



**Natural Heritage Inventory of Rare Plants, Animals and Plant
Communities on Peterson Air Force Base, Colorado Springs, Colorado**

Update to Final Report 1997

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Photograph by Rob Schorr

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Executive Summary

In 2004, the Colorado Natural Heritage Program (CNHP) was contracted by Peterson Air Force Base and the U.S. Fish and Wildlife Service to conduct an update to the rare species inventory published in 1997 (Schuerman et al. 1997). As in 1997, much of the inventory was focused on the eastern part of Peterson Air Force Base (Peterson East) where native habitats are more abundant. Based on targeted inventory areas developed in 1997, much of the inventory focused either in Peterson East, along the undeveloped perimeter of Peterson Air Force Base, or along the riparian corridor of the East Fork of Sand Creek. This report supplements the *Natural Heritage Inventory of Rare Plants, Significant Natural Communities and Animals of Peterson Air Force Base, Colorado Springs, Colorado Final Report* (Schuerman et al. 1997).

The objective of this study was to update the botanical and zoological inventory of Peterson Air Force Base (the Base), concentrating on potential rare, imperiled, or endangered species and significant natural plant communities. Targeted inventory areas (TIAs) were developed in 1997 and reviewed prior to the 2004 inventory. These TIAs were developed based on the availability of suitable habitat for the species and communities found on or near the Base.

The TIAs addressed a wide variety of plant and animal species and one occurrence of northern sandhill prairie plant community. This sandhill plant community is considered to be globally vulnerable by CNHP. It is closely associated with the potential conservation area delineated for the remnant tallgrass community on Colorado Springs Airport (see Doyle et al. 2001). A total of 174 plant species, 29 bird species, 8 mammal species, and 1 reptilian species were documented during the survey periods. None of the plants or animals identified in field surveys are considered threatened, endangered, or species of concern by federal or state agencies. During the Peterson AFB inventory, two birds (Grasshopper Sparrow and Ferruginous Hawk), considered to be rare by CNHP, were found. No rare plants were found during the inventory.

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Introduction

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

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

Some generalist species, like the House Finch (*Carpodacus mexicanus*), have flourished over the last century, having adapted to habitats altered by humans. However, many other species are specialized to survive in vulnerable Colorado habitats; among them are Bell’s twinpod (*Physaria bellii*), the Arkansas darter (*Etheostoma cragini*), and the Pawnee montane skipper (*Hesperia leonardi montana*). These species have special requirements for survival that may be threatened by incompatible land management practices and competition from non-native species. Many of these species have become imperiled not only in Colorado, but also throughout their range. Some species exist in less than five populations in the entire world. The decline of these specialized species often indicates disruptions that could permanently alter entire ecosystems. Thus, recognition and protection of rare and imperiled species is crucial to preserving Colorado’s diverse natural heritage.

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

The need to address this loss in biological diversity has been recognized for decades. Historically, however, many conservation efforts primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically based approach to preserving biological diversity Robert Jenkins of The Nature Conservancy pioneered the Natural Heritage Methodology in the early '70s.

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

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. The 68 Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. Information collected by the Natural Heritage Programs can provide a means to protect species before the need for legal endangerment status arises. It can also enable conservationists and natural resource managers to make informed, objective decisions in prioritizing and focusing conservation efforts.

The Colorado Natural Heritage Program

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

The multi-disciplinary team of scientists, planners, and information managers at CNHP gathers comprehensive information on the rare, threatened, and endangered species and significant plant communities of Colorado. Life history, status, and location data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists.

The Biological and Conservation Data System (BCD), developed by The Nature Conservancy, is used by all Natural Heritage Programs to house data about imperiled species. These data include taxonomic group, global and state rarity rank, federal and state legal status, observation source, observation date, county, township, range, watershed, and other relevant facts and observations. CNHP also uses the Biodiversity Tracking and Conservation System (BioTiCS) for digitizing and mapping occurrences of rare plants, animals, and plant communities. These rare species and plant communities are referred to as “elements of natural diversity”, or simply “elements”.

By using species imperilment ranks and quality ratings for each location, priorities can be established to guide conservation action. Concentrating on site-specific data for each element enables CNHP to evaluate the significance of each location for the conservation of that element, and the biological diversity in Colorado and the nation.

The Natural Heritage Ranking System

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

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

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

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. For example, the lynx, which is thought to be secure in northern North America but is known from less than 5 current locations in Colorado, is ranked G5S1 (globally-secure, but critically imperiled in this state). The Rocky Mountain Columbine, which is known only in Colorado from about 30 locations, is ranked a G3S3 (vulnerable both in the state and globally, since it only occurs in Colorado and then in small numbers). Further, a tiger beetle that is only known from one location in the world at the Great Sand Dunes National Monument is ranked G1S1 (critically imperiled both in the state and globally, because it exists in a single location). CNHP actively collects, maps, and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in

the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness, and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active data collection is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 1.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. Ranks followed by a "B," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example

Table 1. Definition of Natural Heritage Imperilment Ranks.

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

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

S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted by an "S" or a "G" respectively, followed by a number or letter. These ranks should not be interpreted as legal designations.

Legal Designations for Rare Species

Natural Heritage imperilment ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. In Colorado, legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. The

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

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
<u>Code</u>	<u>Abbreviation</u>
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
E(S/A)	Endangered: treated as endangered due to similarity of appearance with listed species.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as S’')	
<u>Code</u>	<u>Definition</u>
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: Significant current or predicted downward trends in population numbers or density. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

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

3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as “S”)	
<u>Code</u>	<u>Definition</u>
BLM	Sensitive: those species found on public lands, designated by a State Director, that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.
State Status:	
The Colorado Division of Wildlife has developed categories of imperilment for nongame species (refer to the Colorado Division of Wildlife’s Chapter 10 – Nongame Wildlife of the Wildlife Commission’s regulations). The categories being used and the associated CNHP codes are provided below.	
E	Endangered: those species or subspecies of native wildlife whose prospects for survival or recruitment within this state are in jeopardy, as determined by the Commission.
T	Threatened: those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or survival that they may become extinct.
SC	Special Concern: those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or are a federal listing “candidate species”) and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado.

U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Candidate species for listing as endangered or threatened under the Endangered Species Act are indicated with a “C”. While obsolete legal status codes (Category 2 and 3) are no longer used, CNHP continues to maintain them in its Biological and Conservation Data system for reference.

Element Occurrences and Their Ranking

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

viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

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

Table 3. Element Occurrence Ranks and Their Definitions

<u>Code</u>	<u>Definition</u>
A	Excellent: the occurrence is relatively large and viable.
B	Good: the occurrence is either small but in good condition, or large but removed from its natural condition. In either scenario, the occurrence is viable.
C	Fair: the occurrence is in poor condition, and possibly of questionable viability.
D	Poor: the occurrence does not merit conservation efforts because it is degraded and not viable.
H	Historic: known from historical record, but not verified for an extended period of time.
X	Extirpated (extinct within the state).
E	Extant: the occurrence does exist but not enough information is available to rank.
F	Failed to find: the occurrence could not be relocated.

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

Potential Conservation Areas and Their Ranking

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

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

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

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

Inventory Methods

The methods for assessing and prioritizing conservation needs over a large area are diverse. This survey was an update to a more thorough survey conducted over multiple months in 1997. The basic steps were as follows:

1. Information Collection Phase

CNHP databases were updated with information regarding known locations of species and significant natural communities within El Paso County. A variety of information sources were consulted, but the majority of the information was readily available from a county-wide survey conducted in 2000 and 2001 by CNHP (Doyle et al. 2001).

2. Identification of Rare and Imperiled Species and Significant Natural

Communities with Potential to Occur on or near Peterson Air Force Base

The information collected in the previous step was used to refine the potential element list and to refine our search areas. Multiple information sources were compiled to develop a list of species that potentially occur on Peterson Air Force Base (see Table 2 and Table 4 in Schuerman et al. 1997).

Although 75 rare and imperiled species and significant natural communities potentially occur on Peterson Air Force Base, biologists focused their efforts on a select subset with the greatest likelihood of being found on Peterson Air Force Base and those likely to be of regulatory concern for the Natural Resources Branch and Civil Engineering (Table 2 in Schuerman et al. 1997).

3. Identifying Targeted Inventory Areas (TIAs)

Survey areas were chosen based on their likelihood of harboring rare or imperiled species or significant natural communities. Known localities were targeted and potential areas were surveyed. Known element occurrences were prioritized for survey. Because this updated survey was based on existing TIAs search effort was focused on these areas.

