooperation of many organizations and individuals. The National Forest Service plays a leadership role in attempting to incorporate diverse opinions in the planning process. Efforts to this end should continue, providing the Comanche National Grassland with stronger ties among federal, state, and local and private interests involved in the protection or management of natural lands. Of particular significance in the rural landscape surrounding the canyon will be partnerships with adjacent landowners. The ecological processes that support the landscape that includes the Picket Wire Canyonlands freely cross political boundaries.

5. **Properly manage significant elements of natural diversity within Picket Wire Canyonlands**.

The development of management plans is a necessary component of natural resource management. This is especially critical for imperiled species and communities. Several organizations and agencies are available for consultation in the development of Management Plans for significant natural lands (e.g., Colorado Natural Areas Program, The Nature Conservancy, and the CNHP). We would also encourage the development of partnerships that could research and develop techniques for maintaining or restoring conservation sites to aid in the preservation of rare or imperiled species or significant natural communities (e.g. Colorado Division of Wildlife, Colorado Native Plant Society, The Nature Conservancy, and various academic institutions).

Other important management activities should include restoration and monitoring. See

the main contents of this report for specific monitoring recommendations. We particularly support the use of volunteers in conducting such efforts.

6. **Actively manage roads and trails through and to conservation sites to control invasive alien plant.** Active monitoring and management of invasive alien plants is critical to the long term health of senstive areas. The Forest Service is encouraged to proactively manage roads and trails to reduce the impacts of these transport corridors.

7. **Continue to identify significant natural resources of the Canyonlands through inventories and other tools**. The refinement of natural resource data is a necessary goal. Inventories or surveys for priority elements of diversity will identify additional strategic management needs. Specifically, we recommend prioritized butterfly surveys of the Picket Wire Canyonlands area [since 1994 was a poor year for butterfly sampling]. Large mammal surveys would also be useful in determining the viability of higher trophic levels in the ecosystem.

8. **Investigate the fire ecology relationship with all habitats of the Picket Wire Canyonlands, particularly the juniper-dominated woodlands.** Fire played an important role in the development and maintenance of many Great Plains communities. The important details that are needed for ecosystem management are missing for the study area. We recommend that the Forest Service expertise in fire ecology be utilized to better understand the ecological needs and implications of various fire management scenarios.

9. **Seek state natural area status as appropriate**. The Colorado Natural Areas Program should be consulted to determine where overlapping conservation goals would benefit from state natural areas designation. Such designations provide recognition of the area, but most importantly and important additional layer of protection. Finally, the Colorado Natural Areas Program staff contains extensive expertise in the management of natural lands.

10. **Work to protect the hydrology and native fish community of the Purgatoire River**. The Forest Service should work with adjacent landowners/managers to protect the ecological integrity of the Purgatoire River watershed. Important factors are water quantity, water quality, and water flow timing.

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APPENDIX A.

Potential Natural Areas Identified in Picket Wire Canyonlands

PNA NUMBER	PNA NAME	STATUS
1	Head of Canyon	O
2	Small Gulch	O
3	South Black Hills Grassland	C, J
4	South Black Hills Basin	C, J
5	Bravo Canyon	O
6	Rourke Canyon South	C, S, J
7	Rourke Ranch Hill	C, J
8	Beaty Canyon South	C, S, J
9	Withers Canyon	C, S
10	Purgatoire River at Minnie Canyon	C, J
11	Purgatoire River at Withers Canyon	O
12	Purgatoire River at Taylor Arroyo	C, J
13	Head of Minnie Canyon	C, J, F

The above table denotes the fate and state of PNAs. Detailed information on each Conservation Site is found in the text of the document.

C = Conservation sites that are known to have one or more occurrences of a natural heritage resource. These are Potential Natural Areas that have known conservation significance.

F = Department of Defense land.

J = Picket Wire Canyonlands land.

O = Omitted from the study as Conservation Sites. This designation does not imply the lack of conservation value; rather, such sites are prioritized lower than sites known to have rare, sensitive, threatened, or endangered species or exemplary natural communities.

S = State land.