# Sensitive Species Survey
# Schriever Air Force Base
# 2017-2018




**December 2018**

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

Colorado State University
*Knowledge to Go Places*

*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
Schriever Air Force Base
2017-2018

***Prepared for***

U.S. Department of Defense
Schriever Air Force Base
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Cover photos clockwise from top left: burrowing owl (*Athene cunicularia*); pronghorn (*Antilocapra americana*); swift fox (*Vulpes velox*); mountain plover chick (*Charadrius montanus*). Mountain plover photo by Max Canestorp, USFWS; all other photos taken by Colorado Natural Heritage Program Staff.

# EXECUTIVE SUMMARY

Schriever Air Force Base (AFB) is located in El Paso County, Colorado, eight miles east of the Colorado Springs developed urban corridor. Colorado Natural Heritage Program (CNHP) zoologists and botanists visited Schriever AFB between June 2017 and September 2018 to document the presence of rare animals, plants, and plant communities. Surveys focused on the undeveloped areas of Schriever AFB deemed the most likely to have potential habitat for the targeted rare species. No federally threatened or endangered animals or plants were found at Schriever AFB during the 2017-2018 surveys. However, seven of the animal species observed during the 2017-2018 surveys are either fully tracked or watch listed by CNHP and an additional ten are considered species of concern within Colorado by either federal agencies, the State of Colorado, or Partners in Flight (PIF).

Results of the 2017-2018 biological assessment document a number of animal species of concern that utilize the native grass communities present on Schriever AFB. Surveys recorded four animal species that are fully tracked by CNHP including the black-tailed prairie dog (*Cynomys ludovicianus*), long-billed curlew (*Numenius americanus*), mountain plover (*Charadrius montanus*), and swift fox (*Vulpes velox*) and an additional three that are watch listed, the burrowing owl (*Athene cunicularia*), Cassin's sparrow (*Peucaea cassinii*), and prairie falcon (*Falco mexicanus*). Our survey also documented nine additional animals listed by either federal agencies, the State of Colorado, or PIF as species of conservation concern: the bank swallow (*Riparia riparia*), grasshopper sparrow (*Ammodramus savannarum*), horned lark (*Eremophila alpestris*), lark bunting (*Calamospiza melanocorys*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus hudsonius*), scaled quail (*Callipepla squamata*), western meadowlark (*Sturnella neglecta*), and monarch butterfly (*Danaus plexippus*). The bird index of integrity (IBI) and the estimates of species richness, diversity, and evenness indicate the structure of the animal community present at Schriever AFB is representative of a landscape with good ecological integrity.

The plant survey identified 159 species, of which 130 were native species. Five B-List Colorado noxious weed species were found in 2017-2018. Rare plant species targeted in the survey included two federally threatened species, Ute ladies' tresses orchid (*Spiranthes diluvialis*) and Colorado butterfly plant (*Oenothera coloradensis*). These species were not found during the survey and have low likelihood of occurring at Schriever AFB. Plains ragweed (*Ambrosia linearis*), a globally vulnerable plant, was documented on the base in 2000 (Fayette et al. 2000) and was refound in the same location in 2017. A rare plant community in playa wetlands on the base, also documented in 2000 (Doyle et al. 2001), continues to occur. The grasslands in the eastern portion of the base are noteworthy in their predominance of native species, lack of development/infrastructure, and abundance of birds. For example, singing grasshopper sparrows and Cassin's sparrows were seen in the grasslands on multiple field visits indicating favorable conditions for their breeding. Interestingly, there are patchy areas with tallgrass species including big bluestem (*Andropogon gerardii*) and prairie sandreed (*Calamovilfa longifolia*). These tall grass species have increased in abundance since 2000.

# ACKNOWLEDGEMENTS

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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

Schriever 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 Schriever AFB, particularly the occurrence of rare species and plant communities, will assist with conservation of these resources as expansion of Schriever AFB infrastructure needed to support its mission occurs.

The U. S. Department of Defense and the Department of Interior – Fish and Wildlife Service contracted with Colorado State University – Colorado Natural Heritage Program (CSU-CNHP) to provide a survey of critical biological resources at Schriever AFB. The objective of the project as defined in the agreement was to document rare animals, plants, and plant communities that occur at Schriever AFB. This survey updates and complements previous biological studies at Schriever AFB (Fayette et al. 2000, North Wind 2012a, North Wind 2012b, Smith et al. 2017) and identifies any additional rare biological resources on Schriever AFB.

# STUDY AREA

Schriever AFB is located in El Paso County, Colorado approximately eight miles east of the Colorado Springs developed urban corridor (Figure 1). It is ringed on most all of its perimeter by a small sliver of Colorado State Land Board property, with the majority of the remaining landscape consisting of privately owned ranchland.

Schriever AFB covers an area of approximately 3,810 acres at elevations ranging from 6,480 to 6,100 feet above mean sea level. The developed cantonment area, base housing, and other infrastructure consists of approximately 835 acres. Approximately 2,270 acres of the base is unimproved and consists of natural vegetation. Habitat of the unimproved area consists mainly of grasslands with a few depressional wetlands (playas) in the northwest and southeast (Figure 2). Additional background information for the base is presented in the Schriever AFB Integrated Natural Resources Management Plan (U. S. Air Force 2015).