4. Field Surveys

The TIAs that included the rarest species were visited at the appropriate time as indicated by the phenology of the targeted elements. The methods used in the surveys vary according to the elements that were being targeted. Generally, the appropriate habitats were visually searched in a systematic fashion and searched as thoroughly as time and cost would allow.

When a rare species or significant plant community is discovered its location is mapped using geographic information systems (GIS). Other data accompanying the geographic locale include numbers observed, breeding status, habitat description, disturbance features, and observable threats, where applicable.

5. Delineation of Preliminary Conservation Planning Boundaries

If elements were present, a preliminary conservation planning boundary was delineated. In order to preserve an element, the ecological processes that support that occurrence

must be preserved. The preliminary conservation planning boundary is meant to include features on the surrounding landscape that provide the necessary ecological processes. These boundaries are considered preliminary and additional information may necessitate alteration.

Survey Methods for Plant and Animal Species at Peterson Air Force Base

Plants and Natural Communities

The Peterson East TIA was judged to offer the highest probability of discovery of botanical resources at Peterson Air Force Base. That area was observed during the base-wide survey of noxious weeds in 2003 (Anderson et al. 2003) to be the floristically and vegetationally richest and least-disturbed portion of the base. Additionally, the only significant natural community previously documented at PAFB, an occurrence of the *Andropogon gerardii/Calamovilfa longifolia* (AG/CL) community type, was located toward the south end of Peterson East (Schuerman et al. 1997). Therefore, the botanical portion of the current biological inventory of PAFB was undertaken exclusively at Peterson East (PE).

In order to record plant species of varying phenology over the entire growing season, three plant surveys were conducted at PE by one person on June 15-18, July 12-15, and August 23-26, 2004. During each survey, PE was searched in its entirety. On a daily basis, an area of PE, which could be manageably inspected in a day's work, was arbitrarily defined. The defined area was then searched by grid transect with overlapping lines-of-sight, or by intensive search.

Plant species encountered were identified in the field by sight, or by using the dichotomous keys of Weber (1996). Specimens of some species were instead collected and later identified or verified by CNHP staff at the University of Colorado Museum Herbarium, Boulder.

Animals

Similar to the botanical assessment of TIAs to be surveyed, zoologists determined that the Pete East TIA had the highest priority of housing rare grassland vertebrates. In these habitats, small mammal live traps were set and checked over a period of 5 days in late July (July 26-30, 2004). Total trapnights in grassland habitats was 320. The element of primary interest in upland grasslands was the olive-backed pocket mouse (*Perognathus fasciatus infraluteus*; G5T?), which is found along the prairie regions of the Front Range corridor.

PE also was searched for prairie birds, including passerines and raptors. In the grasslands, zoologists and botanists searched over 22 hours using binoculars and listening for distinctive bird songs and calls. Singing birds or displaying birds were located and identities were confirmed using field guides.

The zoological element of most interest on PAFB was the Preble's meadow jumping mouse (*Zapus hudsonius preblei*). The Preble's mouse is a riparian obligate subspecies

that is typically found in dense willow shrub corridors of the Front Range of Colorado and southeastern Wyoming. After years of extensive trapping surveys along the Front Range with little success, the Preble's mouse was listed as threatened by the U.S. Fish and Wildlife Service in 1998.

The East Fork of Sand Creek provided riparian areas that appear suitable for the Preble's mouse. Live traps were set along the East Fork of Sand Creek for 4 nights (approximately 750 trapnights) and baited with crimped oats. Additionally, a small ball of polyester fiberfil was included in the trap for insulation.

Results

Plants and Natural Communities

The complete list of plant species found at PE in the summer of 2004, is presented in Appendix I. Altogether, one hundred seventy four species were observed, with 23% of these being alien. No rare or imperiled plant species were discovered.

All of the plant species listed for PE (or PAFB) in the final report of the 1997 biological inventory of Schuerman et al (1997) were again found at PE in 2004, with exception of the following twelve:

Scientific Name	Common Name	Family
<i>Achillea lanulosa</i>	yarrow	Asteraceae
<i>Coreopsis tinctoria</i>	tickseed	Asteraceae
<i>Tetranneuris</i> sp.	tetranneuris	Asteraceae
<i>Polanisia dodecandra</i>	clammyweed	Capparaceae
<i>Dianthus armeria</i> *	Depford pink	Caryophyllaceae
<i>Lupinus plattensis</i>	lupine	Fabaceae
<i>Psoraleidium linearifolium</i>	scurf pea	Fabaceae
<i>Scutellaria brittonii</i>	skullcap	Lamiaceae
<i>Penstemon secundiflorus</i>	beardtongue	Scrophulariaceae
<i>Carex geyeri</i>	elk sedge	Cyperaceae
<i>Elymus lanceolatus</i> *	thickspike wheatgrass	Poaceae
<i>Psathyrostachys junceus</i> *	Russian wild rye	Poaceae

(* alien species)

It is possible that some of these twelve species may still exist at PE, but grow at such low frequency that they are simply difficult to find, even with careful searching. Alternatively, some may have been extirpated due to construction or other habitat change since 1997.

A number of species likely have been introduced in the past for revegetation. All are alien species with exception of *Pascopyrum smithii*, a native which itself is frequently used for reclamation of disturbed land. All of these species can be found throughout PE in areas formerly trenched for utilities, at the field maneuver site south of CISF (which is periodically heavily used), and adjacent to dirt roads and building sites.

An additional number of species likely have been introduced (surreptitiously?) for aesthetic reasons, possibly from “meadow-in-a-can.” They are most often associated with the PE footpath, the perimeter road, or the retention pond at the south end of the CISF south parking lot. *Rudbeckia hirta*, for instance, is aberrant in a plains context, being more typically found in places such as montane aspen groves. *Gaillardia aristata* at PE, for example, possesses a showier look suggesting horticultural selection, compared with plants observed at other locations within Colorado. On the other hand, it is difficult to infer the origin of *Ratibida columnifera* and *Adenolinum lewisii*, since both species show some of the characteristics described previously, yet might be normally expected in a plains situation. While all of these suspected introduced aesthetic species were identified as native species using the keys available for the flora of Colorado, some might actually be non-native.

It is ultimately impossible to know for certain the means by which some species have come to be present at PE. This is not only so for previously mentioned plant species, which could conceivably be components of a native flora, but even for alien species such as *Medicago sativa* which can easily naturalize.

One significant difference between the plant species list generated by the 1997 biological inventory and the current one is the number of new plant species associated with mesic to wet-mesic habitat. Considering PE as a whole, these species are rare to uncommon at best. Nonetheless, both alien and native species adapted to such habitats are now present at PE due to the ever-increasing passive control and concentration of drainage water by means of culverts and retention ponds associated with roads and building parking lots. A particular management concern is the discovery of currently small stands of Canada thistle, *Breca canadensis*, at the mouths of drainage culverts, and especially in the swale into which water from the site of the soon-to-be-built new Base Exchange is to be directed (on the west side of the PE road across from Building 2025 Centralized Integration System Facility (CISF)). Canada thistle, being well adapted to such opportunities for supplemental water, will become an increasing problem in the future, and will demand continual maintenance at PE to prevent widespread establishment.

Besides Canada thistle, two other noxious weeds, yellow toadflax (*Linaria vulgaris*) and tamarisk (*Tamarix ramosissima*), were found at PE for the first time. All occurrences were reported to 21 CES/CEOE personnel, which in turn notified the current grounds maintenance contractor (Embassy Grounds Maintenance). Most importantly, their discovery emphasizes the need for increased vigilance toward the presence of noxious weeds at PE, and the imperative of their rapid removal at the earliest stage of infestation.

The phenomenon of disturbance in biotic systems is complex. Disturbance at various scales is always present, and species adapted to disturbance are normally represented to one extent or another. At PE, though, a few weedy alien species are common indicators of more broad-scale, human-caused disturbance. *Salsola australis* and *Bassia sieversiana*, or *Lappula redowskii*, are especially present at high density along vehicle tracks formerly established for construction, beside roads used for utility access and perimeter security, over strips of ground originally trenched for water and electrical

utilities, and at the field maneuver site south of CISF. Over the years, mowing has probably perpetuated these weeds at highly infested sites by mulching seed into the ground, and even dispersing seed to other, previously unaffected areas at PE.

Birds

Twenty-nine species of birds were identified on Peterson Air Force Base and are listed in Table 4. None of the birds identified were considered rare, threatened or endangered by state or federal agencies. The birds of most conservation concern and potential to occur on Peterson Air Force Base are the Grasshopper Sparrow, the Golden Eagle, the Burrowing Owl, and the Ferruginous Hawk. The Mountain Plover is found in nearby southern and eastern El Paso County, but is not likely to inhabit Peterson Air Force Base because of the lack of bare ground and height of grasses.

