

Sensitive Species Survey Peterson Air Force Base 2017-2018



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Colorado Natural Heritage Program
Colorado State University
Fort Collins, CO 80523

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CNHP's mission is to advance the conservation of Colorado's native species and ecosystems through science, planning, and education for the benefit of current and future generations.

Sensitive Species Survey
Peterson Air Force Base
2017-2018

Prepared for

U.S. Department of Defense
Peterson Air Force Base
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Cover photos clockwise from top left: western rattlesnake (*Crotalus viridis*); big-headed grasshopper (*Aulocara ellioti*); greenthread (*Thelesperma megapotamicum*); big bluestem (*Andropogon gerardii*). All photos taken by Colorado Natural Heritage Program Staff.

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EXECUTIVE SUMMARY

Peterson Air Force Base (AFB) is located in El Paso County, Colorado at the southeastern edge of the densely populated greater Colorado Springs metropolitan area. Colorado Natural Heritage Program zoologists and botanists visited Peterson AFB between June 2017 and September 2018 to document the presence of rare animals, plants, and plant communities. Surveys focused on Peterson East as this area still has remaining patches of native vegetation and was deemed the most likely to have potential habitat for the targeted rare species. No federally threatened or endangered animals or plants or state species of concern were found at Peterson AFB during the 2017-2018 surveys. However, a biologically significant tallgrass prairie plant community, first documented in 1997 (Schuerman et al. 1997), remains in good condition. Approximately 65 acres of the big bluestem – little bluestem (*Andropogon gerardii* – *Schizachyrium scoparium*) community persists in much of the undeveloped area of Peterson East. The tallgrass prairie at Peterson AFB is part of a much larger occurrence (about 2,400 acres) that occurs on adjacent lands, primarily owned by the Colorado Springs Airport. What makes the tallgrass occurrence at Peterson and the adjacent Colorado Springs Airport lands biologically important is the large acreage, the diversity of grasses and forbs, the abundance of big bluestem, and the scarcity of weeds.

The undeveloped grasslands present at Peterson AFB still perform critical functions such as offering habitat for wildlife. Past assessments of the critical biological resources have identified animal species of concern at Peterson AFB (Schuerman et al. 1997, Schorr and Abbott 2004, Sovell and Smith 2012). This biological assessment documents a number of bird species of concern that utilize the native grass communities present on Peterson East. Surveys identified four bird species of concern listed as Common Birds in Steep Decline by Partners in Flight (PIF): the Brewer's blackbird (*Euphagus cyanocephalus*), common nighthawk (*Chordeiles minor*), grasshopper sparrow (*Ammodramus savannarum*), and horned lark (*Eremophila alpestris*). One additional species, the western meadowlark (*Sturnella neglecta*), is considered to be of concern in the Shortgrass Prairie Bird Conservation Region (BCR) by PIF. The bird index of biotic integrity (IBI) and the estimates of species richness, diversity, and evenness indicate the structure of the animal community present at Peterson AFB is of fair condition and representative of a developed landscape that is near a major urban center.

The plant survey identified 165 species, of which 124 were native species. Six B-List Colorado noxious weed species were found in 2017-2018. The rare plant species targeted in the survey included two federally threatened species, Ute ladies' tresses orchid (*Spiranthes diluvialis*) and Colorado butterfly plant (*Oenothera coloradensis*). Both of these species have low likelihood of occurring at Peterson AFB as they are wetland dependent and generally occur in undisturbed habitat. The tallgrass prairie community in Peterson East originally documented in 1997 continues to be in good condition though decreasing in size with continued development of infrastructure on the base.

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The following experts assisted in identification of plant specimens: Pam Smith, Botanist with the Colorado Natural Heritage Program, and Jennifer Ackerfield, Collections Manager at the Colorado State University Herbarium. Their assistance is greatly appreciated.

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INTRODUCTION

Peterson Air Force Base (AFB) is required to manage critical biological resources including rare, threatened, and endangered animals and plants, if present, in order to remain compliant with federal statutes. A key part of managing critical biological resources is field survey and reporting to support management efforts (Groves 2003). Understanding the diversity of biological resources at Peterson AFB, particularly the occurrence of rare species and plant communities, will assist with conservation of these resources as expansion of Peterson AFB infrastructure needed to support its mission occurs.

The U. S. Department of Defense and the Department of Interior – U.S. Fish and Wildlife Service contracted with Colorado State University – Colorado Natural Heritage Program (CSU-CNHP) to provide a survey of critical biological resources on Peterson AFB. The objective of the project as defined in the agreement was to document rare animals, plants, and plant communities that occur at Peterson AFB. This project updates biological information collected previously at Peterson AFB (Sovell and Smith 2012, Schorr and Abbott 2004, Schuerman et al. 1997) and identifies any additional rare biological resources on Peterson AFB.

STUDY AREA

Peterson AFB is located in El Paso County, Colorado at the southeastern edge of the greater Colorado Springs metropolitan area (Figure 1). It is bordered on the south and west by the Colorado Springs Airport and on the north and east by private property.

Peterson AFB covers an area of approximately 1,392 acres at elevations ranging from 6,135 to 6,280 feet above mean sea level. The developed cantonment area, known as Peterson Main, consists of approximately 1,187 acres. Peterson East, including the access corridor, consists of approximately 270 acres (U.S. Air Force 2016). Approximately 160 acres of the base is undeveloped. The undeveloped area is primarily in Peterson East and supports grasslands. Wetland and riparian plant species are associated with scattered low-lying areas and the short reach of East Fork Sand Creek that runs along the western boundary of Peterson AFB (Figure 2). Additional background information for the base is presented in the Peterson AFB Integrated Natural Resources Management Plan (U.S. Air Force 2016).

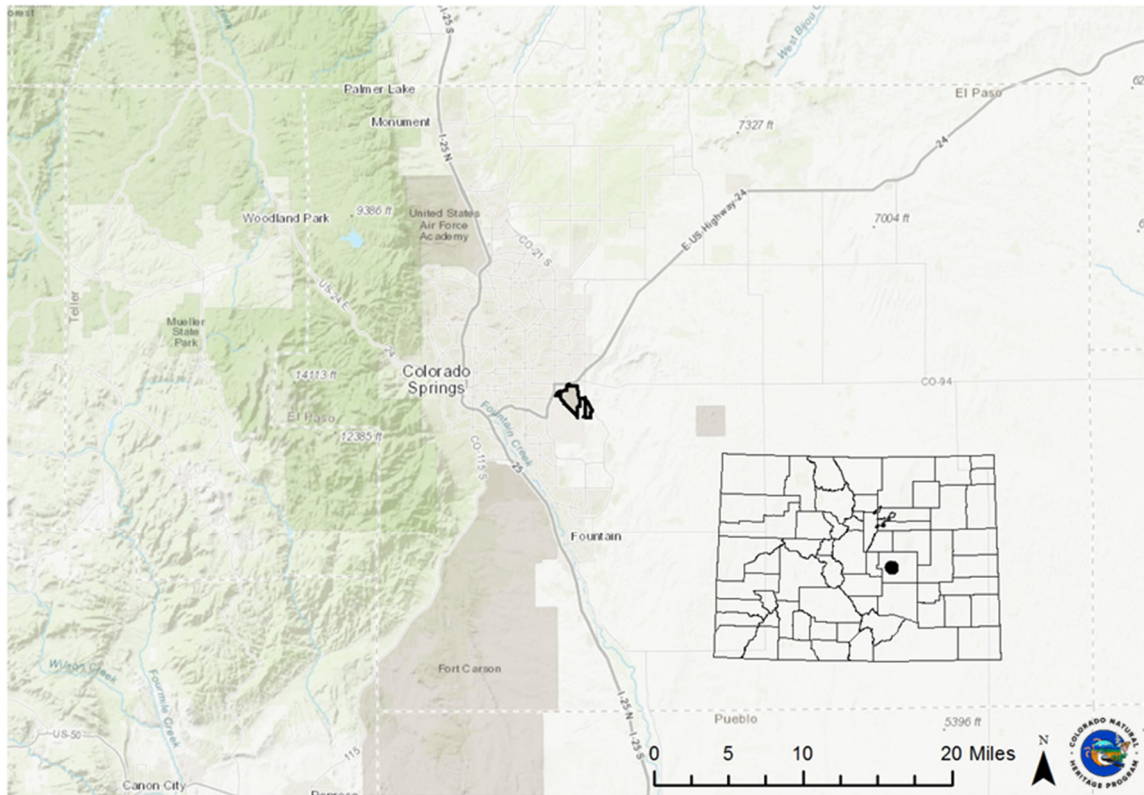


Figure 1. Location of Peterson Air Force Base.