**Figure 1. Location of Schriever Air Force Base.**

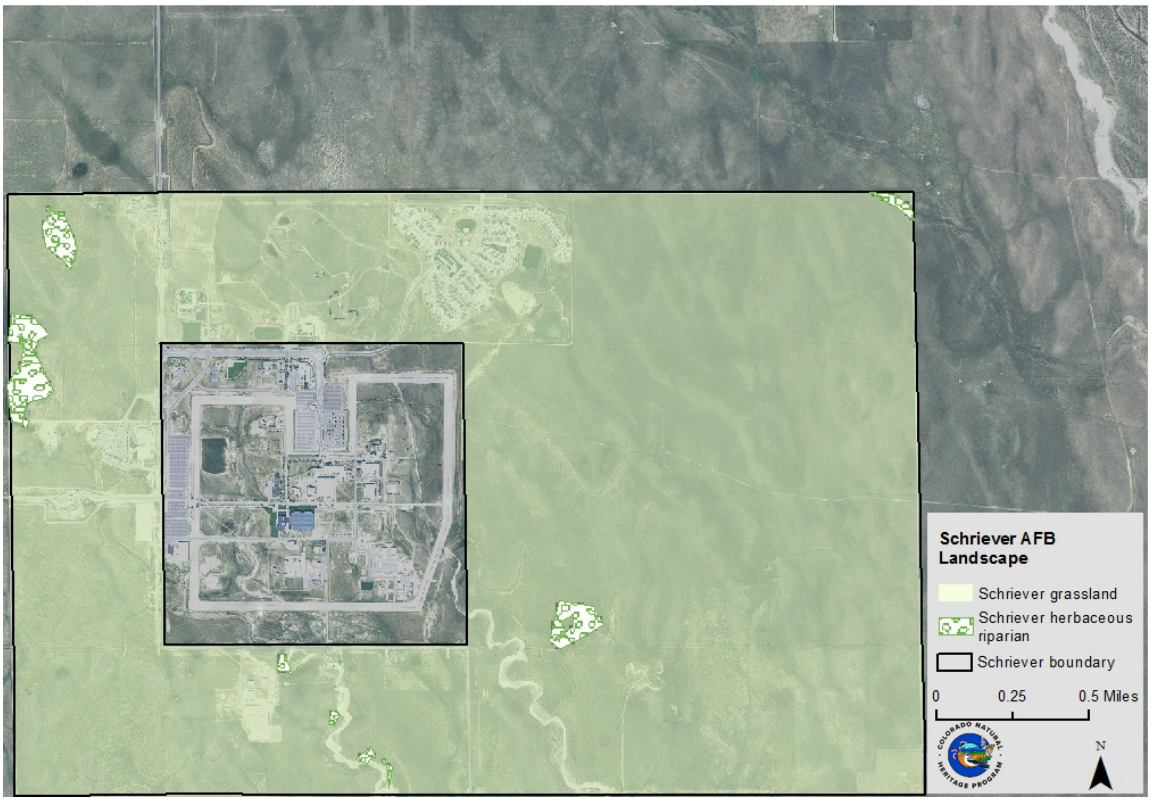


**Figure 2. Habitat types at Schriever Air Force Base (modified from CPW 2011).**

# METHODS

Zoologists and botanists visited Schriever 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 Schriever 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 (Colorado Parks and Wildlife 2015), and previous investigations (Fayette et al. 2000, North Wind 2012a, North Wind 2012b, Smith et al. 2017). 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 and the areas of herbaceous riparian habitats (Figure 2). These habitats were 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 Schriever 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 Schriever AFB. On-the-ground surveys were conducted from June 2017 to July 2018.

### Bird Surveys

Birds were surveyed using a 1,300 meter line transect (Anderson et al. 1979) (Figure 3). The survey was conducted on 12 July 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 to the bird, which was determined using 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 30 July 2017 – 1 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 Schriever AFB 2017-2018 surveys.**

| Common Name | Scientific name | Status[1] | CNHP Rank[2] |
|---|---|---|---|
| **Birds** | | | |
| Bald eagle | *Haliaeetus leucocephalus* | BLM, FS, ST, F, SWAP2 | G5 S1B, S3N |
| Bobolink | *Dolichonyx oryzivorus* | W, SWAP2 | G5 S3B |
| Burrowing owl | *Athene cunicularia* | BLM, FS, ST, F, SWAP1 | G4 S4B |
| Cassin's sparrow | *Peucaea cassinii* | FS, W, SWAP2 | G5 S4B |
| Ferruginous hawk | *Buteo regalis* | BLM, FS, SC, F, SWAP2 | G4 S3B, S4N |
| Mountain plover | *Charadrius montanus* | BLM, FS, SC, F, SWAP1 | G3 S2B |
| Prairie falcon | *Falco mexicanus* | W, SWAP2 | G5 S4B, S4N |
| Wilson's phalarope | *Phalaropus tricolor* | F | G5 S4B, S4N |
| **Insects** | | | |
| Colorado blue | *Euphilotes rita coloradensis* | F, SWAP-I | G3G4T2T3 S2 |
| Cross-line skipper | *Polites origenes* | F | G4G5 S3 |
| Desert forktail | *Ischnura barberi* | F | G4 SU |
| Morrison's skipper | *Stinga morrisoni* | F | G4G5 S3S4 |
| Mottled duskywing | *Erynnis martialis* | F, SWAP-I | G3 S2S3 |
| Ottoe skipper | *Hesperia ottoe* | FS, F, SWAP-I | G3G4 S2 |
| Regal fritillary | *Speyeria idalia* | FS, F, SWAP-I | G3 S1 |
| Rhesus skipper | *Polites rhesus* | F, SWAP-I | G4 S2S3 |
| Saffron-bordered meadowfly | *Sympetrum costiferum* | F | G5 S1? |
| Simius roadside skipper | *Amblyscirtes simius* | F | G4 S3 |
| **Mammals** | | | |
| Black-tailed prairie dog | *Cynomys ludovicianus* | BLM, FS, SC, F, SWAP2 | G4 S3 |
| Common hog-nosed skunk | *Conepatus leuconotus* | FS, F, SWAP2 | G4 S1 |
| Swift fox | *Vulpes velox* | BLM, FS, SC, F, SWAP2 | G3 S3 |
| **Reptiles** | | | |
| Northern many-lined skink | *Plestiodon multivirgatus multivirgatus* | F | G5T5 S4 |
| Hernandez's short-horned lizard | *Phrynosoma hernandesi* | 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.