Two bird species of conservation concern were observed during this survey. They are the Ferruginous Hawk (*Buteo regalis*) and the Grasshopper Sparrow (*Ammodramus savannarum*). Two Ferruginous Hawks were identified on PE. A fledgling hawk was found injured near the walking trail at the north end of PE. It is possible this animal injured itself by flying into the cyclone fence nearby or struck a vehicle while hunting. Alternately, the animal was young and may have misjudged the approach to its prey. An adult Ferruginous Hawk was seen resting on the cyclone fence along the southern boundary of PE.



Young Ferruginous Hawk in hand.
Photograph by Mark Mann

The Ferruginous Hawk prefers open country nesting along cliffs, in trees, utility structures and farm buildings. Adults are considerably larger than Red-tailed Hawks (*Buteo jamaicensis*) and Swainson's Hawks (*Buteo swainsoni*) and their undersides are predominantly white with dark legs. These large-bodied hawks were petitioned for listing under the Endangered Species Act in 1991, but rejected. The U.S. Fish and Wildlife Service considers them a Sensitive Species. Ferruginous Hawks prey on rabbits (*Lepus* spp.), ground squirrels (*Spermophilus* sp.), and prairie dogs (*Cynomys* spp.) (Bechard and Schmutz 1995). Although PE does not house prairie dogs, there is a population of thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*) on Air Force property and along the Colorado Springs Airport runways and adjacent property. Because Bird Aircraft Strike Hazards (BASH) are of concern for the Base and the Colorado Springs Airport, the discovery of a breeding population of Ferruginous Hawks may be a management issue. BASH programs exist in most military branches and can provide more complete guidance on resolving such conflicts.

Peterson Air Force Base would need to do little to ensure the persistence of the Ferruginous Hawks. The Base and the adjacent Colorado Springs Airport provide ideal habitat for thirteen-lined ground squirrels and other prairie rodents. Providing perches away from the runway above suitable rodent habitats may concentrate hunting away from runways. BASH guidelines may provide more specific guidelines.

The Grasshopper Sparrow is an inconspicuous grassland sparrow with a distinctive song. The song is a high-pitched insect-like tsick, tsick, tsurrrrrr or tip-tup-a-zeeeee (Vickery 1996). Grasshopper Sparrows are found in open grasslands, typically with moderate amounts of bare ground (Rising 1996). They feed on insects, almost exclusively selecting grasshoppers. Populations of Grasshopper Sparrow have been in decline and one subspecies has been listed as endangered under the Endangered Species Act. Within the mid-grass prairies of PE and the adjacent Colorado Springs Airport property, at least 10 singing males were identified. This could represent 10 breeding pairs of Grasshopper Sparrows and a respectable population considering the extent of mid-grass prairie at PE.

The three major management techniques recommended for ensuring the persistence of Grasshopper Sparrows are: 1. mowing; 2. grazing; and 3. prescribed burning. Mowing has proven to be a successful technique for managing grassland birds near airports. Mowing is conducted after the breeding season and the regeneration of tallgrasses has been advantageous around airports because it precludes gulls (*Larus* spp.) and crows (*Corvus* spp.), but provides adequate habitat for grassland sparrows and other songbirds. At Westover Air Reserve Base in Cicopee, MA, Grasshopper Sparrows increased from 55 to 168 pairs as a result of deferred (until after breeding) mowing (Melvin 1994). It is likely that Grasshopper Sparrows have flourished at PE because grasses have not been mowed in recent years.

Mammals

During this update to the 1997 rare species inventory of Peterson Air Force Base biologists targeted the rarest mammals that could potentially be captured on the Base. The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is the rarest mammal that likely once existed throughout the riparian areas of Colorado Springs. Much of the mammal trapping effort was directed toward capturing any Preble's mice that may still exist along the riparian areas near Peterson Air Force Base.

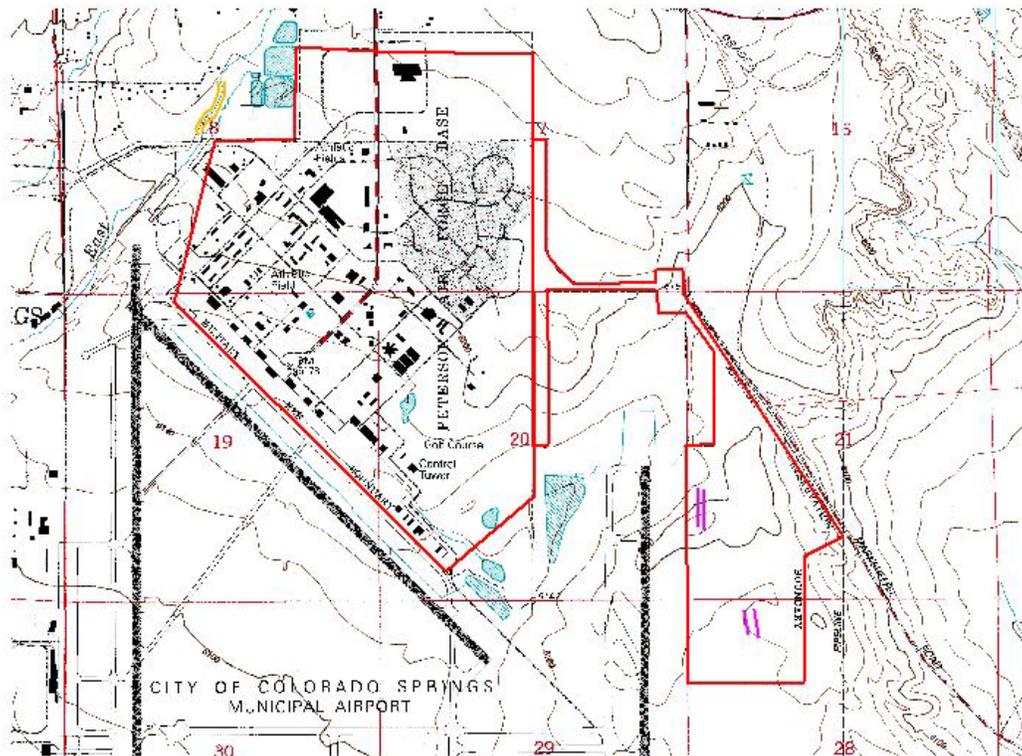
The best Preble's mouse habitat near the Base is along the East Fork of Sand Creek near the West Gate Entrance. South of the West Gate Entrance the East Fork of Sand Creek is rip-rapped and very shrubby cover has developed. North of the West Gate Entrance the East Fork of Sand Creek has an abundance of shrub cover and herbaceous cover (Table 2 Appendix III). This section of the creek is the most-likely habitat for Preble's mice.

In 750 trapnights along the East Fork of Sand Creek, 280 deer mice (*Peromyscus maniculatus*), 43 western harvest mice (*Reithrodontomys megalotis*), 16 prairie voles (*Microtus ochrogaster*), and 3 meadow voles (*Microtus pennsylvanicus*) were captured. No Preble's mice were captured. This is the second time this section of the East Fork of Sand Creek has been trapped extensively without a Preble's mouse capture. The likelihood that Peterson Air Force Base houses a population of Preble's mice is remote.

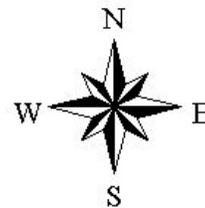
Because little is known about the distribution of assorted pocket mice (*Perognathus* spp.), some trapping was conducted in upland areas of PE. In 250 trapnights, 2 deer mice, 1

Ord's kangaroo rat (*Dipodomys ordii*), and 2 thirteen-lined ground squirrels were trapped. No rare species were captured. Trapping transects are depicted in Figure 1.

Figure 1.
Small mammal trapping conducted in riparian
corridor of East Fork of Sand Creek,
Peterson Air Force Base, El Paso County, Colorado



-  Upland trapping transects
-  Peterson East
-  Preble's mouse trapping transects
- Land Ownership**
-  State Land
-  National Forests and Grasslands
-  Wilderness Areas
-  National Parks and Monuments
-  Bureau of Land Management
-  National Wildlife Refuge
-  Indian Reservations
-  Military Reservations and Other Federal Lands
-  Private Lands



UTMs, NAD 1927, Zone 13:
 525112, 4298104
 Elevation: 6200 ft.

Discussion

Botanical and Ecological

As discussed in the 1997 inventory report, the most important conservation priority for Peterson Air Force Base is the continued maintenance of the northern sandhill prairie community.