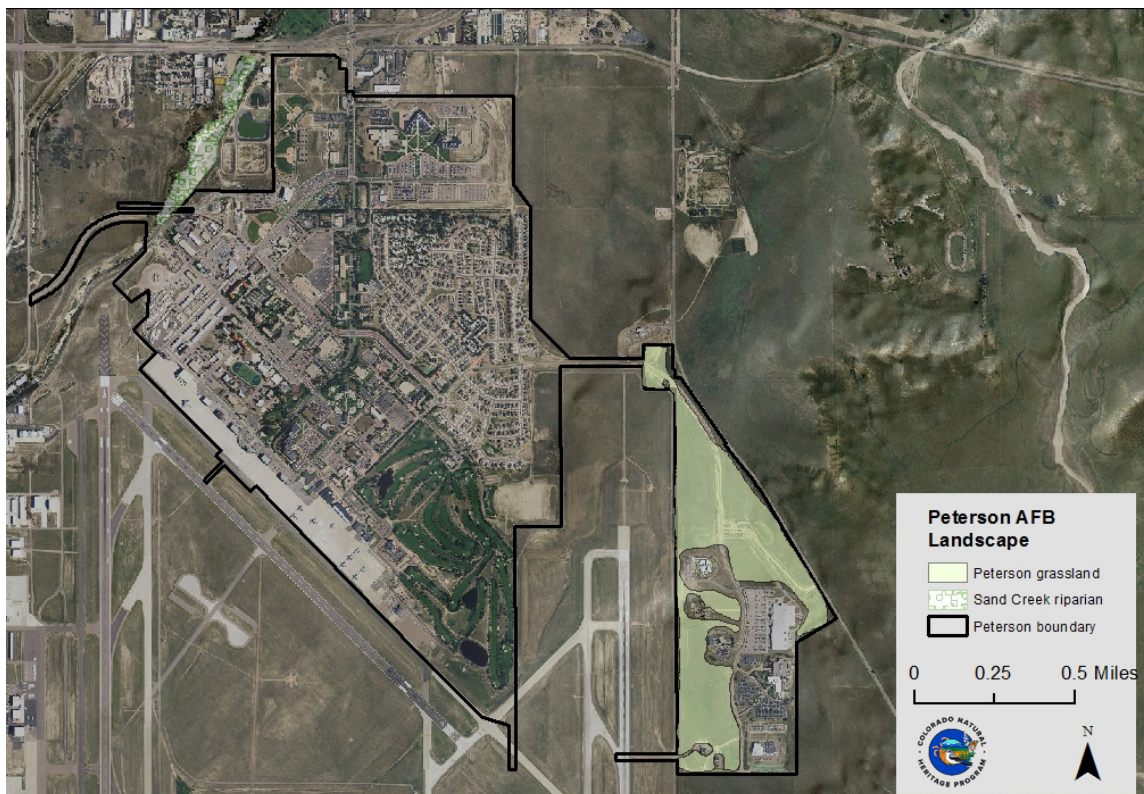


Figure 2. The grassland habitat on Peterson East and riparian habitat along East Fork Sand Creek (modified from CPW 2011).

METHODS

Zoologists and botanists visited Peterson AFB between June 2017 and September 2018 to document the presence of rare animals, plants, and plant communities. A target list of species and communities of conservation concern was prepared prior to conducting on-the-ground surveys. The target list included federal and state listed species and Colorado Natural Heritage Program (CNHP) tracked species with potential to occur at Peterson AFB (Tables 1 and 3). The target list was based on information from available aerial imagery, the CNHP database, the list of species of greatest conservation need identified in the Colorado State Wildlife Action Plan (CPW 2015), and previous investigations (Sovell and Smith 2012, Schorr and Abbott 2004, Schuerman et al. 1997). The target list for rare plants is also based on information from *Flora of the Pikes Peak Region* (Kelso 2016) and online databases (SEINet 2018, USDA-NRCS 2018). Tables 1 and 3 include global and state rarity ranks for each of the targeted species. The methodology behind the rarity ranking system, developed by NatureServe, is presented in Appendix C.

Wildlife

A zoologist conducted ocular and auditory surveys for the animals on the target list. Areas surveyed included the grasslands associated with Peterson East (Figure 2). This area was deemed the most likely to have potential habitat for the target species (Table 1).

Opportunistic observations of wildlife were recorded as they were seen on Peterson AFB. Additionally, bird point count transect and small mammal trapping transect surveys were conducted in order to more rigorously assess bird and mammal populations at Peterson. On-the-ground surveys were conducted from June 2017 to August 2017.

Bird Surveys

Birds were surveyed using a 1,300 meter line transect (Anderson et al. 1979) (Figure 3). The survey was conducted on 14 June 2017. Observers walked the length of each transect slowly, recording all birds seen or heard. Observers stopped bird surveys if conditions became too foggy, windy, or rainy to reliably hear and observe birds. The following data were collected: 1) species name, 2) number of individuals, 3) visual or auditory identification, 4) perpendicular distance from line transect to bird, which was determined with the aid of laser range finders, 5) time of day, 6) transect number and 7) transect segment.

Small Mammal Surveys

Small mammals were surveyed using Sherman live-traps set in a 10X10 rectangle grid with 100 trapping stations, 10-m spacing between traps, and two traps per trapping station (Parmenter et al. 2003). The first two traps were placed at the first transect point and the 10 traplines were placed toward the interior of the open rectangle created by the bird survey transects (Figure 3). Surveys were conducted from 22 August 2017 – 25 August 2017. Traps were baited with rolled oats and polyester batting was placed in each trap for insulation. Traps were opened at dusk and were checked the following morning before 1000 and each grid was trapped for three nights for a total of

600 trap nights. Captured animals were identified, aged, sexed, and given a unique mark on the breast using a permanent marker.

Table 1. List of target wildlife species for the Peterson AFB 2017-2018 surveys.

Common Name	Scientific name	Status ¹	CNHP Rank ²
Birds			
Bobolink	<i>Dolichonyx oryzivorus</i>	W, SWAP2	G5 S3B
Burrowing owl	<i>Athene cunicularia</i>	BLM, FS, ST, W, SWAP1	G4 S4B
Cassin's sparrow	<i>Peucaea cassinii</i>	FS, W, SWAP2	G5 S4B
Ferruginous hawk	<i>Buteo regalis</i>	BLM, FS, SC, F, SWAP2	G4 S3B, S4N
Prairie falcon	<i>Falco mexicanus</i>	W, SWAP2	G5 S4B, S4N
Insects			
Colorado blue	<i>Euphilotes rita coloradensis</i>	F, SWAP-I	G3G4T2T3 S2
Cross-line skipper	<i>Polites origenes</i>	F	G4G5 S3
Morrison's skipper	<i>Stinga morrisoni</i>	F	G4G5 S3S4
Mottled duskywing	<i>Erynnis martialis</i>	F, SWAP-I	G3 S2S3
Ottoo skipper	<i>Hesperia ottoe</i>	FS, F, SWAP-I	G3G4 S2
Regal fritillary	<i>Speyeria idalia</i>	FS, F, SWAP-I	G3 S1
Rhesus skipper	<i>Polites rhesus</i>	F, SWAP-I	G4 S2S3
Mammals			
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	BLM, FS, SC, F, SWAP2	G4 S3
Common hog-nosed skunk	<i>Conepatus leuconotus</i>	FS, F, SWAP2	G4 S1
Swift fox	<i>Vulpes velox</i>	BLM, FS, SC, F, SWAP2	G3 S3
Reptiles			
Northern many-lined skink	<i>Plestiodon multivirgatus multivirgatus</i>	F	G5T5 S4
Hernandez's short-horned lizard	<i>Phrynosoma hernandesi</i>	W	G5 S5

¹ BLM = BLM Sensitive Species; FS = Forest Service Sensitive Species; ST = State Threatened Species; SC = State Special Concern Species; F = CNHP full tracking status, W = CNHP watch list species; SWAP1 and SWAP2 = Tier 1 and Tier 2 species, Colorado State Wildlife Action Plan; SWAP-I = Invertebrate species of greatest conservation concern, Colorado State Wildlife Action Plan.

² See Appendix C for CNHP rank descriptions.