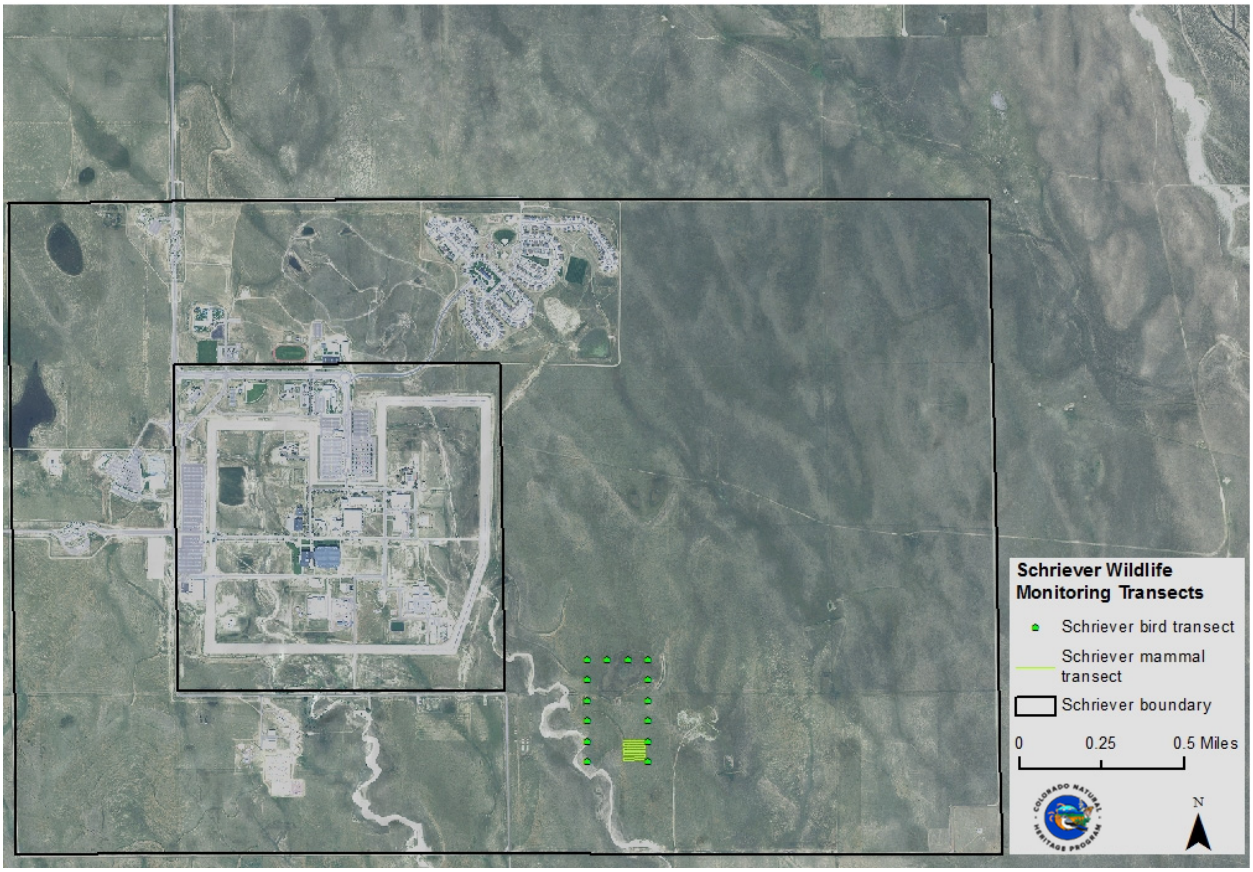


**Figure 3. Location of the bird and small mammal monitoring transects.**

## Data Analysis

To evaluate trends over time in the animal community at Schriever 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 Schriever 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; the Colorado State Wildlife Action Plan; 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. Schriever AFB is within the Shortgrass Prairie physiographic area and the PIF conservation database for this BCR (PIF 2017) was also consulted to identify those bird species that are of concern within the local area, but may not be of national concern.

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 Schriever 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 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, residents, temperate migrants, 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 Schriever AFB receiving an IBI score of 49 and the theoretical minimum community, a score of 11.5, 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 Schriever AFB these thresholds include the following categories:

- excellent (highest integrity) – score of 40.0-49.0;
- good (high integrity) – score of 30.5-39.9;
- fair (medium integrity) – score of 21.0-30.4; and
- poor (low integrity) – score of 11.5-20.9.

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 (11.5 – 49.0) into three nearly equal intervals of 12.5:

- good (good integrity) – score of 36.7-49.0;
- fair (moderate integrity) – score of 24.1-36.6; and
- poor (low integrity) – score of 11.5-24.0.

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

| Biotic Integrity Element | Guild Category | Response Guild | Number of Species in Guild | Guild Classification |
|---|---|---|---|---|
| Functional | Trophic | omnivore | 9 | generalist |
| | Insectivore Foraging Behavior | ground gleaner | 6 | specialist |
| | | aerial forager | 2 | specialist |
| Compositional | Origin | exotic/non-native | 3 | generalist |
| | Migration Status | resident | 11 | generalist |
| | | temperate migrant | 4 | generalist |
| | Number of Broods | single-brooded | 10 | specialist |
| | Population Limiting | nest predator/brood parasite | 3 | generalist |
| Structural | Nest Placement | open-ground nester | 11 | specialist |
| | Primary Habitat | grassland dependent | 8 | specialist |

## Plants and Plant Communities

On-the-ground plant surveys were conducted by a CNHP botanist on 13-14 June, 6 July, 9 August, and 10 September 2017, and 5 May and 12 September 2018. The portions of Schriever AFB 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. Generalized habitat and flowering period for the target species are summarized in Table 3. 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 Schriever AFB 2017-2018 surveys.**

| Common Name | Scientific Name | Status[1] | CNHP Rank[2] | Habitat | Flowering Period |
|---|---|---|---|---|---|
| **Plants** | | | | | |
| Plains ragweed | *Ambrosia linearis* | F | G3 S3 | Playa lake basins on plains, roadsides, clay-rich soils. | June –August |
| Dwarf milkweed | *Asclepias uncialis* ssp. *uncialis* | BLM, FS, SWAP2, F | G3G4T2T3 S2 | Sandy or gravelly soils, in open areas of grasslands. | April – June |
| Crawe's sedge | *Carex crawei* | F | G5 S1 | Moist open ground, 5,500-7,000 feet. | June – August |
| Sandhill goosefoot | *Chenopodium cycloides* | FS, F | G3G4 S1 | Open sandy areas, plains. | June – September |
| Southwestern waterwort | *Elatine rubella* | F | G5 S2 | Pond-shores, muddy banks, shallow water, plains to foothills. | April – July |
| Yellow stargrass | *Hypoxis hirsuta* | F | G5 S1 | Moist swales and wetlands, plains grasslands where seeps occur. | April – July |
| Small-headed rush | *Juncus brachycephalus* | F | G5 S1 | Open wet gravels along flowing stream channels on the plains. | July – September |
| Narrow-panicled rush | *Juncus brevicaudatus* | F | G5 S1 | Open wet gravels along flowing stream channels on the plains. | July – September |
| Gay-feather | *Liatris ligulistylis* | 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 | *Oenothera coloradensis (Gaura neomexicana* ssp. *coloradensis)* | LT, SWAP1, F | G3T2 S1 | Moist soils in wet meadows of floodplains. Northern Colorado. | June – September |
| American currant | *Ribes americanum* | F | G5 S2 | Very moist areas, along streams and around springs. | May – July |
| Pale blue-eyed grass | *Sisyrinchium pallidum* | BLM, F | G3 S2 | Moist meadows, often in depressions. | June – August |
| Ute ladies' tresses | *Spiranthes diluvialis* | LT, SWAP1, F | G2G3 S2 | Along streams and open seepage areas. | July – September |
| New England aster | *Symphyotrichum novae-angliae (Virgulus novae-angliae)* | F | G5 S1 | Floodplain, moist locations on plains. | August – October |
| **Plant Communities** | | | | | |
| Western Great Plains bluestem tallgrass prairie | *Andropogon gerardii – Schizachyrium scoparium* Western Great Plains Grassland | F | G2? S2 | | |
| Blue grama – buffalograss grassland | *Bouteloua gracilis – Bouteloua dactyloides* grassland | P | G4 S2? | | |
| Playa grassland | *Pascopyrum smithii – Eleocharis* 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 Schriever 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 Schriever AFB as well as three other Air Force installations visited in 2017-2018[1]. 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

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

have not evolved since the last Ice Age and whose introduction was facilitated by human activities. 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 Schriever AFB were described and mapped as part of the plant survey.

# RESULTS

## Wildlife

There were 57 animal species documented during the 2017-2018 survey of Schriever AFB: 34 birds, 15 insects, six mammals, and two reptiles were documented (Appendix A). There ephemeral aquatic habitats at Schriever AFB were dry when the 2017-2018 animal surveys were conducted. Consequently, no fish or amphibians were recorded at Schriever AFB.

No federally threatened or endangered animals were found at Schriever AFB. However, seven of the animal species observed during the 2017-2018 surveys are either fully tracked or watch listed by CNHP and an additional 10 species are considered species of concern within Colorado by either federal agencies, the State of Colorado, or PIF (Table 6).