Ramets of big bluestem and prairie sandreed, the two species which define the big bluestem/prairie sandreed (*Andropogon gerardii*/*Calamovilfa longifolia* (AG/CL)) community type, can be found individually or in small clumps anywhere at PE. However, the AG/CL community is best expressed where these tall grasses are found at highest frequency toward the south end of PE, in the neighborhood of CISF. It was there that a small occurrence of the AG/CL community type was located during the 1997 survey (Schuerman et al 1997). Attempts to relocate that occurrence were unsuccessful. It is possible that the occurrence is no longer extant, due to expansion of the parking lots south of CISF, or widened activity of the field maneuver site to the south.

Nonetheless, a site was identified on the west side of the PE road, west of CISF and north of Fire Station No. 7, which represents the most extensive and highest-frequency, least-disturbed occurrence of *A. gerardii* and *C. longifolia* found at PE in 2004 (Figure 2). At the fullest extent of growth in August, these two dominant grasses are very common there, and reach a height of some 1.5 m. Needle-and-thread (*Hesperostipa comata*), blue grama (*Chondrosium gracile*) and buffalograss (*Buchloe dactyloides*) are abundant and form structural layers of decreasing height within the vegetation matrix. Many dicot species are nestled almost invisibly within the grass layers, golden aster (*Heterotheca villosa*) being most common.

Although the AG/CL occurrence is comparatively intact, water drainage currently directed onto the site from the northeast creates an incursion of disturbance, washing considerable sand and gravel onto the site. This situation can be expected to worsen, as this is the swale into which water from the soon-to-be-built new Base Exchange is to be directed. As previously discussed, such conditions are conducive to the establishment and growth of noxious weeds, including Canada thistle.

Promotion of continuance of the AG/CL community at PE should be viewed in the context of its particular condition, the overall condition of the natural vegetation of PE, and of prospects for future conservation. While the present condition of the particular AG/CL occurrence discussed above is good, it is nonetheless small, only 5.5 acres, and is coming under increased disturbance pressure. More broadly, vegetation at PE is in fair to good condition, but at full growth in August extensive stands of Russian thistle (*Salsola australis*) and kochia (*Bassia sieversiana*), or beggar's tick (*Lappula redowskii*), are evident which are not readily apparent most of the year. On the other hand, many native plant species do still grow there, and no noxious weed species have yet widely established at the site. Being the largest piece of open land at Peterson Air Force Base, PE decidedly will be the location of most future development on base. For instance, construction of a new Base Exchange, north of CISF on the east side of Stewart Avenue and across from the radar facility, will shortly be underway.

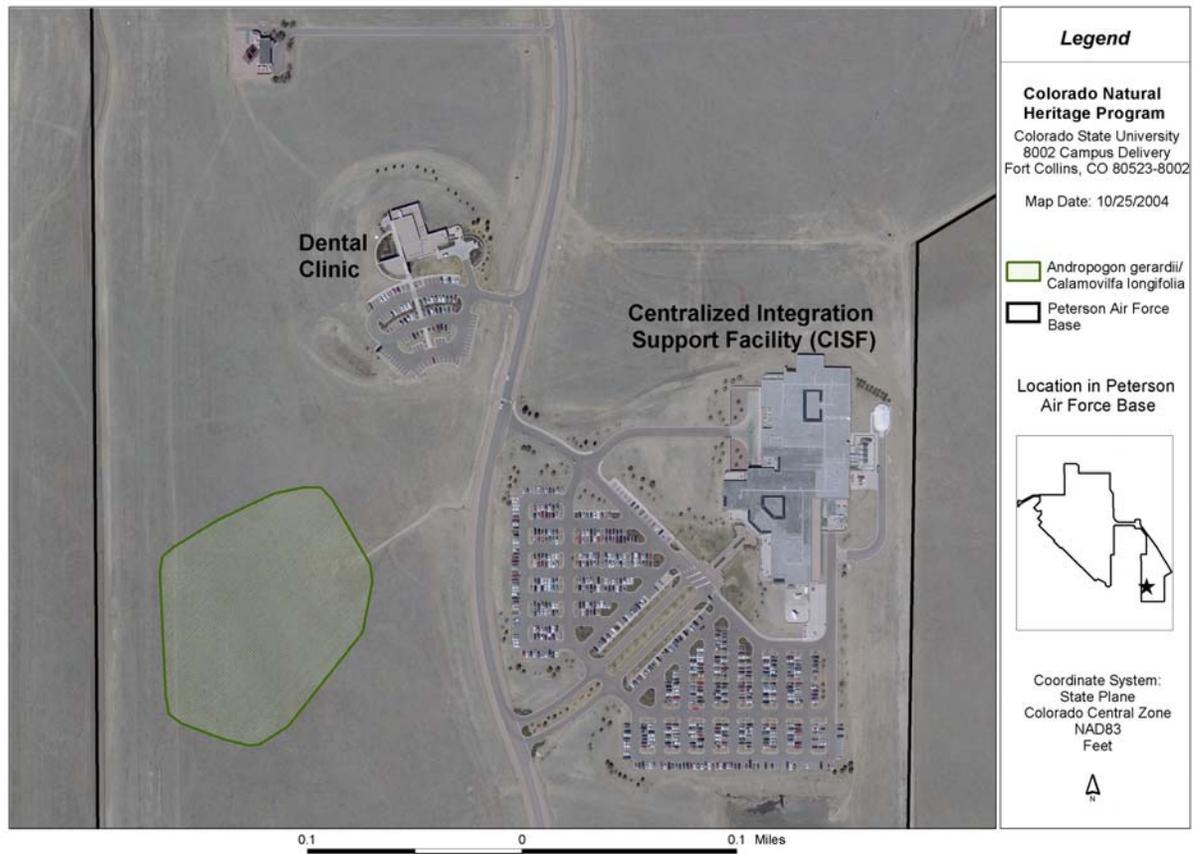


Figure 2. Location of the *Andropogon gerardii*/*Calamoviifa longifolia* community identified at Peterson East, Summer, 2004.

Both practical and inherent values are associated with keeping the natural vegetation in general, and the *AG/CL* community in particular, at PE. Because a healthy native plant community is a first line of defense against invasion of noxious weeds, maintaining natural vegetation at PE simply makes good pragmatic sense. The better, natural processes of grazing and fire are still precluded from use at PE (as previously discussed in Schuerman et al 1997), but mowing will no doubt continue to be applied as a management tool in the future. To reiterate a conclusion of Schuerman et al. (1997), mowing should be timed during the growing season to minimize disturbance of the broader biotic community. Vegetation was not mown at PE in 2004, however, providing a season of rest, which certainly has allowed partial recovery of some natural elements there. Periodically introducing such a hiatus is an excellent idea worth continuing in future. Whatever the system of timing, though, it is imperative that mowing occurs at a proper height. Vegetation is supposed to be mown at a height of 9 inches at PE (Phil McDonald, Grounds Manager, pers. comm. 2003); however, ample evidence was found during this year's survey that mowing was done in 2003 at a height of around 4 inches. Mowing so low will both sap the vigor of the natural vegetation and create open domain, conditions ripe for establishment of noxious weeds.

Although it is not an extensive, pristine example of the *AG/CL* community type, the *AG/CL* occurrence at PE still retains intrinsic biological value. For example, any remaining *AG/CL* would continue to serve as critical habitat for any existing Argos skipper (*Atrytone argos*) or Ottoe skipper (*Hesperia ottoe*) butterflies, rare species dependent upon big bluestem as a host plant (Schuerman et al 1997). More generally, native plants at PE will also continue to serve as habitat for a host of more common organisms large and small, and to contribute genetic diversity to native populations in the vicinity. Even though base development may someday force extirpation of this community from PE, it should nonetheless be retained for as long as possible for the sake of such values.

Zoological

There are several rare zoological elements that may exist on PAFB. Because of funding and time this survey focused on the rare vertebrate components that could be detected readily. In particular, the six rare vertebrate elements that may occur on PAFB are the Preble's meadow jumping mouse, the black-tailed prairie dog (*Cynomys ludovicianus*), the olive-backed pocket mouse, the swift fox, the Ferruginous Hawk, the Mountain Plover, and the Grasshopper Sparrow.

PAFB is surrounded by considerable acreage of mid-grass prairie that seems appropriate for prairie dogs. The historic range of black-tailed prairie dogs (prairie dogs) includes El Paso County, however, the current range has retracted considerably. Because of control measures used throughout the 1900's and prairie dog's susceptibility to bubonic plague, the current distribution of prairie dogs is more restricted. The nearest prairie dog towns on record occur south of PAFB approximately 9.5 miles.