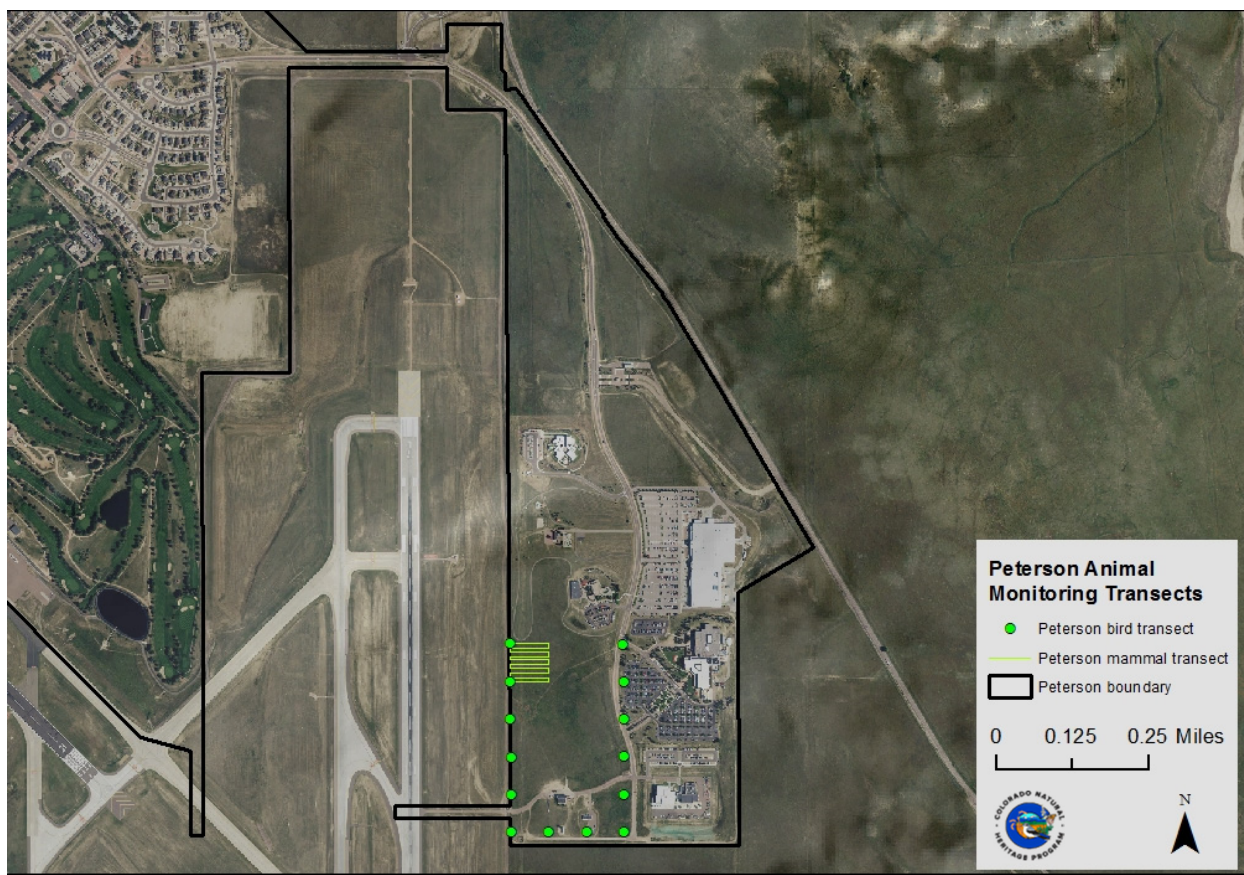


Figure 3. Location of the bird and small mammal monitoring transects.

Data Analysis

To evaluate trends over time in the animal community at Peterson AFB between the current year's survey and any future surveys, we calculated species richness and diversity for both birds and mammals at the sampling transects. We also examined the number of species of concern that were recorded across the entire Peterson AFB, and for birds only, we calculated a Bird Index of Biotic Integrity (IBI) (O'Connell et al. 2000).

Hill's diversity index (N1) (Jost 2006, Chao et al. 2010) was used to estimate diversity because it converts the diversity index into equivalent or *effective number* of species present. For example, if you have 10 species present in a sample, but the distribution of individuals is quite uneven across those 10 species, then ecologically speaking, the effective number of species in your community may be smaller. Hill's N1 is the theoretical value for that smaller number of species in the community. Hill's E5 was used as an index of evenness, which takes on a value between 0 and 1 and approaches zero as a single species becomes dominant in a community, while higher values indicate greater equivalency in cover among species (Ludwig and Reynolds 1988). Hill's E5 also remains relatively constant with sampling variation, as in the occurrence of a rare species or when species richness varies among samples (Ludwig and Reynolds 1988).

To identify species of concern we used lists developed by CNHP and Partners in Flight (PIF), a cooperative effort among federal, state, and local government agencies that identifies and assesses bird species of concern based on biological criteria including population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (Rosenberg et al. 2016). PIF assessments are conducted nationally and regionally within Bird Conservation Regions (BCRs). This approach recognizes that some species may be declining dramatically at the local scale, even though they are not of high concern nationally. Peterson AFB is within the Shortgrass Prairie physiographic area and the bird conservation plan for this BCR was also consulted to identify those bird species that are of concern within the local area, but may not be of national concern (PIF 2017).

The bird IBI is based on the methodology developed for bird communities of the mid-Atlantic Highlands (O’Connell et al. 1998). It is important to note that the bird IBI was modified from O’Connell et al. (1998) to reflect the land-use and land-cover types at Peterson AFB (e.g., grassland). Specialist guilds included in the IBI tend to be associated with extensive grassland cover. Therefore, higher IBI scores reflect bird communities associated with aspects of mature grassland structure, function, and composition. For example, sites with higher grassland bird IBI scores consist of a bird community with more grassland-dependent species, ground gleaners, and single-brooded or open ground nesters (i.e., specialists) but with fewer omnivores, exotic/non-natives, nest predators/brood parasites, temperate migrants, residents, and shrub nesters (i.e., generalists). The biotic or ecological “condition” described by the bird IBI then moves along a disturbance gradient from relatively intact, extensive, mature grassland with high IBI scores to more disturbed, developed, or urban grassland with low IBI scores. The response guilds incorporated into the bird IBI are listed in Table 2. An extensive discussion for why these guilds are chosen over others can be found in Standard Operating Procedure #9 – Bird Community Index (Marshall et al. 2016).

The integrity represented by the IBI score is based upon a theoretical maximum bird community at Peterson AFB receiving an IBI score of 57.5 and the theoretical minimum community, a score of 14, which corresponds to either only species from “specialist guilds” being detected or only species from “generalist guilds” being detected, respectively. Threshold levels for bird IBI scores have not been rigorously defined, but O’Connell et al. (2000) established thresholds that include four categories of condition corresponding to the proportional species richness of each specialist guild and generalist guild. For the bird IBI score at Peterson AFB these thresholds include the following categories:

- excellent (highest integrity) – score of 47.1-57.5;
- good (high integrity) – score of 36.1-47.0;
- fair (medium integrity) – score of 25.1-36.0; and
- poor (low integrity) – score of 14.0-25.0.

The condition classes were modified to determine the resource condition indicator scoring for the bird IBI using a three-tiered rating system by dividing the range in IBI scores that was possible (14.0 to 57.1) into three categories of equal range (14.3):

- good (high integrity) – score of 42.8-57.1;

- fair (moderate integrity) – score of 28.4-42.7; and
- poor (low integrity) – score of 14.0-28.3.

Table 2. Bird species guilds used to calculate IBI scores at Peterson AFB.

Biotic Integrity Element	Guild Category	Response Guild	Number of Species in Guild	Guild Classification
Functional	Trophic	omnivore	8	generalist
	Insectivore Foraging Behavior	ground gleaner	4	specialist
		aerial forager	2	specialist
Compositional	Origin	exotic/non-native	4	generalist
	Migration Status	resident	8	generalist
		temperate migrant	4	generalist
	Number of Broods	single-brooded	8	specialist
	Population Limiting	nest predator/brood parasite	3	generalist
Structural	Nest Placement	canopy nester	3	specialist
		shrub nester	2	generalist
		open-ground nester	5	specialist
	Primary Habitat	grassland dependent	2	specialist

Plants and Plant Communities

On-the-ground plant surveys were conducted by a CNHP botanist on 14 June, 6 July, 7 August, and 10 September 2017, and 3 May and 11 and 13 September, 2018. Peterson East was visited on all survey dates and East Fork Sand Creek was visited on 7 August 2017. The portions of Peterson with the highest potential to support targeted rare plants were surveyed. The target plant species are listed in Table 3, based on information from *Flora of the Pikes Peak Region* (Kelso 2016), online herbarium databases (SEINet 2018, USDA-NRCS 2018), and the CNHP database. Plant species lists were compiled using a dichotomous key (Ackerfield 2015, Weber and Wittmann 2012) for unknown species. Species names were cross-walked to follow the nomenclature of the USDA-NRCS (2018) database.