**Table 6. Wildlife species of conservation concern documented at Schriever AFB in 2017-2018.**

| Common Name | Scientific Name | Status[1] | CNHP Rank[2] |
|---|---|---|---|
| **Birds** | | | |
| Bank swallow | *Riparia riparia* | CBISD | G5 S5 |
| Brewer's blackbird | *Euphagus cyanocephalus* | CBISD | G5 S5B, S4N |
| Burrowing owl | *Athene cunicularia* | BLM, FS, ST, SPBCR, W, SWAP1 | G4 S4B |
| Cassin's sparrow | *Peucaea cassinii* | SPBCR, W, SWAP2 | G5 S4B |
| Grasshopper sparrow | *Ammodramus savannarum* | CBISD, SPBCR, SWAP2 | G5 S3S4B |
| Horned lark | *Eremophila alpestris* | CBISD | G5 S5B |
| Lark bunting | *Calamospiza melanocorys* | CBISD, SPBCR, SWAP2 | G5 S4 |
| Loggerhead shrike | *Lanius ludovicianus* | CBISD | G4 S3S4B |
| Long-billed curlew | *Numenius americanus* | BLM, FS, SC, F, SWAP2 | G5 S2B |
| Mountain plover | *Charadrius montanus* | BLM, FS, SC, F, SWAP1 | G3 S2B |
| Northern harrier | *Circus hudsonius* | SPBCR, SWAP2 | G5 S3B |
| Prairie falcon | *Falco mexicanus* | SPBCR, W, SWAP2 | G5 S4B, S4N |
| Scaled quail | *Callipepla squamata* | PIFYW, SPBCR | G5 S4 |
| Swainson's hawk | *Buteo swainsoni* | SWAP2 | G5 S5B |
| Western meadowlark | *Sturnella neglecta* | SPBCR | G5 S5 |
| **Insects** | | | |
| Monarch | *Danaus plexippus* | SWAP-I | G4 S5 |
| **Mammals** | | | |
| Black-tailed prairie dog | *Cynomys ludovicianus* | BLM, FS, SC, F, SWAP2 | G4 S3 |
| Swift fox | *Vulpes velox* | BLM, FS, SC, F, SWAP2 | G3 S3 |

[1] PIFYW = PIF yellow watch list; CBISD = PIF common bird in steep decline; SPBCR = PIF species of regional concern in the shortgrass prairie; BLM = BLM Sensitive Species; FS = USFS Sensitive Species; ST = State Threatened Species; SC = State Special Concern Species, F = CNHP fully tracked; W = CNHP watch listed; SWAP1 and SWAP 2 = 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.

The rarest of these 18 species as ranked by CNHP are the black-tailed prairie dog (*Cynomys ludovicianus*), mountain plover (*Charadrius montanus*), and swift fox (*Vulpes velox*). The prairie dog is considered globally apparently secure (G4) and vulnerable in Colorado (S3), with stable numbers in the state, but few protected populations (CNHP 2018). The mountain plover is considered globally vulnerable (G3) and rare within the state (S2B), with the loss of native habitats, loss of prairie dogs, alteration of current grazing regimes, agricultural lands as a reproductive sink, habitat fragmentation, oil and mineral development, small-scale landscape changes (e.g. roads), and agricultural pesticides being the main sources of threat in Colorado (CNHP 2018, Dinsmore 2003). The swift fox is ranked both within the state and globally as vulnerable (G3 S3), with loss of high

quality habitat, trapping, shooting, poisoning, predation by coyote (*Canis latrans*), and competition with coyote and red fox (*Vulpes vulpes*) creating cause for concern in Colorado (CNHP 2018).

### Bird Community

There were a total of 34 species of birds documented at Schriever AFB. This included the scaled quail which is a PIF yellow watch list species, six bird species considered Common Bird Species in Steep Decline by PIF, and eight that are considered of regional concern in the shortgrass prairie BCR by PIF (Table 6). Nine of the birds were listed as species of concern in the Colorado State Wildlife Action Plan and three species are considered sensitive by the U. S. Forest Service and the Bureau of Land Management (Table 6). There were eight species and a total of 48 individuals recorded from the bird transect during the 2017 survey (Appendix A). Values of community diversity and evenness calculated for the transect were 5 (the *effective species* richness) and 0.3, respectively.

The bird IBI score in 2017 was 38.5, indicating that the composition of the Schriever AFB bird community is of good integrity. There was a high percentage of specialist ground nesting birds (38 percent) and grassland dependent species (29 percent) at Schriever AFB. A grassland bird community of good integrity would have upwards of 11 percent of its species represented as ground nesters and grassland dependents would make up at least 26 percent of the represented species. An IBI score of anywhere from 36.7 to 49 represents a community of good integrity. There were also very few bird species in the exotic/non-native (10 percent), temperate migrant (15 percent), and nest predator/brood parasite (9 percent) guilds, guilds that represent generalist species tolerant to habitat degradation.

### Small Mammal Community

Only one mammal, the thirteen-lined ground squirrel, was trapped during the 2017 survey at Schriever AFB (Appendix A). It was represented by only one individual in 600 trap nights that were performed at Schriever AFB in 2017. Twenty-four 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.

## Plants and Plant Communities

No threatened or endangered plants or SWAP Tier 1 or Tier 2 species (Colorado Parks and Wildlife 2015) were found during the 2017-2018 survey at Schriever AFB.

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 (Fayette et al. 2000, U. S. Air Force 2015) and are unlikely to occur at Schriever AFB as there is no suitable habitat. Both species are wetland-dependent and have never been documented nearby. 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.

One CNHP tracked species, plains ragweed (*Ambrosia linearis*), was documented at Schriever AFB in 2017. This plant was first documented at Schriever AFB in 2000 (Fayette et al. 2000). In 2017 the species was found at the same location as in 2000, that is, at the base of a constructed berm. Other areas with similar habitat were searched in 2017 and no additional plants were found. Plains ragweed is endemic to Colorado and is known primarily from Elbert, El Paso, Kiowa, and Lincoln Counties with one small population documented in Denver County.

The remaining 11 species on the target plant list were searched for and not found. Two of the target plants are known from dry habitats (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 159 plant species found during the 2017-2018 survey at Schriever AFB (Appendix B). Of these 159 species, 130 species (82 percent) were native species.

### *Mean C and Mean C for native species*

The Mean C calculation was conducted using the C-values for the 159 plant species listed in Appendix B. The Mean C-value for the Schriever AFB is 3.6. 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 Schriever 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 Schriever AFB is 4.4. For the 130 native species about 25 percent are considered adapted to disturbance (C-values 1-3), 60 percent are generally matrix species (C-values 4-6), 6 percent are generally found in higher quality habitats (C-value 7-10), and 9 percent do not have C-values assigned.

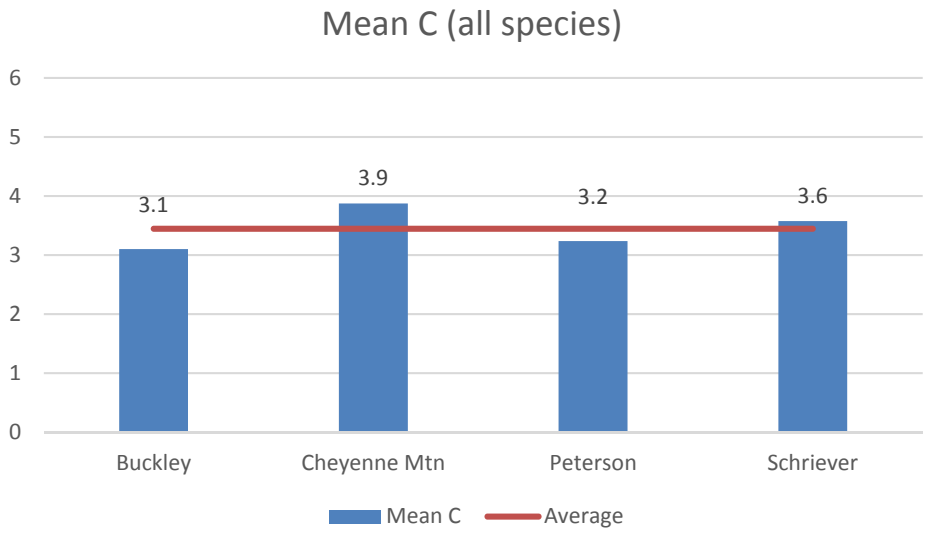


**Figure 4. Mean C-values generated from plant lists collected at Schriever AFB and three other Air Force installations in 2017-2018. The average Mean C-value for the four installations is 3.4.**