Because prairie dogs create towns that are vital grassland habitat components for a host of species, the discovery of prairie dogs may indicate the health of grassland systems near PAFB. Such a discovery would need to be managed with the overall mission of PAFB as an Air Force Base, considering that the raptors that feed on prairie dogs may contribute to Bird Aircraft Strike Hazards (BASH). Management of prairie dogs and the associated prairie species is not mutually exclusive with the mission of an aircraft base such as PAFB, but careful application of BASH prevention measures and habitat conservation would be required.

The Preble's meadow jumping mouse is a riparian obligate, preferring the mesic shrublands along the banks of streams and river systems. The Preble's mouse has never been captured this far south and east, with the nearest captures occurring near the Black Forest to the north and along Fountain Creek in Colorado Springs to the west. Habitat along the East Fork of Sand Creek at the edge of PAFB property is the most suitable habitat for Preble's mice near PAFB. This riparian system provides some of the same habitat components that have been associated with successful Preble's mouse capture locations. The East Fork of Sand Creek has dense, tall riparian shrubs with patches of dense herbaceous cover and some overstory trees. However, the herbaceous ground cover is more sparse than most successful capture locations, and the prevalence of

historic and recent human disturbance suggests that system has been impacted more severely than current conditions show.

This survey's trapping effort along East Fork of Sand Creek is the second effort in 8 years (Schuerman et al. 1997). Both efforts trapped for hundreds of trapnights over multiple nights without success. It is likely that the East Fork of Sand Creek near PAFB is not inhabited by Preble's mice.

The olive-backed pocket mouse is found along grassland ecosystems at the base of the Front Range south to Las Animas County (Fitzgerald et al. 1994). This pocket mouse has been found in grasslands similar to those found on PAFB, which include such grasses as stipa (*Stipa* spp.), three-awn (*Aristida* spp.), little bluestem (*Andropogon gerardii*) and blue grama (*Chondrosum gracile*). This is one of the rare small mammals of Colorado, but its status is unknown. Development along the Front Range may have extirpated some populations (Fitzgerald et al. 1994).

With the combination of urban development within the heart of the base and the grassland communities of PE, the bird communities on PAFB are diverse. The rarest bird that may be found on PAFB is the Mountain Plover. Although commonly considered a likely visitor to PE grassland habitats, there is little suitable habitat available. Mountain Plovers require much more bare ground than what is found in PE and large expanses of short-grass prairie. The probability of finding Mountain Plover on PAFB is very low.

Two rare birds that have been found on PAFB are grassland-associated species. Multiple individuals of the Ferruginous Hawk and the Grasshopper Sparrow were found on PAFB in 2004. In PE, a juvenile Ferruginous Hawk was found injured near the pedestrian trail. This hawk may have broken its wing during a collision with the nearby fence or traffic along Stewart Avenue east. An adult Ferruginous Hawk was seen roosting on the fence at the southeast corner of PE.

Because the Ferruginous Hawk requires vast expanses of open country, management for this bird cannot be accomplished solely within the borders of PAFB. Measures to improve Ferruginous Hawk numbers include installation of nesting platforms, improving prey base and precluding habitat degradation (Bechard and Schmutz 1995). Although this is a species of conservation concern (proposed for listing under the Endangered Species Act in 1991), management for this raptor at PAFB will require the consideration of possible BASH conflicts. The Ferruginous Hawk is one of the bird species that may conflict with the PAFB mission, but careful management may ensure healthy populations of this hawk and the Air Force mission. This would require working with PAFB neighbors to provide nesting habitat and adequate feeding habitat away from the flight lines at PAFB. Additionally, this may require grassland management techniques that preclude prey (small and medium-sized mammals) from areas near flight lines.

The Grasshopper Sparrow is a small songbird that inhabits mid-grass prairies. It feeds on grassland invertebrates and nests in lush grass communities. Part of the reason Grasshopper Sparrows were seen in such abundance in 2004 (5 - 10 displaying males just

in PE) is because mowing has been absent recently. The growth of taller grasses has made the area more advantageous for breeding. The three most successful management techniques for attracting and improving success of Grasshopper Sparrows, include mowing, grazing and prescribed burning. Deferred mowing until after the breeding season is considered one of the more successful methods of improving Grasshopper Sparrow habitat. Minimizing grazing in drier habitats has successfully let grassland communities regenerate and has provided additional habitat for Grasshopper Sparrows. The first year after a prescribed burn in grassland habitats is a proven way of improving habitat for the Grasshopper Sparrow and other grassland songbirds.

Acknowledgments

We would like to thank Mark Mann for his time and effort in allowing access to Peterson AFB and providing necessary resources. Special thanks is extended to Tim Hogan and Nan Lederer of the University of Colorado Museum Herbarium, Boulder, for assistance with identification of a handful of difficult plant specimens. Also, Mark Mann and Rob Schorr would like to thank the High Country Veterinary Hospital for their efforts to rehabilitate an injured Ferruginous Hawk found during the study.

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Appendix I. Complete List of Plants found at Peterson East, Peterson Air Force Base During the 2004 Survey.

Dicots (Forbs)

Species Name	Common Name	Family	Notes
<i>Amaranthus retroflexus</i> *	amaranth	Amaranthaceae	
<i>Froelichia gracilis</i>	cottonwool	Amaranthaceae	
<i>Asclepias pumila</i>	milkweed	Asclepiadaceae	1
<i>Asclepias speciosa</i>	milkweed	Asclepiadaceae	
<i>Asclepias viridiflora</i>	milkweed	Asclepiadaceae	
<i>Achillea millefolium</i> *	yarrow	Asteraceae	1,3
<i>Ambrosia psilostachya</i> var. <i>coronopifolia</i>	ragweed	Asteraceae	
<i>Artemisia frigida</i>	fringed sage	Asteraceae	1
<i>Artemisia ludoviciana</i>	wormwood	Asteraceae	1
<i>Breea canadensis</i> *	Canada thistle	Asteraceae	4
<i>Cirsium canescens</i>	white plains thistle	Asteraceae	1
<i>Cirsium flodmanii</i>	Flodman's thistle	Asteraceae	
<i>Conyza canadensis</i> *	horseweed	Asteraceae	
<i>Cyclachaena xanthifolia</i>	marsh elder	Asteraceae	
<i>Dyssodia papposa</i>	fetid marigold	Asteraceae	
<i>Echinacea angustifolia</i>	purple coneflower	Asteraceae	3
<i>Engelmannia peristenia</i>	engelmannia	Asteraceae	1
<i>Erigeron canus</i>	fleabane	Asteraceae	1
<i>Erigeron vetensis</i>	fleabane	Asteraceae	
<i>Gaillardia aristata</i>	blanketflower	Asteraceae	1,3
<i>Grindelia squarrosa</i>	gumweed	Asteraceae	
<i>Helianthus rigidus</i> var. <i>subrhomboideus</i>	sunflower	Asteraceae	
<i>Heterotheca villosa</i>	golden aster	Asteraceae	1
<i>Hymenopappus tenuifolius</i>	hymenopappus	Asteraceae	
<i>Lactuca serriola</i> *	prickly lettuce	Asteraceae	
<i>Leucanthemum vulgare</i> *	oxeye daisy	Asteraceae	1,3
<i>Liatris punctata</i>	gayfeather	Asteraceae	
<i>Lygodesmia juncea</i>	skeletonweed	Asteraceae	
<i>Machaeranthera bigelovii</i>	tansy aster	Asteraceae	
<i>Machaeranthera pinnatifida</i>	tansy aster	Asteraceae	
<i>Oligoneuron rigidum</i>	stiff goldenrod	Asteraceae	
<i>Oligosporus caudatus</i>	tarragon	Asteraceae	
<i>Packera plattensis</i>	groundsel	Asteraceae	
<i>Packera tridenticulata</i>	groundsel	Asteraceae	1
<i>Podospermum laciniatum</i> *	false salsify	Asteraceae	
<i>Ratibida columnifera</i>	prairie coneflower	Asteraceae	1,3?
<i>Rudbeckia hirta</i>	blackeyed susan	Asteraceae	3
<i>Senecio spartioides</i>	butterweed	Asteraceae	
<i>Solidago multiradiata</i>	goldenrod	Asteraceae	
<i>Taraxacum officinale</i> *	dandelion	Asteraceae	1
<i>Thelesperma filifolium</i>	thelesperma	Asteraceae	1
<i>Thelesperma megapotamicum</i>	thelesperma	Asteraceae	1