Table 3. List of target plant species and plant communities for the Peterson AFB 2017-2018 surveys.

Common Name	Scientific Name	Status ¹	CNHP Rank ²	Habitat	Flowering Period
Plants					
Plains ragweed	<i>Ambrosia linearis</i>	F	G3 S3	Playa lake basins on plains, roadsides, clay-rich soils.	June –August
Dwarf milkweed	<i>Asclepias uncialis</i> ssp. <i>uncialis</i>	BLM, FS, SWAP2, F	G3G4T2T3 S2	Sandy or gravelly soils, in open areas of grasslands.	April – June
Crawe’s sedge	<i>Carex crawei</i>	F	G5 S1	Moist open ground, 5,500-7,000 feet.	June – August
Sandhill goosefoot	<i>Chenopodium cycloides</i>	FS, F	G3G4 S1	Open sandy areas, plains.	June – September
Southwestern waterwort	<i>Elatine rubella</i>	F	G5 S2	Pond-shores, muddy banks, shallow water, plains to foothills.	April – July
Yellow stargrass	<i>Hypoxis hirsuta</i>	F	G5 S1	Moist swales and wetlands, plains grasslands where seeps occur.	April – July
Small-headed rush	<i>Juncus brachycephalus</i>	F	G5 S1	Open wet gravels along flowing stream channels on the plains.	July – September
Narrow-panicled rush	<i>Juncus brevicaudatus</i>	F	G5 S1	Open wet gravels along flowing stream channels on the plains.	July – September
Gay-feather	<i>Liatris ligulistylis</i>	F	G5? S2	Wet meadows, plains to lower foothills.	July – September

Common Name	Scientific Name	Status ¹	CNHP Rank ²	Habitat	Flowering Period
Colorado butterfly plant	<i>Oenothera coloradensis</i> (<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>)	LT, SWAP1, F	G3T2 S1	Moist soils in wet meadows of floodplains. Northern Colorado.	June – September
American currant	<i>Ribes americanum</i>	F	G5 S2	Very moist areas, along streams and around springs.	May – July
Pale blue-eyed grass	<i>Sisyrinchium pallidum</i>	BLM, F	G3 S2	Moist meadows, often in depressions.	June – August
Ute ladies' tresses	<i>Spiranthes diluvialis</i>	LT, SWAP1, F	G2G3 S2	Along streams and open seepage areas.	July – September
New England aster	<i>Symphyotrichum novae-angliae</i> (<i>Virgulus novae-angliae</i>)	F	G5 S1	Floodplain, moist locations on plains.	August – October
Plant Communities					
Western Great Plains bluestem tallgrass prairie	<i>Andropogon gerardii</i> – <i>Schizachyrium scoparium</i> Western Great Plains Grassland	F	G2? S2		
Blue grama – buffalograss grassland	<i>Bouteloua gracilis</i> – <i>Buchloe dactyloides</i> grassland	P	G4 S2?		
Playa grassland	<i>Pascopyrum smithii</i> – <i>Eleocharis</i> spp. wet meadow	F	G1 S1		

¹ LT = Federally Listed Threatened Species; BLM = BLM Sensitive Species; FS = Forest Service Sensitive Species; SWAP1 and SWAP2 = Tier 1 and Tier 2 Plants of Greatest Conservation Need identified in Colorado State Wildlife Action Plan, Rare Plant Addendum; F = CNHP full tracking status.

² See Appendix C for CNHP rank descriptions.

Sources for habitat and flowering period information: CNHP (1997), Ackerfield (2015), Kelso (2016), Wingate (2017).

Floristic Quality Assessment

The plant list generated at Peterson AFB was used to conduct a Floristic Quality Assessment (FQA). The FQA method uses the plant species list to calculate several parameters to assess the degree of “naturalness” of an area (Swink and Wilhelm 1994, Wilhelm and Masters 1996). The FQA parameters calculated for this project were species richness, percent native species, mean coefficient of conservatism (Mean C), and Mean C for native species. Species richness is simply the total number of species found at the site and percent native species is the number of native species divided by the total number of species. The Mean C is calculated from coefficient of conservatism, or C-value, assigned to each species in the state or regional flora based on the degree to which a plant species displays fidelity to a specific habitat or set of environmental conditions (Wilhelm and Ladd 1988). C-values range from 0–10 where values of 10 are assigned to species adapted to a specific set of biotic and abiotic factors, interactions, and natural disturbances (i.e., most conservative) and values of 1 are assigned to plants adapted to severe disturbance. Non-native species are assigned a value of 0. C-values for Colorado plant species were assigned by a panel of botanical experts (Rocchio 2007). Generalized categories for C-values summarized by Taft et al. (1997, 2006) are shown in Table 4.

Table 4. Coefficient of conservatism (C-value) categories as presented by Taft et al. (1997, 2006).

C-value	General conditions
9-10	Restricted to high-quality natural areas
7-8	Mostly associated with natural areas but tolerate some disturbance
4-6	Competitors and dominant or matrix species of several habitats
2-3	Associated with somewhat stable, though degraded environments
1	Adapted to severe disturbances, particularly anthropogenic
0	Non-native species

The Mean C is calculated by averaging the C-values of all plant species found within the site. The Mean C was calculated for Peterson AFB as well as three other Air Force installations visited in 2017-2018¹. Additionally, the Mean C for native species was calculated for each installation. Land managers can use these tools to re-evaluate areas as additional data become available. These metrics provide ways to measure changes for areas that are being restored or to see if natural changes are occurring that are enhancing the landscape. Mean C has been shown to reflect the biotic condition of a wetland (Lemly and Rocchio 2009) and is also used to generate data on landscape condition and quality in mixed uplands and wetlands.

Non-native Species

Non-native plant species, including those on the Colorado Department of Agriculture List of noxious weeds (Colorado Department of Agriculture 2017), were noted during the plant surveys. Non-native species are typically defined as non-indigenous or species occurring in an area where they have not evolved since the last Ice Age and whose introduction was facilitated by human activities.

¹ The FQA calculator developed by CNHP is available online at <https://cnhp.colostate.edu/cwic/tools/calculator/>.

Noxious weeds are a subset of non-native species for which the Colorado Department of Agriculture provides prioritized management goals (Table 5).

Table 5. Colorado Noxious Weed Act List A, B, C, and watch list definitions.

List A species are invasive weeds that are either not known to occur in Colorado or are of very limited distribution and are required to be eradicated (completely eliminated).
List B species are invasive weeds with populations of varying distribution and densities within the state. The level of mandated control is based on local conditions. These weeds may require eradication within certain areas of the state.
List C species are widespread and common within the state. They may pose a risk to agricultural lands and may be required to be controlled.
Watch List species are not known but are expected to be found in Colorado and should be reported when found.

Colorado Noxious Weed Act, 35-5.5-104.5 to 35.5-118

Plant Communities

Plant communities are assemblages of plants that co-exist in a similar environment; different communities are defined by their structure, form, and/or species composition. NatureServe Explorer (2018) reports information on plant communities based on the U.S. National Vegetation Classification (USNVC 2017). The classification system provides a systematic way of describing and assessing ecological diversity. Notable plant communities at Peterson were described and mapped as part of the plant survey.

RESULTS

Wildlife

There were 30 animal species documented during the 2017-2018 survey of Peterson AFB: 23 birds, 2 insects, 4 mammals, and 1 reptile (Appendix A). The aquatic habitats at Peterson AFB are limited to a short stretch of the East Fork of Sand Creek and three maintained ponds in the vicinity of the golf course in the developed section of the installation, consequently, no fish or amphibians were recorded at Peterson AFB.

No federally threatened or endangered animals were found at Peterson AFB. However, the black-tailed prairie dog (*Cynomys ludovicianus*), which is a species of Special Concern in Colorado and fully tracked by CNHP was observed on grassland directly adjacent to and east of Peterson East. Prairie dog mounds were observed north of the Peterson AFB Exchange and north of the Marksheffel Road entrance on Peterson East, but appeared to be inactive on the date of the surveys. This species is considered to be globally apparently secure (G4), but there is cause for long-term concern due to declines in population. Statewide the species is considered vulnerable (S3) with a moderate risk of extinction due to recent and widespread declines in the state.