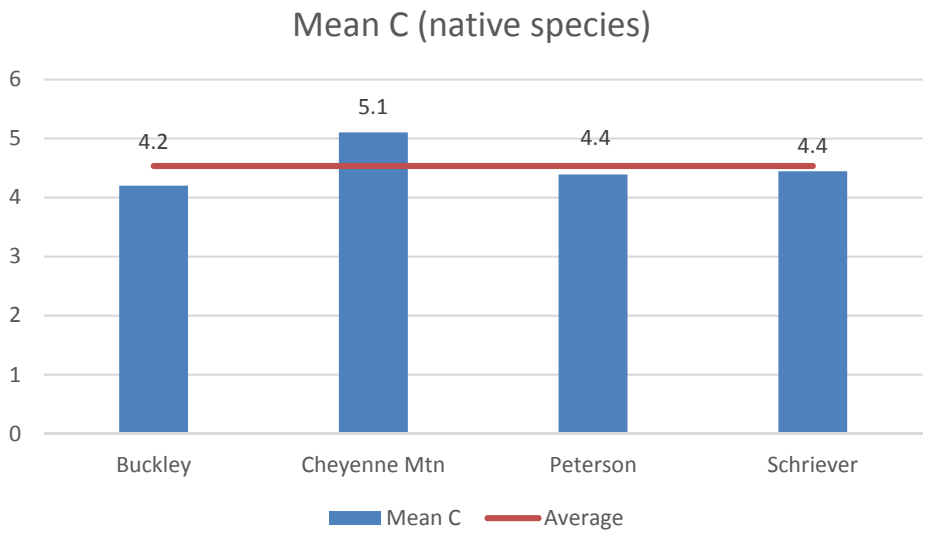


**Figure 5. Mean C-values generated from the native species plant lists collected at Schriever AFB and three other Air Force installations in 2017-2018. The native species average Mean C-value for the four installations is 4.5.**

### Non-Native Species

About 18 percent of the plant species found at Schriever AFB in 2017-2018 were non-native species (Appendix B). Of the 29 non-natives found 9 are included on the Colorado Department of Agriculture (2017) Noxious Weed List, 5 as B-list species and 4 as C-list species. The B-list species are listed below:

- Whitetop/hoary cress (*Cardaria draba*)
- Diffuse knapweed (*Centaurea diffusa*)
- Canada thistle (*Cirsium arvense*)

- Russian olive (*Eleagnus angustifolia*)
- Salt-cedar (*Tamarix chinensis*)

The C-list species found at Schriever AFB were 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

The most notable plant communities at Schriever AFB are the playa communities in the northwest portion of the base and the intact grasslands in the eastern portion of the base.

The playa communities were documented by CNHP in 2000 (Doyle et al. 2001) as a globally rare plant community (*Pascopyrum smithii – Eleocharis* spp.) (G1 S1). The community appears to be unchanged since 2000. The vegetation in the playas occurs in two zones, resulting from differences in the period of inundation. The lowest part, which is inundated most often and for the longest time, is dominated by spikerush (*Eleocharis acicularis* and *E. palustris*) and bare ground; the higher part is dominated by western wheatgrass (*Pascopyrum smithii*), a cool-season perennial. These basins remain dry throughout most of the year and collect water only after heavy rainfall.

A CNHP Potential Conservation Area (PCA) encompasses the Schriever AFB playas. 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). The PCA is called Schriever Playas PCA and is assigned a High Biodiversity Significance rank (B rank) by virtue of the rarity of the playa community it contains.

The grasslands in the eastern portion of the base are generally dominated by blue grama (*Bouteloua gracilis*) with a mix of other shortgrass and midgrass species and patchy areas of tallgrass species including big bluestem (*Andropogon gerardii*) and prairie sandreed (*Calamovilfa longifolia*).

# DISCUSSION

The element with the highest biodiversity significance recorded at Schriever AFB was the mountain plover. One adult mountain plover and two chicks were recorded in a prairie dog colony in the southeast portion of the base on 6 June 2018 (Canestorp pers. comm. 2018). In Colorado, the mountain plover is known from the eastern plains of the state, which is within the central portion of the species' breeding range (Knopf and Wunder 2006). Historical numbers of this species were greatly reduced as a result of "market" hunting and the conversion of shortgrass prairie to agricultural land, primarily for winter wheat, which has destroyed nesting habitat (Knopf and Wunder 2006). Appropriate habitat for the mountain plover in Colorado includes shortgrass prairie dominated by buffalograss (*Bouteloua dactyloides*) and blue grama, primarily on level areas where intensive grazing by either livestock or prairie dogs has resulted in very short grasses allowing for good mobility and visibility. Surveys conducted in 2005 indicate that there were approximately 8,500 mountain plover breeding in eastern Colorado, but populations have declined by 2.6 percent

annually from 2005-2015 (Sauer et al. 2017, Tipton et al. 2009). The mountain plover is considered globally vulnerable (G3) and rare within the state (S2B), with the loss of native habitats, loss of prairie dogs, alteration of current grazing regimes, agricultural lands as a reproductive sink, habitat fragmentation, oil and mineral development, small-scale landscape changes (e.g. roads), and agricultural pesticides being the main sources of threat in Colorado (CNHP 2018, Dinsmore 2003).

The element with the second highest biodiversity significance was the swift fox, which was recorded near the west perimeter fence south of the West (Irwin) Gate. In Colorado, the swift fox is known from the eastern plains of the state, which is within the south-central portion of the species' range (Armstrong et al. 2011). Historical numbers of this species were greatly reduced as a result of predator control programs, but the species has been experiencing local recoveries in Colorado and in nearby states (Armstrong et al. 2011). Appropriate habitat for the swift fox in Colorado includes shortgrass prairie with flat to gently rolling terrain and low-growing sparse vegetation that allows for good mobility and visibility. Surveys by Colorado Parks and Wildlife have determined that swift fox populations have remained stable throughout their range in Colorado over the last 20 years (Stratman 2017). Banning the use of poisons on public land and reducing the use of other poison control techniques have assisted the increase in the population size of this species. Threats to the species include agricultural conversion, trapping, shooting, poisoning, predation, and competition (Marks 2005, Armstrong et al. 2011). Predation by and interspecific competition with coyotes and expansion of red fox populations are the two most serious limiting factors to swift fox recolonization of suitable habitat identified within the species' historic range (Marks 2005). While the swift fox population has declined in human-altered habitats, those of predators and competitors (coyote, red fox, gray fox [*Urocyon cinereoargenteus*]) have thrived (Marks 2005). The swift fox is considered vulnerable globally (G3) and in Colorado (S3).