Species Name	Common Name	Family	Notes
<i>Tragopogon dubius*</i>	salsify	Asteraceae	1
<i>Virgulus falcatus</i>	autumn aster	Asteraceae	
<i>Cryptantha fendleri</i>	white forget-me-not	Boraginaceae	
<i>Lappula redowskii</i>	beggar's tick	Boraginaceae	
<i>Lithospermum incisum</i>	puccoon	Boraginaceae	
<i>Mertensia lanceolata</i>	chimingbells	Boraginaceae	1
<i>Oreocarya suffruticosa</i>	white forget-me-not	Boraginaceae	1
<i>Erysimum capitatum</i>	wallflower	Brassicaceae	
<i>Lepidium densiflorum</i>	peppergrass	Brassicaceae	1
<i>Lesquerella montana</i>	bladderpod	Brassicaceae	1
<i>Rorippa sinuata</i>	yellowcress	Brassicaceae	4
<i>Sisymbrium altissimum</i>	Jim Hill mustard	Brassicaceae	
<i>Coryphantha vivipara</i>	nipple cactus	Cactaceae	
<i>Opuntia fragilis</i>	brittle cactus	Cactaceae	
<i>Opuntia macrorhiza</i>	pricklypear	Cactaceae	1
<i>Cleome serrulata</i>	rocky mountain beeplant	Capparaceae	
<i>Bassia sieversiana*</i>	kochia	Chenopodiaceae	
<i>Chenopodium desiccatum</i>	goosefoot	Chenopodiaceae	1
<i>Chenopodium pratericola</i>	goosefoot	Chenopodiaceae	1
<i>Cycloloma atriplicifolium</i>	winged pigweed	Chenopodiaceae	
<i>Salsola australis*</i>	Russian thistle	Chenopodiaceae	1
<i>Convolvulus arvensis*</i>	bindweed	Convolvulaceae	1
<i>Cucurbita foetidissima</i>	gourd	Cucurbitaceae	
<i>Chamaesyce glyptosperma</i>	spurge	Euphorbiaceae	
<i>Tithymalus brachyceras</i>	spurge	Euphorbiaceae	
<i>Astragalus agrestis</i>	milkvetch	Fabaceae	
<i>Astragalus ceramicus</i>	easter-egg milkvetch	Fabaceae	1
<i>Astragalus cicer*</i>	milkvetch	Fabaceae	2
<i>Astragalus crassicaarpus</i>	groundplum	Fabaceae	
<i>Astragalus missouriensis</i>	milkvetch	Fabaceae	
<i>Dalea candida var. oligophylla</i>	dalea	Fabaceae	
<i>Dalea purpurea</i>	dalea	Fabaceae	
<i>Lupinus caudatus</i>	lupine	Fabaceae	
<i>Medicago lupulina*</i>	black medic	Fabaceae	
<i>Medicago sativa*</i>	alfalfa	Fabaceae	1,2?
<i>Melilotus albus*</i>	white sweetclover	Fabaceae	
<i>Melilotus officinale*</i>	yellow sweetclover	Fabaceae	1
<i>Oxytropis lambertii</i>	locoweed	Fabaceae	1
<i>Psoralidium digitatum</i>	scurf pea	Fabaceae	
<i>Psoralidium lanceolatum</i>	scurf pea	Fabaceae	1
<i>Psoralidium tenuiflorum</i>	scurf pea	Fabaceae	
<i>Trifolium pratense*</i>	clover	Fabaceae	
<i>Erodium cicutarium</i>	cranebill	Geraniaceae	
<i>Adenolinum lewisii</i>	wild blue flax	Linaceae	1,3?
<i>Nuttallia nuda</i>	blazingstar	Loasaceae	1
<i>Malva neglecta</i>	cheeseweed	Malvaceae	

Species Name	Common Name	Family	Notes
<i>Sphaeralcea coccinea</i>	cowboy's delight	Malvaceae	
<i>Abronia fragrans</i>	sand verbena	Nyctaginaceae	1
<i>Oxybaphus linearis</i>	umbrellawort	Nyctaginaceae	1
<i>Calylophus serrulatus</i>	calylophus	Onagraceae	
<i>Epilobium ciliatum</i>	willowherb	Onagraceae	4
<i>Gaura coccinea</i>	gaura	Onagraceae	1
<i>Gaura mollis</i>	gaura	Onagraceae	
<i>Oenothera coronopifolia</i>	evening primrose	Onagraceae	
<i>Oenothera howardii</i>	evening primrose	Onagraceae	1,3
<i>Oenothera latifolia</i>	evening primrose	Onagraceae	1
<i>Oenothera nuttallii</i>	evening primrose	Onagraceae	
<i>Argemone polyanthemus</i>	prickly poppy	Papaveraceae	
<i>Argemone squarrosa</i>	prickly poppy	Papaveraceae	
<i>Plantago patagonica</i>	wooly plantain	Plantaginaceae	1
<i>Ipomopsis aggregata</i> ssp. <i>candida</i>	gilia	Polemoniaceae	3
<i>Eriogonum annuum</i>	wild buckwheat	Polygonaceae	
<i>Eriogonum effusum</i>	wild buckwheat	Polygonaceae	
<i>Persicaria lapathifolia</i> *	smartweed	Polygonaceae	4
<i>Polygonum douglasii</i>	knotweed	Polygonaceae	
<i>Polygonum ramosissimum</i> *	knotweed	Polygonaceae	
<i>Rumex crispus</i> *	curly dock	Polygonaceae	
<i>Portulaca oleracea</i> *	purslane	Portulacaceae	
<i>Cerasus pumila</i> ssp. <i>besseyi</i>	sand cherry	Rosaceae	
<i>Potentilla pensylvanica</i>	cinquefoil	Rosaceae	
<i>Populus deltoides</i> ssp. <i>monilifera</i>	cottonwood	Salicaceae	4
<i>Salix exigua</i>	sandbar willow	Salicaceae	4
<i>Linaria vulgaris</i> *	yellow toadflax	Scrophulariaceae	
<i>Penstemon albidus</i>	beardtongue	Scrophulariaceae	
<i>Penstemon angustifolius</i>	beardtongue	Scrophulariaceae	
<i>Penstemon strictus</i>	beardtongue	Scrophulariaceae	1
<i>Penstemon virgatus</i> ssp. <i>asa-grayi</i>	beardtongue	Scrophulariaceae	
<i>Physalis pumila</i> ssp. <i>hispida</i>	ground cherry	Solanaceae	
<i>Tamarix ramosissima</i> *	tamarisk	Tamaricaceae	
<i>Ulmus pumila</i> *	Chinese elm	Ulmaceae	
<i>Verbena bracteata</i> *	vervain	Verbenaceae	1
<i>Tribulus terrestris</i> *	puncturevine	Zygophyllaceae	

Monocots

Species Name	Common Name	Family	Notes
<i>Yucca glauca</i>	Spanish bayonet	Agavaceae	
<i>Allium textile</i>	onion	Alliaceae	1
<i>Tradescantia occidentalis</i>	spiderwort	Commelinaceae	1
<i>Carex pensylvanica</i> ssp. <i>heliophila</i>	sunsedge	Cyperaceae	
<i>Carex stenophylla</i> ssp. <i>eleocharis</i>	spikesedge	Cyperaceae	
<i>Eleocharis palustris</i>	spikerush	Cyperaceae	4

Species Name	Common Name	Family	Notes
<i>Schoenoplectus lacustris</i> ssp. <i>acutus</i>	bulrush	Cyperaceae	4
<i>Juncus arcticus</i> ssp. <i>ater</i>	arctic rush	Juncaceae	4
<i>Juncus dudleyi</i>	rush	Juncaceae	4
<i>Achnatherum hymenoides</i>	indian ricegrass	Poaceae	
<i>Achnatherum robustum</i>	sleepygrass	Poaceae	
<i>Agropyron cristatum</i> *	crested wheatgrass	Poaceae	1,2
<i>Andropogon gerardii</i>	big bluestem	Poaceae	1
<i>Anisantha tectorum</i> *	cheatgrass	Poaceae	1
<i>Aristida divaricata</i>	three-awn	Poaceae	
<i>Aristida purpurea</i>	three-awn	Poaceae	1
<i>Bothriochloa ischaemum</i> var. <i>songarica</i> *	king ranch bluestem	Poaceae	2
<i>Bouteloua curtipendula</i>	sideoats grama	Poaceae	
<i>Bromopsis inermis</i> *	smooth brome	Poaceae	1
<i>Bromus japonicus</i>	brome	Poaceae	
<i>Buchloe dactyloides</i>	buffalograss	Poaceae	1
<i>Calamovilfa longifolia</i>	prairie sandreed	Poaceae	1
<i>Cenchrus longispinus</i>	sandbur	Poaceae	
<i>Chloris verticillata</i> *	windmillgrass	Poaceae	
<i>Chondrosium gracile</i>	blue grama	Poaceae	1
<i>Echinochloa crus-galli</i> *	barnyardgrass	Poaceae	4
<i>Elymus longifolius</i>	squirreltail	Poaceae	
<i>Elytrigia repens</i> *	quackgrass	Poaceae	
<i>Eragrostis curvula</i> *	lovegrass	Poaceae	
<i>Eragrostis minor</i> *	lovegrass	Poaceae	
<i>Festuca pratensis</i> *	fescue	Poaceae	
<i>Hesperostipa comata</i>	needle and thread	Poaceae	1
<i>Koeleria macrantha</i>	junegrass	Poaceae	
<i>Lolium perenne</i> *	ryegrass	Poaceae	
<i>Monroa squarrosa</i>	false buffalograss	Poaceae	
<i>Muhlenbergia montana</i>	mountain muhly	Poaceae	
<i>Muhlenbergia torreyi</i>	ring muhly	Poaceae	
<i>Nassella viridula</i>	needlegrass	Poaceae	
<i>Panicum virgatum</i>	switchgrass	Poaceae	
<i>Pascopyrum smithii</i>	western wheatgrass	Poaceae	1,2?
<i>Poa pratensis</i> *	Kentucky bluegrass	Poaceae	
<i>Schedonnardus paniculatus</i>	tumblegrass	Poaceae	
<i>Schizachyrium scoparium</i>	little bluestem	Poaceae	
<i>Setaria glauca</i> *	foxtail	Poaceae	
<i>Sporobolus cryptandrus</i>	dropseed	Poaceae	1
<i>Sporobolus texanus</i>	dropseed	Poaceae	4
<i>Vulpia octoflora</i>	sixweeks fescue	Poaceae	
<i>Typha latifolia</i>	broadleaved cattail	Typhaceae	4