Bird Community

There were a total of 12 species of birds documented at Peterson AFB. This included four bird species of concern listed as Common Birds in Steep Decline by PIF: the Brewer's blackbird (*Euphagus cyanocephalus*), common nighthawk (*Chordeiles minor*), grasshopper sparrow (*Ammodramus savannarum*), and horned lark (*Eremophila alpestris*). One additional species, the western meadowlark (*Sturnella neglecta*), is considered by PIF to be of concern in the Shortgrass Prairie BCR. There were six species and a total of 13 individuals recorded from the bird transect during the 2017 survey (Appendix A). Values of community diversity and evenness calculated for the transect were 2.8 and 0.5, respectively.

The grassland bird IBI score in 2017 was 39, indicating that the composition of the Peterson AFB bird community is of fair integrity. There was a high percentage of non-native introduced bird species at Peterson AFB (17 percent). A bird community of high integrity would have anywhere from 0 to 0.5 percent of its species represented by non-natives. There were also very few bird species in the specialist compositional guild represented by single-brooded species or the specialist structural guild represented by canopy nesting species.

Small Mammal Community

No mammal species of concern were documented at the Peterson AFB and species richness was four. There were three species recorded from the small mammal transect during the 2017 survey. Only five total individuals were trapped during the 600 trap nights that were performed at Peterson AFB in 2017. Eight trap nights were lost to traps that were closed and empty and may reflect overly sensitive trip mechanisms that may have been triggered early by animals attempting to enter the trap, or by wind, or by some other disturbance to the trap.

The values of community diversity and evenness calculated for the transect were 2.6 and 0.8, respectively.

Plants and Plant Communities

No threatened, endangered, or CNHP tracked plants were found. Of the 165 plant species identified 124 were native species.

Of the 14 plant species on the plant target list (Table 3), two are federally threatened species, Ute ladies' tresses orchid (*Spiranthes diluvialis*) and Colorado butterfly plant (*Oenothera coloradensis*). These species were not found during 2017-2018 or previous surveys (Sovell and Smith 2012, Schorr and Abbott 2004, and Schuerman et al. 1997) and are unlikely to occur at Peterson AFB. Both species are wetland-dependent and generally occur in undisturbed habitat. In 1857, Ute ladies' tresses was collected from a wet meadow at Cheyenne Canyon; it has not been documented in El Paso County since then. Colorado butterfly plant has not been documented in El Paso County and is generally known from wet meadows in northern Colorado.

The remaining 12 species on the target plant list were searched for and not found. Three of the target plants are known from dry to slightly moist habitats (plains ragweed [*Ambrosia linearis*],

dwarf milkweed [*Asclepias uncialis*], and sandhill goosefoot [*Chenopodium cycloides*]) and the remaining plants are wetland-dependent.

Floristic Quality Assessment

Species richness and percent native species

There were 165 plant species found during the 2017-2018 survey at Peterson AFB (Appendix B). Of these 165 species, 124 species (75 percent) were native species.

Mean C and Mean C for native species

The Mean C calculation was conducted using the C-values for the 165 plant species listed in Appendix B. The Mean C-value for the Peterson AFB is 3.2. This value reflects the high number of non-native species as well as native plant species that are either matrix species in a variety of habitats and/or are tolerant of disturbance. For comparison, the Mean C-values for Peterson AFB and three other Air Force installations surveyed in 2017-2018 are shown on Figure 4. The average Mean C-value for the four installations is 3.4. Figure 5 shows the Mean C-values calculated using just the native species found at the installations in 2017-2018. The Mean C-value for native species at Peterson AFB is 4.4. For the 124 native species about 29 percent are considered adapted to disturbance (C-values 1-3), 55 percent are generally matrix species (C-values 4-6), 9 percent are generally found in higher quality habitats (C-value 7-10), and 7 percent do not have C-values assigned.

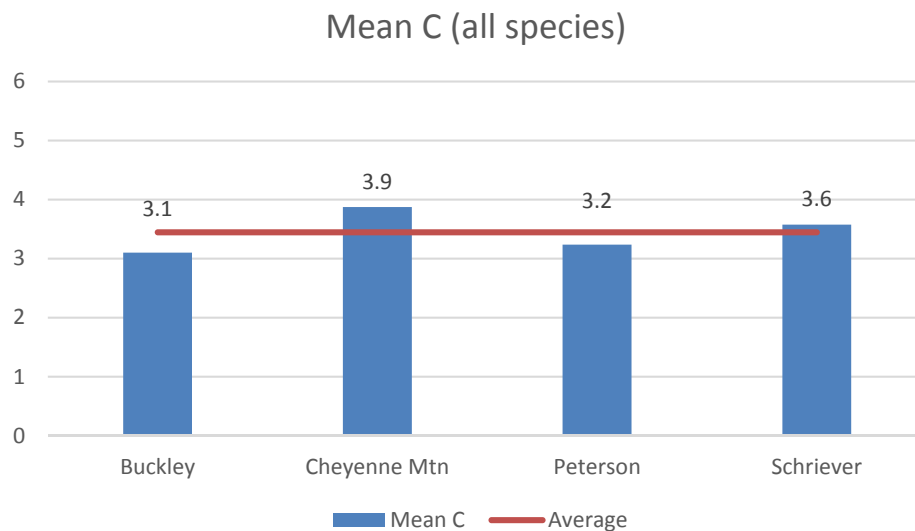


Figure 4. Mean C-values generated from plant lists collected at Peterson AFB and three other military installations in 2017-2018. The average Mean C-value for the four installations is 3.4.

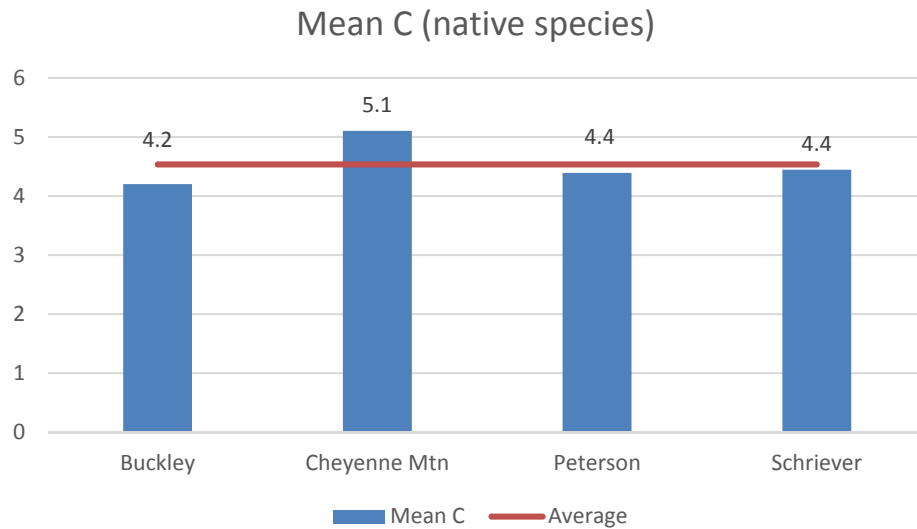


Figure 5. Mean C-values generated from the native species plant lists collected at Peterson AFB and three other military installations in 2017-2018. The native species average Mean C-value for the four installations is 4.5

Non-Native Species

About 25 percent of the plant species found at Peterson AFB in 2017-2018 were non-native species (Appendix B). Of the 41 non-natives found 12 are included on the Colorado Department of Agriculture (2017) Noxious Weed List, 6 as B-list species and 6 as C-list species. The B-list species and their general locations at Peterson AFB are summarized below:

- | | |
|--|--|
| • Diffuse knapweed (<i>Centaurea diffusa</i>) | Dispersed, primarily noticed at SE end of base |
| • Canada thistle (<i>Cirsium arvense</i>) | Dispersed, primarily in moist areas |
| • Common teasel (<i>Dipsacus fullonum</i>) | East Fork Sand Creek only |
| • Russian olive (<i>Eleagnus angustifolia</i>) | East Fork Sand Creek only |
| • Bouncing bet (<i>Saponaria officinalis</i>) | East Fork Sand Creek only |
| • Salt-cedar (<i>Tamarix chinensis</i>) | East Fork Sand Creek only |

As noted above, four of the B-list species were found only along East Fork Sand Creek. These species were present at low quantities. For example, only a few individuals of common teasel and bouncing bet were found. The C-list species found at Peterson AFB were common burdock (*Arctium minus*), downy brome or cheatgrass (*Bromus tectorum*), field bindweed (*Convolvulus arvensis*), redstem filaree (*Erodium cicutarium*), puncturevine (*Tribulus terrestris*), and common mullein (*Verbascum thapsus*). As noted in Table 5, C-list species are common and widespread throughout the state.