There were a total of 14 bird species that are considered by either CNHP, federal agencies, the State of Colorado, or PIF as birds of conservation priority (CNHP 2018, PIF 2017, Rosenberg et al. 2016, Colorado Parks and Wildlife 2015, Beidleman 2000). The presence of such a robust community of priority bird species is a testament to the integrity of the grassland found within, and protected by, the perimeter fence that encloses Schriever AFB. The restriction of grazing within the perimeter of Schriever AFB has resulted in the recovery of the prairie and subsequent increase in diversity of the bird community occupying the landscape. The health of the bird community is subsequently reflected in the high value of the bird IBI score, 38.5, which is 79 percent of the maximum bird IBI score of 49 possible for Schriever AFB.

The grasslands at Schriever AFB are in good condition with relatively few weeds and with an absence of grazing by livestock. In addition to the robust bird community there are many large black-tailed prairie dog towns scattered throughout the site. Prairie dogs are thought to be a keystone species (Kotliar et al. 1999) and their presence increases the diversity of plant and animal communities within Schriever AFB. Burrowing owl (*Athene cunicularia*) are commonly seen within prairie dog colonies within the site and swift fox exploit prairie dogs as prey and take advantage of the vegetative structure created by the grazing of the prairie dogs at the base (Kotliar et al. 1999, Colorado Division of Wildlife 2003).

The values for the metrics of native bird species richness, diversity, evenness, the bird IBI, and the number of species of concern present at Schriever AFB indicate an animal community that is in good condition. The structure of the animal community present at Schriever AFB is representative of a landscape with good ecological integrity. 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 undersampled (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 1 mammal in total and only 48 individual birds on the sampling transects, consequently, our calculation of diversity is only a fair indicator of actual diversity at Schriever AFB. Comparing the metrics of diversity across time as additional future surveys are conducted at Schriever AFB will allow examining trends in the structure of the mammal community. Animal communities at Schriever AFB may be expected to change due to future development of the landscape both on and surrounding Schriever AFB and through the effects of a changing climate.

The grasslands in the eastern portion of the base are noteworthy in their predominance of native species, lack of development/infrastructure, and abundance of birds. For example, singing grasshopper sparrows and Cassin's sparrows were seen in the grasslands on multiple field visits indicating favorable conditions for their breeding. Interestingly, there are patchy areas with tallgrass species including big bluestem (*Andropogon gerardii*) and prairie sandreed (*Calamovilfa longifolia*). These grasses were not nearly as prevalent during the original biological survey (Fayette et al. 2000). According to the INRMP (U. S. Air Force 2015), the buffer zone was purchased in 1987 and the perimeter fence was constructed in about 2004. Prior to purchase by Schriever AFB and during at least part of the period between 1987 and 2004 the buffer zone grasslands were leased for livestock grazing. During the 13 years since the construction of the perimeter fence and consequent exclusion of livestock grazing the structure of the grassland has undergone change. The result of the exclusion of livestock grazing over the past 13 years is an increase in tallgrass and midgrass species at Schriever AFB.

In 2000 (Fayette et al. 2000), the prairie landscape was described as being dominated by blue grama, buffalo grass, three-awn grass (*Aristida purpurea*), sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread (*Hesperostipa comata*). Though these grasses are present, in some areas, big bluestem and little bluestem are dominant or codominant.

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# APPENDIX A. WILDLIFE SPECIES LIST

**Birds, Insects, Mammals, and Reptiles found at Schriever Air Force Base during the 2017 Survey**

| Common Name | Scientific Name | Status[1] | Survey Method[2] |
|---|---|---|---|
| American kestrel | *Falco sparverius* | | w |
| American robin | *Turdus migratorius* | | w |
| Bank swallow | *Riparia riparia* | CBISD | w, bt |
| Barn swallow | *Hirundo rustica* | | w |
| Brewer's blackbird | *Euphagus cyanocephalus* | CBISD | w |
| Burrowing owl | *Athene cunicularia* | BLM, FS, ST, SPBCR, W, SWAP1 | w |
| Cassin's kingbird | *Tyrannus vociferans* | | w |
| Cassin's sparrow | *Peucaea cassinii* | W, SPBCR, SWAP2 | w |
| Chipping sparrow | *Spizella passerina* | | w |
| Eurasian collared-dove | *Streptopelia decaocto* | | w |
| European starling | *Sturnus vulgaris* | | w |
| Grasshopper sparrow | *Ammodramus savannarum* | W, CBISD, SPBCR, SWAP2 | w, bt |
| Great horned owl | *Bubo virginianus* | | w |
| Horned lark | *Eremophila alpestris* | CBISD | w, bt |
| House finch | *Haemorhous mexicanus* | | w |
| Killdeer | *Charadrius vociferus* | | w |
| Lark bunting | *Calamospiza melanocorys* | CBISD, SPBCR, SWAP2 | w, bt |
| Lark sparrow | *Chondestes grammacus* | | w |
| Loggerhead shrike | *Lanius ludovicianus* | CBISD | w |
| Long-billed curlew | *Numenius americanus* | BLM, FS, SC, F, SPBCR, SWAP2 | w |
| Mountain plover | *Charadrius montanus* | BLM, FS, SC, F, SPBCR, SWAP1 | w |
| Mourning dove | *Zenaida macroura* | | w, bt |
| Northern harrier | *Circus cyaneus* | SWAP2 | w |
| Prairie falcon | *Falco mexicanus* | W, SPBCR, SWAP2 | w |
| Red-tailed hawk | *Buteo jamaicensis* | | w, bt |
| Rock pigeon | *Columba livia* | | w |
| Savannah sparrow | *Passerculus sandwichensis* | | w |
| Say's phoebe | *Sayornis saya* | SPBCR | w |
| Scaled quail | *Callipepla squamata* | | w |
| Swainson's hawk | *Buteo swainsoni* | SPBCR, SWAP2 | w |
| Turkey vulture | *Cathartes aura* | | w |
| Vesper sparrow | *Pooecetes gramineus* | | w |
| Western kingbird | *Tyrannus verticalis* | | w, bt |
| Western meadowlark | *Sturnella neglecta* | | w, bt |

| Common Name | Scientific Name | Status[1] | Survey Method[2] |
|---|---|---|---|
| **Insects** | | | |
| Acmon blue | *Plebejus acmon* | | w |
| Aphrodite fritillary | *Speyeria aphrodite* | | w |
| American bumble bee | *Bombus pennsylvanicus* | | w |
| Antlion | *Brachynemurus hubbardii* | | w |
| Checkered white | *Pontia protodice* | | w |
| Clouded sulphur | *Colias philodice* | | w |
| Common sootywing | *Pholisora catullus* | | w |
| Dainty sulphur | *Nathalis iole* | | w |
| Monarch | *Danaus plexippus* | SWAP-I | w |
| Painted crescent | *Phyciodes picta* | | w |
| Riding's satyr | *Neominois ridingsii* | | w |
| Two-tailed swallowtail | *Papilio multicaudata* | | w |
| Western tiger swallowtail | *Papilio rutulus* | | w |
| Variegated fritillary | *Euptoieta claudia* | | w |
| Western harvester ant | *Pogonomyrmex occidentalis* | | w |
| | | | |
| **Mammals** | | | |
| Black-tailed prairie dog | *Cynomys ludovicianus* | BLM, FS, SC, F, SWAP2 | w |
| Desert cottontail | *Sylvilagus auduboni* | | w |
| Northern pocket gopher | *Thomomys talpoides* | | w |
| Pronghorn | *Antilocapra americana* | | w |
| Swift fox | *Vulpes velox* | BLM, FS, SC, F, SWAP2 | w |
| Thirteen-lined ground squirrel | *Ictidomys tridecemlineatus* | | w, mt |
| **Reptiles** | | | |
| Gophersnake | *Pituophis catenifer* | | |
| Lesser earless lizard | *Holbrookia maculata* | | |

[1] CBISD = PIF common bird in steep decline; SPBCR = PIF species of concern in the shortgrass prairie; BLM = BLM Sensitive Species; FS = USFS Sensitive Species; SC = State Special Concern Species; F = CNHP fully tracked, W = CNHP watch listed; 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] Survey methods include: bt = bird transect, mt = mammal trapping transect, and w = walking survey.