*Alien species (Weber 1996)

Notes: 1. Also found at Peterson East (or PAFB) during 1997 survey. 2. Likely introduced for revegetation. 3. Likely introduced for aesthetics (meadow-in-a-can?), some of these keying to native species, but non-native. 4. Associated with water management modifications (culverts, retention ponds) and swales. ? Questionable (see text).

**Appendix II. List of Birds and Mammals seen at Peterson Air Force Base
During the 2004 Survey.**

Birds

Common Name	Species Name
American Crow	<i>Corvus brachyrhynchus</i>
American Robin	<i>Turdus migratorius</i>
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
European Starling	<i>Sturnus vulgaris</i>
Ferruginous Hawk	<i>Buteo regalis</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Great Blue Heron	<i>Ardeus herodia</i>
Horned Lark	<i>Eremophila alpestris</i>
House Finch	<i>Carpodacus mexicanus</i>
House Wren	<i>Troglodytes aedon</i>
Killdeer	<i>Charadrius vociferus</i>
Lark Bunting	<i>Calamospiza melanocorys</i>
Mallard	<i>Anas platyrhynchos</i>
Mourning Dove	<i>Zenaida macroura</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx ruficollis</i>
Red-wing blackbird	<i>Agelaius phoeniceus</i>
Swainson's Hawk	<i>Buteo swainsoni</i>
Violet-green Swallow	<i>Tachycineta thalassina</i>
Western Kingbird	<i>Tyrannus verticalis</i>
Western Meadowlark	<i>Sturnella neglecta</i>
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>

Mammals

Common Name	Species Name
cottontail	<i>Sylvilagus sp.</i>
coyote	<i>Canis latrans</i>
deer mouse	<i>Peromyscus maniculatus</i>
meadow vole	<i>Microtus pennsylvanicus</i>
Ord's kangaroo rat	<i>Dipodomys ordii</i>
prairie vole	<i>Microtus ochrogaster</i>
thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>
western harvest mouse	<i>Reithrodontomys megalotis</i>

Appendix III. Preble's meadow jumping mouse survey report for trapping conducted along East Fork of Sand Creek, Peterson Air Force Base.



**Preble's Meadow Jumping Mouse Trapping
at Peterson Air Force Base,
El Paso County, Colorado**

East Fork of Sand Creek

**Survey Report submitted to Natural Resources, Peterson Air Force
Base,
by the Colorado Natural Heritage Program**

Rob Schorr

24 November 2004

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Figure 3. East Fork Sand Creek, looking south toward West Gate Entrance

Appendix – U.S. Fish and Wildlife Service Recommended Survey Form

A. Introduction

The meadow jumping mouse (*Zapus hudsonius*) is found from British Columbia eastward to the Atlantic coast and southward to Kansas, Colorado, and Georgia with an isolated subspecies in New Mexico (Jones 1981). There are two subspecies of meadow jumping mouse found in Colorado. *Zapus h. luteus* has been found in Las Animas County, Colorado and is the northern extent of the subspecies which is centered in New Mexico (Jones 1999). *Zapus h. preblei* is found along the Piedmont of Colorado from Colorado Springs north to the southeastern counties of Wyoming. Potentially, there is some sympatry between *Z. h. preblei* and the western jumping mouse (*Z. princeps*) along the drainages that feed the South Platte River and the Arkansas River in Colorado. To date, *Z. h. preblei* has been documented to elevations up to 7500 feet.

B. Methods

To determine the presence of jumping mice, Sherman live traps (8 cm x 8 cm x 11 cm) are baited with oats and placed in appropriate habitats. Prior to surveying, areas of appropriate habitat are identified. In addition to oats, a small ball of polyfil batting is placed in each trap to provide insulating nesting material. The U.S. Fish and Wildlife Service mandates at least 400 trapnights (one trap set one night = 1 trapnight) over 3 consecutive nights be conducted to document the presence of Preble's meadow jumping mouse (U.S. Fish and Wildlife Service Interim Survey Guidelines for Preble's Meadow Jumping Mouse, 1999). Transects are documented on the enclosed maps. Tables of survey results are included with this report to document the ecological characteristics of the survey site.

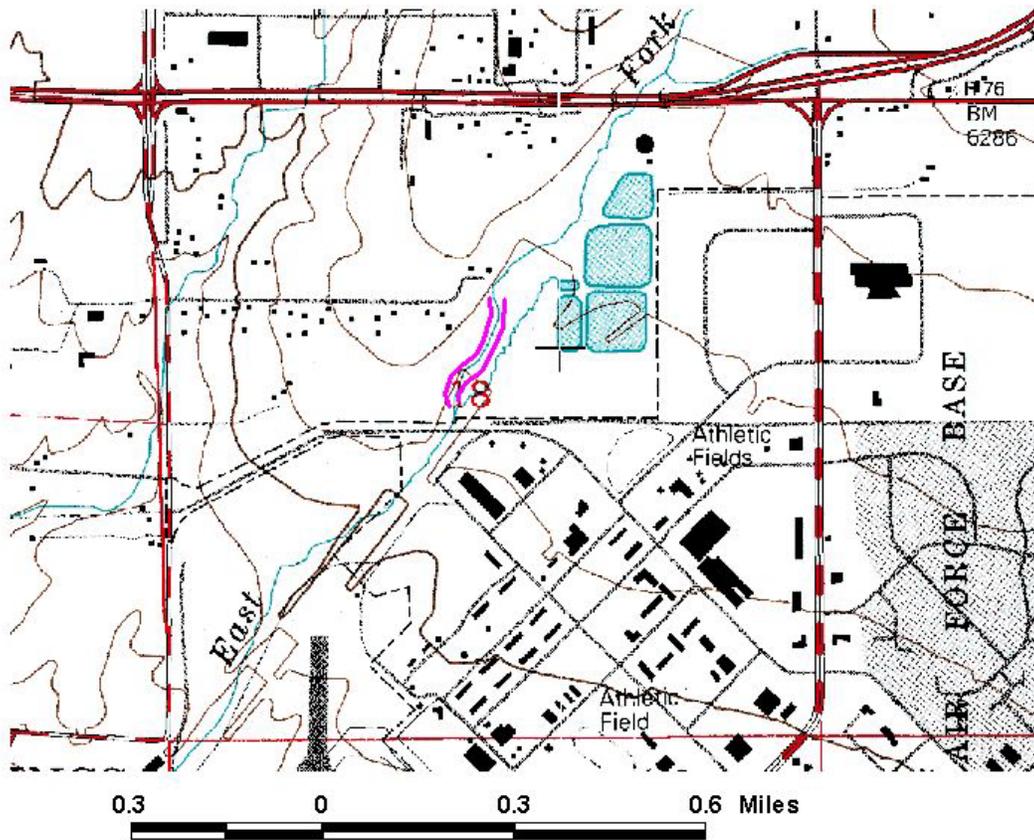
C. Ecological characteristics

East Fork Sand Creek, El Paso Co., Township 14S, Range 65W, Sections 18, SW ¼ of NE ¼ of Section 18. Elevation 6400 ft (Figure 1).