Plant Communities

There was one notable plant community recorded at Peterson AFB during 2017-2018, the xeric tallgrass prairie big bluestem – little bluestem (*Andropogon gerardii* – *Schizachyrium scoparium*) community. This tallgrass prairie community has been documented by Sovell and Smith (2012),

Schorr and Abbott (2004), and Schuerman et al. (1997)². The community occurrence consists of three polygons on Peterson East and extends onto adjacent undeveloped land to the south and east. During 2017-2018, the mapped boundaries on Peterson East were expanded to include most of the undeveloped grassland area in Peterson East (about 65 acres). Though the mapped boundaries were expanded the extent of the grassland has decreased through the years as development of infrastructure continues at Peterson East. The grassland is part of a larger occurrence surrounding Peterson AFB and the Colorado Springs Airport. In total, the entire occurrence occupies about 2,400 acres and its size and condition warrant a rank of good (B rank) estimated viability (see Appendix C for a discussion of Heritage methodology).

A CNHP Potential Conservation Area (PCA) also overlaps Peterson AFB. A PCA is CNHP's best estimate of the primary area required to support the long-term survival of the targeted species or natural communities contained by the PCA (CNHP 2018). A PCA was drawn for the Mesic Tallgrass Prairie community and associated plants and animals. The PCA is called the Colorado Springs Airport PCA and includes most of Peterson AFB within its boundary. The PCA is assigned a High Biodiversity Significance rank (B rank) by virtue of the rarity and good condition of the Mesic Tallgrass Prairie community it contains.

DISCUSSION

The element with the highest biodiversity significance at Peterson AFB is the remnant tallgrass prairie that occurs on most of the undeveloped areas of Peterson East. In Colorado, tallgrass prairie remnants are limited to the plains adjacent to the Front Range where rainfall amounts and soils are appropriate. Further east of the Front Range, the rainfall amount diminishes and shortgrass prairie dominates. Most prairies of this type along the Front Range have been converted to industrial and urban/suburban uses or severely altered by agricultural practices making this occurrence quite rare. Very few large patches of tallgrass prairie remain in Colorado.

Peterson East supports approximately 65 acres of tallgrass prairie. The tallgrass community extends onto adjacent land and in total covers approximately 2,400 acres. The community is most extensive within about two square miles south of the Colorado Springs Airport between Drennan and Powers Roads and occurs in small patches within surrounding areas such as Peterson AFB. This occurrence is the second largest tallgrass prairie of its type with only a nearby occurrence at Judge Orr Road (~5,400 acres) being larger. What makes the tallgrass occurrence at Peterson and the Colorado Springs Airport so unique is the large acreage, the diversity of grasses and forbs, the abundance of big bluestem, and the scarcity of weeds.

The Brewer's blackbird, common nighthawk, grasshopper sparrow, and horned lark, identified as "common birds in steep decline" by PIF (Rosenberg et al. 2016), were found at Peterson East during

² Prior to 2017, the tallgrass prairie community at Peterson AFB was classified in the CNHP database as big bluestem – prairie sandreed (*Andropogon gerardii* – *Calamovilfa longifolia*). The plant community has not changed through the years but the big bluestem – prairie sandreed community has been replaced by big bluestem – little bluestem (*A. gerardii* - *Schizachyrium scoparium*) in the current U.S. National Vegetation Classification System (2017).

2017. These are species that are still too numerous to warrant Watch Listed status by PIF, but that are experiencing long-term declines of over 50 percent since 1970. All four of these species have experienced range-wide declines of between 60 and 70 percent in the last 50 years (Rosenberg et al. 2016). In addition, the ferruginous hawk (*Buteo regalis*) (Schorr and Abbott 2004) and black-tailed prairie dog (Sovell and Smith 2012) have been documented during past surveys on Peterson East; these two species are fully tracked by CNHP. Black-tailed prairie dog populations have declined throughout their range in North America. Two of the most influential factors have been habitat fragmentation and the widespread occurrence of plague. Prairie dog populations have found it increasingly difficult to recover from plague events and repopulate suitable habitat. Habitat fragmentation hampers recovery of colonies by restricting recruitment, and may play a key role in the severity of epidemics.

The values for the metrics of native animal species richness, diversity, evenness, the bird IBI, and the number of species of concern present at Peterson AFB indicate an animal community that is in fair condition. The structure of the animal community present at Peterson AFB is representative of a developed landscape that is near a major urban center. The number of species encountered has a strong effect on the accuracy of estimates for species richness, diversity, and evenness. Species diversity measures are biased when sample sizes are small. When sample size is not sufficiently large to observe all species, the unobserved species are under sampled (Gotelli and Chao 2013). Soetaert and Heip (1990) estimated that over 100 individuals are required to estimate diversity with 90 percent precision. Our survey only encountered five mammals in total and only 13 individual birds on the sampling transects, consequently, our calculation of diversity is probably not a reliable indicator of actual diversity at Peterson AFB. Comparing the metrics of diversity across time as additional future surveys are conducted at Peterson AFB will allow examining trends in the structure of the animal community. Animal communities at Peterson AFB could change due to future development of the landscape both on and surrounding Peterson AFB and through the effects of a changing climate.

Numerous animals were not detected during the 2017-2018 survey that had been observed in previous surveys at Peterson AFB. The notably absent bird species include the lark bunting (*Calamospiza melanocorys*), ferruginous hawk (*Buteo regalis*), short-eared owl (*Asio flammeus*), and Swainson's hawk (*Buteo swainsoni*). The mammal community was particularly depauperate on the trapping transect. The deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), northern grasshopper mouse (*Onychomys leucogaster*), Ord's kangaroo rat (*Dipodomys ordii*), plains harvest mouse (*Reithrodontomys montanus*), plains pocket mouse (*Perognathus flavescens*), prairie vole (*Microtus ochrogaster*), and white-tailed jackrabbit (*Lepus townsendii*) were all previously observed at Peterson AFB, but they were absent during this survey.

No targeted rare plants were found at Peterson AFB in 2017. The two federally threatened species on the target list are not expected to occur at Peterson AFB as they are both wetland dependent, prefer undisturbed habitat, and have not been found within the region. The low floristic quality assessment value of 3.2 reflects that Peterson AFB occurs within a developed landscape that is near a major urban center. However, it does not reflect the high quality tallgrass prairie present at Peterson AFB as the percent cover of species is not reflected in the value. Approximately 27 percent

of the species found at Peterson AFB in 2017-2018 are non-native species. The non-native plants include six B-List noxious weeds and six C-List noxious weeds.

Today, Peterson AFB contains fewer species and plant communities than probably occupied the site in historic times. Although a moderately diverse community of plants and animals still occupies Peterson AFB, urban and commercial development have resulted in habitat loss, degradation, and fragmentation with subsequent declines in biodiversity in the immediate region. Nonetheless, five elements of conservation priority, the Brewer's blackbird, common nighthawk, grasshopper sparrow, horned lark, and xeric tallgrass prairie were documented at Peterson AFB, suggesting that Peterson AFB and the surrounding airport property act as a surrogate reserve or a refugia of biodiversity, in what otherwise is a highly modified urban/exurban and commercial landscape.

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APPENDIX A. WILDLIFE SPECIES LIST

Birds, Insects, Mammals, and Reptiles found at Peterson Air Force Base during the 2017-2018 Survey

Common Name	Scientific Name	Status ¹	Survey Method ²
Birds			
American goldfinch	<i>Spinus tristis</i>		w
American robin	<i>Turdus migratorius</i>		w, bt
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	CBISD	w, bt
Brown-headed cowbird	<i>Molothrus ater</i>		w
Bullock's oriole	<i>Icterus bullocki</i>		w
Common nighthawk	<i>Chordeiles minor</i>	CBISD	w
Common raven	<i>Corvus corax</i>		w
Eastern kingbird	<i>Tyrannus tyrannus</i>		w
Eurasian collared-dove	<i>Streptopelia decaocto</i>		w, bt
European starling	<i>Sturnus vulgaris</i>		w
Grasshopper sparrow	<i>Ammodramus savannarum</i>	CBISD, SPBCR, FS, SWAP2	w
Great horned owl	<i>Bubo virginianus</i>		w
Horned lark	<i>Eremophila alpestris</i>	CBISD	w, bt
House finch	<i>Haemorhous mexicanus</i>		w
Killdeer	<i>Charadrius vociferus</i>		w
Lark sparrow	<i>Chondestes grammacus</i>		w
Lesser goldfinch	<i>Spinus psaltria</i>		w
Mourning dove	<i>Zenaida macroura</i>		w
Say's phoebe	<i>Sayornis saya</i>		w
Turkey vulture	<i>Cathartes aura</i>		w
Vesper sparrow	<i>Pooecetes gramineus</i>		w
Western kingbird	<i>Tyrannus verticalis</i>		w, bt
Western meadowlark	<i>Sturnella neglecta</i>	SPBCR	w, bt
Insects			
Western pondhawk	<i>Erythemis collocata</i>		w
Big-headed grasshopper	<i>Aulocara elliotti</i>		w
Mammals			
Hispid cotton rat	<i>Sigmodon hispidus</i>		tt
Northern pocket gopher	<i>Thomomys talpoides</i>		w
Thirteen-lined ground squirrel	<i>Ictidomys tridecemlineatus</i>		tt

Common Name	Scientific Name	Status ¹	Survey Method ²
Western harvest mouse	<i>Reithrodontomys megalotis</i>		w, tt
Reptiles			
Western rattlesnake	<i>Crotalus viridis</i>		w

¹ CBISD = PIF common bird in steep decline; SPBCR = PIF species of concern in the shortgrass prairie; FS = USFS Sensitive Species; SWAP2 = Tier 2 species, Colorado State Wildlife Action Plan.

² Survey methods include: bt = bird transect, tt = mammal trapping transect, and w = walking survey.

APPENDIX B. PLANT SPECIES AND PLANT COMMUNITIES LIST

Plants and Plant Communities found at Peterson Air Force Base during the 2017-2018 Survey		
Scientific name	Common name	C-value ¹
Native Species		
<i>Abronia fragrans</i>	Fragrant sand-verbena	6
<i>Achnatherum hymenoides</i>	Indian ricegrass	5
<i>Achnatherum robustum</i>	Sleepygrass	3
<i>Aliciella pinnatifida</i>	Sticky gilia	5
<i>Allium textile</i>	Textile onion	5
<i>Amaranthus blitoides</i>	Mat amaranth	4
<i>Ambrosia acanthicarpa</i>	Annual bursage	4
<i>Ambrosia psilostachya</i>	Western ragweed	3
<i>Ambrosia tomentosa</i>	Skeleton-leaf bursage	3
<i>Ambrosia trifida</i> var. <i>trifida</i>	Great ragweed	NA*
<i>Andropogon gerardii</i>	Big bluestem	9
<i>Argemone polyanthemus</i>	Crested prickly-poppy	3
<i>Aristida divaricata</i>	Poverty three-awn	5
<i>Aristida purpurea</i>	Purple three-awn	3
<i>Artemisia biennis</i> var. <i>biennis</i>	Biennial sagewort	NA*
<i>Artemisia campestris</i>	Field sagewort	5
<i>Artemisia campestris</i> ssp. <i>borealis</i> var. <i>scouleriana</i> (<i>A. campestris</i> var. <i>pacifica</i>)	Field sagewort	5
<i>Artemisia frigida</i>	Fringed sagebrush	4
<i>Artemisia ludoviciana</i>	Louisiana sagewort	4
<i>Asclepias pumila</i>	Plains milkweed	4
<i>Asclepias speciosa</i>	Showy milkweed	3
<i>Astragalus agrestis</i>	Purple milkvetch	6
<i>Bouteloua curtipendula</i>	Sideoats grama	6
<i>Bouteloua dactyloides</i> (<i>Buchloë dactyloides</i>)	Buffalograss	4
<i>Bouteloua gracilis</i>	Blue grama	4
<i>Bouteloua hirsuta</i> var. <i>hirsuta</i>	Hairy grama	6
<i>Brickellia eupatorioides</i>	False boneset	6
<i>Calamovilfa longifolia</i>	Prairie sandreed	7
<i>Calylophus lavandulifolius</i> (<i>Oenothera lavandulifolia</i>)	Lavender-leaf sundrops	7
<i>Calylophus serrulatus</i> (<i>Oenothera serrulata</i> var. <i>serrulata</i>)	Yellow sundrops	7
<i>Carex duriuscula</i>	Needleleaf sedge	7

Plants and Plant Communities found at Peterson Air Force Base during the 2017-2018 Survey		
Scientific name	Common name	C-value ¹
<i>Chamaesyce glyptosperma</i>	Ribseed sandmat	2
<i>Chenopodium album</i>	Lambsquarters	NA*
<i>Chenopodium desiccatum</i>	Aridland goosefoot	3
<i>Chenopodium pratericola</i>	Desert goosefoot	4
<i>Chloris verticillata</i>	Tumble windmill grass	1
<i>Cirsium canescens</i>	Prairie thistle	6
<i>Cirsium ochrocentrum</i>	Yellowspine thistle	4
<i>Cirsium undulatum</i>	Wavyleaf thistle	5
<i>Comandra umbellata</i> ssp. <i>pallida</i>	Pale bastard toadflax	5
<i>Conyza canadensis</i>	Horseweed	NA*
<i>Cryptantha cineria</i> var. <i>jamesii</i> (<i>Oreocarya suffruticosa</i>)	James' cryptantha	6
<i>Cryptantha fendleri</i>	Sand-dune cryptantha	3
<i>Cyclachaena xanthifolia</i>	Giant sumpweed	2
<i>Cyperus schweinitzii</i>	Schweintz's flatsedge	6
<i>Dalea purpurea</i>	Purple prairie clover	5
<i>Dyssodia papposa</i>	Fetid marigold	2
<i>Elymus canadensis</i>	Canada wildrye	4
<i>Elymus elymoides</i>	Squirreltail	4
<i>Elymus trachycaulus</i>	Slender wheatgrass	4
<i>Engelmannia pinnatifida</i>	Engelmann's daisy	3
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	3
<i>Erigeron colomexicanus</i> (<i>E. tracyi</i>)	Running daisy	6
<i>Erigeron flagellaris</i>	Trailing daisy	3
<i>Eriogonum annuum</i>	Annual wild buckwheat	4
<i>Eriogonum effusum</i>	Spreading buckwheat	5
<i>Euphorbia dentata</i>	Toothed spurge	1
<i>Evolvulus nuttallianus</i>	Shaggy dwarf morning-glory	6
<i>Froelichia gracilis</i>	Slender snakecotton	4
<i>Grindelia squarrosa</i>	Curlycup gumweed	1
<i>Gutierrezia sarothrae</i>	Broom snakeweed	3
<i>Helianthus annuus</i>	Common sunflower	1
<i>Helianthus petiolaris</i>	Prairie sunflower	2
<i>Hesperostipa comata</i>	Needle and thread	6
<i>Heterotheca villosa</i>	Hairy false goldenaster	3
<i>Hordeum jubatum</i>	Foxtail barley	2
<i>Juncus interior</i>	Inland rush	5
<i>Lepidium densiflorum</i>	Common pepperweed	NA*
<i>Lesquerella montana</i> (<i>Physaria montana</i>)	Mountain bladderpod	5

Plants and Plant Communities found at Peterson Air Force Base during the 2017-2018 Survey		
Scientific name	Common name	C-value ¹
<i>Leucocrinum montanum</i>	Common sand lily	6
<i>Liatris punctata</i>	Dotted blazing star	6
<i>Lupinus plattensis</i>	Nebraska lupine	6
<i>Lycurus setosus</i> (<i>Muhlenbergia alopecuroides</i>)	Bristly wolfstail	8
<i>Machaeranthera bigelovii</i> (<i>Dieteria bigelovii</i> var. <i>bigelovii</i>)	Bigelow's tansy-aster	3
<i>Machaeranthera pinnatifida</i> (<i>Xanthisma spinulosum</i>)	Spiny goldenweed	4
<i>Mentzelia nuda</i>	White-flowered blazingstar	4
<i>Mertensia lanceolata</i>	Prairie bluebells	6
<i>Mirabilis hirsuta</i>	Hairy four o'clock	6
<i>Mirabilis linearis</i>	Narrowleaf four o'clock	5
<i>Muhlenbergia montana</i>	Mountain muhly	7
<i>Muhlenbergia racemosa</i>	Marsh muhly	5
<i>Oenothera coronopifolia</i>	Crownleaf evening primrose	4
<i>Oenothera curtifolia</i>	Velvetweed	1
<i>Oenothera latifolia</i> (<i>Oenothera pallida</i> ssp. <i>latifolia</i>)	Pale evening primrose	5
<i>Oenothera suffrutescens</i>	Scarlet beeblossom/Gaura	5
<i>Oenothera villosa</i>	Hairy evening primrose	4
<i>Opuntia fragilis</i>	Brittle prickly pear	3
<i>Opuntia macrorhiza</i>	Western prickly pear	3
<i>Oxytropis lambertii</i>	Purple locoweed	5
<i>Packera tridenticulata</i>	Threetooth ragwort	7
<i>Panicum capillare</i>	Witchgrass	NA*
<i>Panicum virgatum</i>	Switchgrass	5
<i>Pascopyrum smithii</i>	Western wheatgrass	5
<i>Paspalum setaceum</i>	Thin paspalum	NA
<i>Penstemon albidus</i>	White penstemon	5
<i>Penstemon angustifolius</i>	Broadbeard penstemon	5
<i>Physalis hispida</i>	Prairie ground cherry	5
<i>Plantago patagonica</i>	Woolly plantain	2
<i>Polanisia dodecandra</i> ssp. <i>trachysperma</i>	Red whisker clammyweed	1
<i>Polygonum douglasii</i>	Douglas' knotweed	3
<i>Populus deltoides</i> ssp. <i>monilifera</i>	Plains cottonwood	3
<i>Potentilla paradoxa</i> (<i>Potentilla supina</i> ssp. <i>paradoxa</i>)	Bush cinquefoil	1
<i>Prunus pumila</i> var. <i>besseyi</i> **	Sand-cherry	10
<i>Psoralidium tenuiflorum</i>	Slimflower scurfpea	5

Plants and Plant Communities found at Peterson Air Force Base during the 2017-2018 Survey		
Scientific name	Common name	C-value ¹
<i>Ratibida columnifera</i>	Prairie coneflower	4
<i>Rorippa sinuata</i>	Spreading yellow-cress	4
<i>Salix exigua</i>	Coyote willow/Sandbar willow	3
<i>Schedonnardus paniculatus</i> (<i>Muhlenbergia paniculata</i>)	Tumblegrass	2
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	Little bluestem	5
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	3
<i>Senecio spartioides</i>	Narrow-leaved butterweed	5
<i>Sorghastrum nutans</i>	Indian grass	10
<i>Sphaeralcea coccinea</i>	Scarlet globemallow	4
<i>Sporobolus airoides</i>	Alkali sacaton	5
<i>Sporobolus cryptandrus</i>	Sand dropseed	2
<i>Stephanomeria pauciflora</i>	Brownplume wire lettuce	5
<i>Thelesperma filifolium</i> var. <i>intermedium</i>	Stiff greenthread	5
<i>Thelesperma megapotamicum</i>	Hopi tea greenthread	5
<i>Tradescantia occidentalis</i>	Prairie spiderwort	5
<i>Typha latifolia</i>	Broadleaf cattail	2
<i>Verbena bracteata</i>	Prostrate vervain	NA*
<i>Veronica anagallis-aquatica</i>	Water speedwell	NA*
<i>Yucca glauca</i>	Great Plains yucca	4
<i>Zinnia grandiflora</i>	Rocky Mountain zinnia	7
Non-native Species		
<i>Agropyron cristatum</i>	Crested wheatgrass	0
<i>Arctium minus</i>	Common burdock	0 (C-List)
<i>Bassia scoparia</i> (<i>Kochia scoparia</i>)	Kochia/Burning bush	0
<i>Bothriochloa ischaemum</i>	Yellow bluestem	0
<i>Bromus arvensis</i> (<i>B. japonicus</i>)	Japanese brome	0
<i>Bromus inermis</i>	Smooth brome	0
<i>Bromus tectorum</i>	Cheatgrass	0 (C-List)
<i>Centaurea diffusa</i>	Ciffuse knapweed	0 (B-List)
<i>Cirsium arvense</i>	Canada thistle	0 (B-List)
<i>Convolvulus arvensis</i>	Field bindweed	0 (C-List)
<i>Descurainia sophia</i>	Flixweed	0
<i>Dipsacus fullonum</i>	Common teasel	0 (B-List)
<i>Echinochloa crus-galli</i>	Barnyard grass	0
<i>Elaeagnus angustifolia</i>	Russian olive	0 (B-List)
<i>Eragrostis barrelieri</i>	Mediterranean lovegrass	0
<i>Eragrostis curvula</i>	Weeping lovegrass	0
<i>Erodium cicutarium</i>	Redstem filaree	0 (C-List)

Plants and Plant Communities found at Peterson Air Force Base during the 2017-2018 Survey		
Scientific name	Common name	C-value ¹
<i>Lactuca serriola</i>	Prickly lettuce	0
<i>Lolium perenne</i>	Perennial ryegrass	0
<i>Medicago lupulina</i>	Black medick	0
<i>Medicago sativa</i>	Alfalfa	0
<i>Melilotus officinalis</i>	Yellow sweet clover	0
<i>Melilotus officinalis</i> (<i>M. albus</i>)	White sweet clover	0
<i>Persicaria maculosa</i>	Lady's thumb	0
<i>Plantago lanceolata</i>	Narrowleaf plantain	0
<i>Poa pratensis</i>	Kentucky bluegrass	0
<i>Polygonum convolvulus</i> (<i>Fallopia convolvulus</i>)	Black bindweed	0
<i>Psathyrostachys juncea</i>	Russian wildrye	0
<i>Rumex crispus</i>	Curly dock	0
<i>Salsola collina</i>	Tumbleweed	0
<i>Saponaria officinalis</i>	Bouncingbet	0 (B-List)
<i>Schedonorus arundinaceus</i>	Tall fescue	0
<i>Tamarix chinensis</i>	Salt-cedar	0 (B-List)
<i>Taraxacum officinale</i>	Common dandelion	0
<i>Thinopyrum intermedium</i>	Intermediate wheatgrass	0
<i>Thlaspi arvense</i>	Field pennycress	0
<i>Tragopogon dubius</i>	Western salsify	0
<i>Tribulus terrestris</i>	Puncture vine	0 (C-List)
<i>Trifolium pratense</i>	Red clover	0
<i>Ulmus pumila</i>	Siberian elm	0
<i>Verbascum thapsus</i>	Common mullein	0 (C-List)
Plant Communities		
<i>Andropogon gerardii</i> – <i>Schizachyrium scoparium</i> Western Great Plains grassland	Western Great Plains bluestem tallgrass prairie	

¹ C-value = coefficient of conservatism (see page 10 for discussion); NA = C-value not available

* Considered native by USDA-NRCS (2018) and non-native by Ackerfield (2015) and/or Weber and Wittman (2012).

**Could be escape from horticultural plantings.

NA = No C-value assigned.

B-List and C-List denote species on Colorado Noxious Weed B and C lists.

Bold indicates element tracked by CNHP.

Nomenclature follows USDA-NRCS (2018) PLANTS database. Synonyms from Ackerfield (2015) shown in parentheses.

APPENDIX C. UNDERSTANDING NATURAL HERITAGE CONSERVATION STATUS

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

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. 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 "watch listed," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A description of each of the Natural Heritage ranks is provided in Table 1C.

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

Table 1C. 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 throughout 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.
SC	Element is extant only in captivity or cultivation.
S	Migrant whose occurrences are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.
SA	Accidental in the state.
SR	Reported to occur in the state but unverified.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.

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

Legal Designations for Rare Species

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

Table 2C. Federal and state agency special designations for rare species.

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

Element Occurrences and their Ranking

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

Size – a measure of the area or abundance of the element’s occurrence. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance). This factor for an occurrence is evaluated relative to other known and/or presumed viable, examples.

Condition/Quality – an integrated measure of the composition, structure and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory and ground cover in a forest community) and biotic interactions (such as levels of competition, predation and disease).

Landscape Context – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

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

Table 3C. Element Occurrence ranks and their definitions.

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

Potential Conservation Areas

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

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

Ranking of Potential Conservation Areas

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

Table 4C. Natural Heritage Program biological diversity ranks and their definitions.

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

Protection Urgency Ranks

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

Table 5C. Natural Heritage Program protection urgency ranks and their definitions.

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

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

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

Management Urgency Ranks

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

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

Table 6C. Natural Heritage Program management urgency ranks and their definitions.

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