# APPENDIX B. PLANT SPECIES AND PLANT COMMUNITIES LIST

| Plants found at Schriever Air Force Base during the 2017-2018 Survey | | |
|---|---|---|
| **Scientific name** | **Common name** | **C-value[1]** |
| **Native Species** | | |
| *Abronia fragrans* | Fragrant sand-verbena | 6 |
| *Achnatherum hymenoides* | Indian ricegrass | 5 |
| *Achnatherum robustum* | Sleepygrass | 3 |
| *Agrostis scabra* | Ticklegrass | 4 |
| *Allium textile* | Textile onion | 5 |
| *Amaranthus retroflexus* | Redroot amaranth | NA* |
| ***Ambrosia linearis*** | **Plains ragweed** | **4** |
| *Ambrosia psilostachya* | Western ragweed | 3 |
| *Ambrosia tomentosa* | Skeleton-leaf bursage | 3 |
| *Andropogon gerardii* | Big bluestem | 9 |
| *Antennaria parvifolia* | Small-leaf pussytoes | NA |
| *Argemone polyanthemos* | Crested prickly-poppy | 3 |
| *Aristida divaricata* | Poverty three-awn | 5 |
| *Aristida purpurea* | Purple three-awn | 3 |
| *Artemisia frigida* | Fringed sagebrush | 4 |
| *Artemisia ludoviciana* | Louisiana sagewort | 4 |
| *Asclepias speciosa* | Showy milkweed | 3 |
| *Astragalus agrestis* | Purple milkvetch | 6 |
| *Astragalus drummondii* | Drummond's milkvetch | 6 |
| *Astragalus gracilis* | Slender milkvetch | 6 |
| *Bouteloua curtipendula* | Sideoats grama | 6 |
| *Bouteloua dactyloides* *(Buchloë dactyloides)* | Buffalograss | 4 |
| *Bouteloua gracilis* | Blue grama | 4 |
| *Bouteloua hirsuta var. hirsuta* | Hairy grama | 6 |
| *Bouteloua simplex* | Matted grama | NA* |
| *Brickellia eupatorioides* | False boneset | 6 |
| *Calamovilfa longifolia* | Prairie sandreed | 7 |
| *Carex duriuscula* | Needleleaf sedge | 7 |
| *Carex praegracilis* | Clustered field sedge | 5 |
| *Castilleja integra* | Wholeleaf Indian paintbrush | 6 |
| *Chamaesyce glyptosperma* | Ribseed sandmat | 2 |
| *Chenopodium album* | Lambsquarters | NA* |
| *Chenopodium desiccatum* | Aridland goosefoot | 3 |

| Plants found at Schriever Air Force Base during the 2017-2018 Survey | | |
|---|---|---|
| **Scientific name** | **Common name** | **C-value[1]** |
| *Chenopodium leptophyllum* | Narrowleaf goosefoot | 5 |
| *Chenopodium pratericola* | Desert goosefoot | 4 |
| *Cirsium canescens* | Prairie thistle | 6 |
| *Cirsium ochrocentrum* | Yellowspine thistle | 4 |
| *Cirsium undulatum* | Wavyleaf thistle | 5 |
| *Comandra umbellata ssp. pallida* | Pale bastard toadflax | 5 |
| *Conyza canadensis* | Horseweed | NA* |
| *Coreopsis tinctoria* | Plains coreopsis | 3 |
| *Cryptantha cineria var. jamesii (Oreocarya suffruticosa)* | James' cryptantha | 6 |
| *Cryptantha fendleri* | Sand-dune cryptantha | 3 |
| *Cyclachaena xanthifolia* | Giant sumpweed | 2 |
| *Cycloloma atriplicifolium* | Winged pigweed | 2 |
| *Cylindropuntia imbricata* | Tree cholla | 4 |
| *Cyperus fendlerianus* | Fendler's flatsedge | 7 |
| *Dyssodia papposa* | Fetid marigold | 2 |
| *Echinocereus viridiflorus* | Nylon hedgehog cactus | 6 |
| *Eleocharis acicularis* | Needle spikerush | 5 |
| *Eleocharis palustris* | Common spikerush | 3 |
| *Elymus elymoides* | Squirreltail | 4 |
| *Erigeron colomexicanus (Erigeron tracyi)* | Running daisy | 6 |
| *Erigeron divergens* | Spreading daisy | 4 |
| *Erigeron flagellaris* | Trailing daisy | 3 |
| *Erigeron pumilus* | Shaggy daisy | 5 |
| *Eriogonum annuum* | Annual wild buckwheat | 4 |
| *Eriogonum effusum* | Spreading buckwheat | 5 |
| *Erysimum asperum* | Western wallflower | 4 |
| *Erysimum capitatum* | Sand dune wallflower | 5 |
| *Evolvulus nuttallianus* | Shaggy dwarf morning-glory | 6 |
| *Grindelia squarrosa* | Curlycup gumweed | 1 |
| *Gutierrezia sarothrae* | Broom snakeweed | 3 |
| *Helianthus annuus* | Common sunflower | 1 |
| *Helianthus petiolaris* | Prairie sunflower | 2 |
| *Hesperostipa comata* | Needle and thread | 6 |
| *Heterotheca villosa* | Hairy false goldenaster | 3 |
| *Hordeum jubatum* | Foxtail barley | 2 |
| *Hymenopappus filifolius* | Fineleaf hymenopappus | 6 |
| *Hymenopappus tenuifolius* | Chalk Hill hymenopappus | 6 |
| *Lappula occidentalis* | Western stickseed | 2 |
| *Lepidium densiflorum* | Common pepperweed | NA* |

| Plants found at Schriever Air Force Base during the 2017-2018 Survey | | |
|---|---|---|
| **Scientific name** | **Common name** | **C-value[1]** |
| *Lesquerella montana (Physaria montana)* | Mountain bladderpod | 5 |
| *Leucocrinum montanum* | Common sand lily | 6 |
| *Liatris punctata* | Dotted blazing star | 6 |
| *Lithospermum incisum* | Plains stoneseed/Puccoon | 5 |
| *Lomatium orientale* | Salt-and-pepper | 6 |
| *Lupinus plattensis* | Nebraska lupine | 6 |
| *Lycurus setosus (Muhlenbergia alopecuroides)* | Bristly wolfstail | 8 |
| *Lygodesmia juncea* | Rush skeletonweed | 4 |
| *Machaeranthera canescens (Dieteria canescens)* | Hoary tansy-aster | 4 |
| *Machaeranthera pinnatifida (Xanthisma spinulosum)* | Spiny goldenweed | 4 |
| *Mentzelia nuda* | White-flowered blazingstar | 4 |
| *Mirabilis linearis* | Narrowleaf four o'clock | NA |
| *Muhlenbergia torreyi* | Ring muhly | 5 |
| *Munroa squarrosa* | False buffalograss | 4 |
| *Oenothera albicaulis* | Whitest evening primrose | 6 |
| *Oenothera coronopifolia* | Crownleaf evening primrose | 4 |
| *Oenothera curtifolia* | Velvetweed | 1 |
| *Oenothera latifolia (Oenothera pallida* ssp. *latifolia)* | Pale evening primrose | 5 |
| *Oenothera suffrutescens* | Scarlet beeblossom/Gaura | 5 |
| *Oenothera villosa* | Hairy evening primrose | 4 |
| *Opuntia fragilis* | Brittle prickly pear | 3 |
| *Opuntia macrorhiza* | Western prickly pear | 3 |
| *Opuntia polyacantha* | Plains prickly pear | 4 |
| *Oxytropis lambertii* | Purple locoweed | 5 |
| *Oxytropis sericea* var. *sericea* | White locoweed | 5 |
| *Packera fendleri* | Fendler's ragwort | 4 |
| *Packera tridenticulata* | Threetooth ragwort | 7 |
| *Panicum virgatum* | Switchgrass | 5 |
| *Pascopyrum smithii* | Western wheatgrass | 5 |
| *Penstemon albidus* | White penstemon | 5 |
| *Physalis hederifolia* var. *comata* | Ivy-leaf ground cherry | 5 |
| *Plantago patagonica* | Woolly plantain | 2 |
| *Populus deltoides ssp. monilifera* | Plains cottonwood | 3 |
| *Portulaca oleracea* | Common purslane | NA* |
| *Potentilla paradoxa (Potentilla supina* ssp. *paradoxa)* | Bush cinquefoil | 1 |

| Plants found at Schriever Air Force Base during the 2017-2018 Survey | | |
|---|---|---|
| **Scientific name** | **Common name** | **C-value[1]** |
| *Potentilla pensylvanica* | Pennsylvania cinquefoil | 6 |
| *Psoralidium tenuiflorum* | Slimflower scurfpea | 5 |
| *Quincula lobata* | Chinese lantern | 3 |
| *Ratibida columnifera* | Prairie coneflower | 4 |
| *Ribes aureum* | Golden currant | 6 |
| *Salix exigua* | Coyote willow/Sandbar willow | 3 |
| *Schedonnardus paniculatus (Muhlenbergia paniculata)* | Tumblegrass | 2 |
| *Schizachyrium scoparium* var. *scoparium* | Little bluestem | 5 |
| *Senecio spartioides* | Narrow-leaved butterweed | 5 |
| *Solanum triflorum* | Cutleaf nightshade | 2 |
| *Sorghastrum nutans* | Indian grass | 10 |
| *Sphaeralcea coccinea* | Scarlet globemallow | 4 |
| *Sporobolus cryptandrus* | Sand dropseed | 2 |
| *Stephanomeria pauciflora* | Brownplume wire lettuce | 5 |
| *Symphyotrichum falcatum* | White prairie aster | 4 |
| *Thelesperma filifolium* var. *intermedium* | Stiff greenthread | 5 |
| *Thelesperma megapotamicum* | Hopi tea greenthread | 5 |
| *Tradescantia occidentalis* | Prairie spiderwort | 5 |
| *Verbena bracteata* | Prostrate vervain | NA* |
| *Verbesina encelioides* | Golden crownbeard | NA* |
| *Veronica peregrina ssp. xalapensis* | Purslane speedwell | NA* |
| *Yucca glauca* | Great Plains yucca | 4 |
| *Zinnia grandiflora* | Rocky Mountain zinnia | 7 |
| | | |
| ***Non-native Species*** | | |
| *Agropyron cristatum* | Crested wheatgrass | 0 |
| *Amaranthus albus* | Tumble pigweed | 0 |
| *Bassia scoparia (Kochia scoparia)* | Kochia/Burning bush | 0 |
| *Bothriochloa ischaemum* | Yellow bluestem | 0 |
| *Bromus inermis* | Smooth brome | 0 |
| *Cardaria chalepensis (Lepidium chalapensis)* | Lenspod whitetop | 0 |
| *Cardaria draba (Lepidium draba)* | Whitetop/hoary cress | 0 (B-List) |
| *Centaurea diffusa* | Diffuse knapweed | 0 (B-List) |
| *Cirsium arvense* | Canada thistle | 0 (B-List) |
| *Convolvulus arvensis* | Field bindweed | 0 (C-List) |
| *Elaeagnus angustifolia* | Russian olive | 0 (B-List) |
| *Eragrostis barrelieri* | Mediterranean lovegrass | 0 |

| Plants found at Schriever Air Force Base during the 2017-2018 Survey | | |
|---|---|---|
| **Scientific name** | **Common name** | **C-value[1]** |
| *Erodium cicutarium* | Redstem filaree | 0 (C-List) |
| *Lactuca serriola* | Prickly lettuce | 0 |
| *Malva neglecta* | Common mallow | 0 |
| *Melilotus officinalis* | Yellow sweet clover | 0 |
| *Polygonum argyrocoleon* | Silversheath knotweed | 0 |
| *Polygonum aviculare* | Prostrate knotweed | 0 |
| *Polygonum convolvulus* *(Fallopia convolvulus )* | Black bindweed | 0 |
| *Psathyrostachys juncea* | Russian wildrye | 0 |
| *Rumex crispus* | Curly dock | 0 |
| *Salsola tragus* | Russian thistle/tumbleweed | 0 |
| *Tamarix chinensis* | Tamarisk/salt-cedar | 0 (B-List) |
| *Taraxacum officinale* | Common dandelion | 0 |
| *Thinopyrum intermedium* | Intermediate wheatgrass | 0 |
| *Thlaspi arvense* | Field pennycress | 0 |
| *Tragopogon dubius* | Western salsify | 0 |
| *Tribulus terrestris* | Puncture vine | 0 (C-List) |
| *Verbascum thapsus* | Common mullein | 0 (C-List) |
| | | |
| **Plant Communities** | | |
| ***Pascopyrum smithii – Eleocharis* spp. wet meadow** | **Playa grassland** | |
| | | |

[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). 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 captivation 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:<br>Significant current or predicted downward trends in population numbers or density.<br>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):<br>only known occurrence of an element<br>A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence)<br>concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more) |
| **B2** | Very High Significance:<br>B- or C-ranked occurrence of a G1 element<br>A- or B-ranked occurrence of a G2 element<br>One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element.<br>Concentration of A- or B-ranked G3 elements (four or more)<br>Concentration of C-ranked G2 elements (four or more) |
| **B3** | High Significance:<br>C-ranked occurrence of a G2 element<br>A- or B-ranked occurrence of a G3 element<br>D-ranked occurrence of a G1 element (if best available occurrence)<br>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:<br>Other A- or B-ranked occurrences of a G4 or G5 community<br>C-ranked occurrence of a G3 element<br>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)<br>Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more)<br>D-ranked occurrence of a G2 element<br>At least C-ranked occurrence of a disjunct G4 or G5 element<br>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. |