Along the surveyed section of East Fork Sand Creek there were two and, sometimes, three channels with active flows. The channel was sandy and ranged in width from 2 feet to 6 feet. Flows were particularly high because of recent (within the last several weeks) heavy rains.

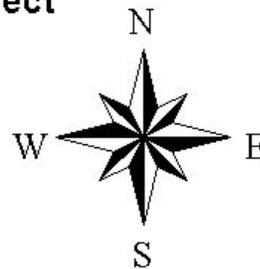
Vegetation along the survey portion of the creek was dense (Figure 2). The herbaceous cover was dominated by forbs and grasses, including blue gramma (*Chondrosium gracilis*), sand dropseed (*Sporobolus cryptandrus*), smooth brome (*Bromopsis inermis*), white and yellow sweetclover (*Melilotus alba* and *officinale*), Canada thistle (*Breca arvensis*), ragweed (*Ambrosia psilostachya*), and curlydock (*Rumex crispus*). Shrub cover was dense coyote willow (*Salix exigua*) up to eight feet in height. The dominant tree species were elm (*Ulmus sp.*), Russian olive (*Eleagnus angustifolia*) with scattered broad-leaved cottonwood (*Populus deltoides*). Uplands surrounding the creekbed were mid-grass prairie of blue gramma and needle-and-thread grass (*Hesperostipa comata*). See Table 2 for a list of common plants found along the East Fork Sand Creek survey area.

Figure 1.
Small mammal trapping conducted in riparian
corridor of East Fork of Sand Creek,
Peterson Air Force Base, El Paso County, Colorado



 Small mammal trapping transect

UTMs, NAD 1927, Zone 13:
525112, 4298104
Elevation: 6200 ft.



D. Results and additional comments

Two parallel transects were used for a total of 760 trapnights over 4 nights from July 26 to July 30. Four species of small mammals were captured (Table 1). A majority (>75%) of those captures were deer mice (*Peromyscus maniculatus*).

Table 1. Summary of small mammals captured along East Fork Sand Creek, El Paso County, on Peterson Air Force Base.

Species/Trap Result	Total Captures	% of captures
<i>Zapus hudsonius preblei</i>	0	0
<i>Reithrodontomys megalotis</i>	43	12
<i>Peromyscus maniculatus</i>	280	77
<i>Microtus pennsylvanicus</i>	3	1
<i>Microtus ochrogaster</i>	16	4
Closed and Empty	22	6
Total	364	100

*Total traps open and empty were 396 over 760 trapnights.

Table 2. Common plants found along East Fork Sand Creek, El Paso County, on the Peterson Air Force Base. Most common species are in bold font.

Species	Common Name
Trees	
<i>Populus deltoides</i>	broad-leaved cottonwood
<i>Ulmus americana</i>	American elm
<i>Eleagnus angustifolia</i>	Russian olive
Shrubs	
<i>Salix exigua</i>	coyote willow
<i>Rosa woodsii</i>	wild rose
Forbs	
<i>Melilotus alba</i>	white sweetclover
<i>Rumex crispus</i>	curlydock
<i>Ambrosia psilostachya</i>	western ragweed
<i>Oligosporus caudatus</i>	sage
<i>Melilotus officinale</i>	yellow sweetclover
<i>Convolvulus arvensis</i>	bindweed
<i>Opuntia macrorhiza</i>	prickly pear
<i>Typha latifolia</i>	broadleaf cattail
<i>Breca arvensis</i>	Canada thistle
Grasses	
<i>Chondrosium gracilis</i>	blue gramma
<i>Bromopsis inermis</i>	smooth brome
<i>Elymus trachyclausa</i>	slender wheatgrass
<i>Nassella viridula</i>	green needlegrass
<i>Sporobolus cryptandrus</i>	sand dropseed

E. Conclusions

The habitat along this survey portion of East Fork Sand Creek had well developed willow shrub component with dense herbaceous cover in many areas. Recent flooding left debris accumulating along much of the survey section. Much willow was broken and laying down because of the recent flooding. The riparian shrub zone was 10-15 feet wide in some areas and dense enough to make travel difficult. The crown of the willow shrub component was dense enough to limit light reaching the ground. Although, the willow component was as dense as comparable areas where Preble's meadow jumping mice have been captured there was much trash and evidence of human activity in the riparian zone. Additionally much of the riparian herbaceous cover was weedy species.



Figure 2. East Fork of Sand Creek looking north from the bridge near the West Gate Entrance.



Figure 3. East Fork of Sand Creek looking south toward the West Gate Entrance.

Zapus hudsonius preblei, Preble's Meadow Jumping Mouse

Survey Field Data Compilation Form

TRAPPING SURVEY EVALUATED, NOT TRAPPED

Fill out both sections 1 and 2 if trapping survey, fill out only section 1 if habitat evaluation (ie. not trapped).

SECTION 1

Surveyor:

Organization/Company Rob Schorr, Colorado Natural Heritage Program
Full Name(s) Robert Schorr

Location:

Descriptive Site Name (creek, nearby road intersection, etc.)

East Fork of Sand Creek
U.S.G.S. Quad Name Elsmere County El Paso Elevation 6200 ft.
Township(s) 14S Range(s) 65W Section(s) 18
¼ Section(s) SW of NE
UTM Coordinates, Zone 13 Northing 4298104 Easting 525112
Directions to Location Take Powers Blvd to West Gate Entrance of Peterson
Air Force Base.
Land Ownership U.S. Air Force

Habitat:

General Habitat Description

Coyote willow shrub with broadleaf cottonwood and Russian olive overstory

Dominant Plant Community Salix exigua, Carex canadensis, Melilotus alba/affinis etc. w/
associated graminoids

Drainage Type: Perennial Stream Ephemeral Stream _____ Pond/Lake _____
Ditch _____ Other _____

SECTION 2:

Z. h. preblei found? Yes No Dates of Survey 26 July - 30 July 2004

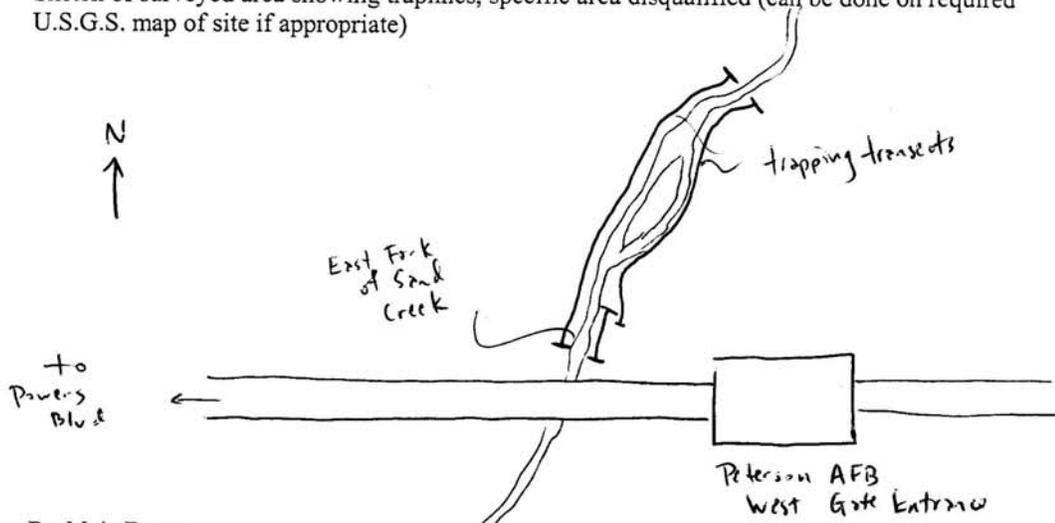
Trapping Information:

Type of Traps Sherman live Type of Bait rolled oats
% Available (unsprung) 52 Number of Nights Trapped 4
Total Trapnights 760
Weather conditions prior to and during survey mild with afternoon thunderstorms

Associated Animal Species (especially urban predators, rats, house mice)

deer mice, prairie voles, meadow voles, western harvest mice, raccoons, mule deer

Sketch of surveyed area showing traplines, specific area disqualified (can be done on required U.S.G.S. map of site if appropriate)



Preble's Data:

Number of Preble's trapped or seen 0

Distance from water (m) Sex (m/f) Evidence of repro.* Weight (grams). Marked or tagged?

- 1.
2. NA
- 3.
- 4.

(Continue on separate sheet if needed)

* Reproduction evidence for males is descended testes, for females is enlarged nipples.

Evidence of disease, predation or injury _____

(Submit injury/mortality form if appropriate)

Genetic Material Obtained? Yes _____ No _____ Forwarded to _____

Specimen(s)? Yes _____ No _____ Forwarded to _____

Additional Comments: