

Final Report

Survey of Lands Affected by the Proposed Expansion of the Rocky Mountain Resources Limestone Quarry



WARNER COLLEGE
OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY



CNHP's mission is to preserve the natural diversity of life by contributing the essential scientific foundation that leads to lasting conservation of Colorado's biological wealth.

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EXECUTIVE SUMMARY

In July of 2018 and June of 2019 biological surveys were conducted by the Colorado Natural Heritage Program for the City of Glenwood Springs. The site of these surveys was the proposed Rocky Mountain Resources (RMR) limestone quarry mine expansion. The goal of these surveys was to document natural heritage resources at the proposed mine site. Surveys documented one State-rare vascular plant species, silverleaf milkvetch (*Astragalus argophyllus* var. *martinii*) (G5T4 S1). Surveys further revealed that habitat throughout the survey site is a complex mosaic of plant communities which provide important ecosystem functions essential to the viability of native wildlife populations. Specifically, the survey site provides forage and important migration routes during critical times of the year for elk, deer and bighorn sheep, and provides breeding habitat for a several native wildlife species that are designated by the State as Species of Concern. Additionally, high quality natural habitats, such as occur at this site, also provide important ecosystem functions such as carbon sequestration, and water storage and cleansing functions.

Contents

EXECUTIVE SUMMARY	i
INTRODUCTION	1
METHODS.....	6
RESULTS	6
DISCUSSION.....	13
LITERATURE CITED	17
Appendix 1. Mammal species documented to occur at the survey site, 2019.....	20
Appendix 2. Bird species documented at the survey site 2019. Concern scores of 14 or higher, or with a concern score of 13 are the species most at risk of extinction without significant conservation actions to reverse declines and reduce threats (NABCI 2016).	21
Appendix 3. Vascular plant species documented at the survey site, July 2018.	24
Figure 1. Map of proposed mine expansion and survey area.	1
Figure 2. Elk use: Red lines show migratory pathways between summer (pink) and winter (blue) range. .	3
Figure 3. Mule deer use: Red lines show migratory path between summer (pink) and winter (blue) range.	3
Figure 4. Bighorn sheep: Red lines show migratory path between summer (pink) and winter (blue) range. Bighorn production areas are indicated in green.	4
Figure 5. Canada lynx: Potential Canada lynx habitat is indicated in pink.....	4
Figure 6. Limestone outcrops at the survey site, provide potential bat habitat.	5
Figure 7: Pinyon-juniper woodlands occur in a complex mosaic with montane shrublands.	8
Figure 8. Montane shrublands here provide an abundance of wildlife forage, cover and breeding habitat.	9
Figure 9. Aspen Woodlands provide habitat for many species and mammals and breeding birds.	10
Figure 10: Douglas fir forests are dense, cool stands on south-facing slopes of the proposed mine site.	11
Figure 11. Road-induced habitat fragmentation creates barriers to migration.	15
Figure 12. Habitat at the proposed mine site provides high quality resources that support a moderately high diversity of native wildlife. In the face of increasing anthropogenic habitat alteration these habitats become all the more critical to sustain native biodiversity.....	16
Table 1. Dominant natural communities at the survey site.	12

INTRODUCTION

In June of 2018 the Colorado Natural Heritage Program contracted with the City of Glenwood Springs to conduct biological surveys of the lands affected by the proposed expansion of the Mid-Continent Limestone Quarry.

The survey site is located at a proposed limestone quarry mine site in Garfield County, Colorado in the Upper Sonoran life zone on south-facing slopes at elevations between 2026m and 2493m (6647ft and 8179ft). Figure 1 provides a map of the proposed mine expansion and area where CNHP conducted biological surveys with survey tracks. The site is characterized by steep, 55% to 75% gradient, slopes located on pre-Pennsylvanian Leadville limestone which is interspersed with exposures of Precambrian-age granitic rocks (Tweto 1979). Thermal springs and caves are associated with Leadville Limestone and several cave sites are known to occur adjacent to the proposed quarry expansion. One nearby cave, the Fairy Cave, was created when the floor of the valley was higher, and hot spring water flowed up through cracks in the limestone, dissolving the cave chambers (Chronic and Williams 2002).

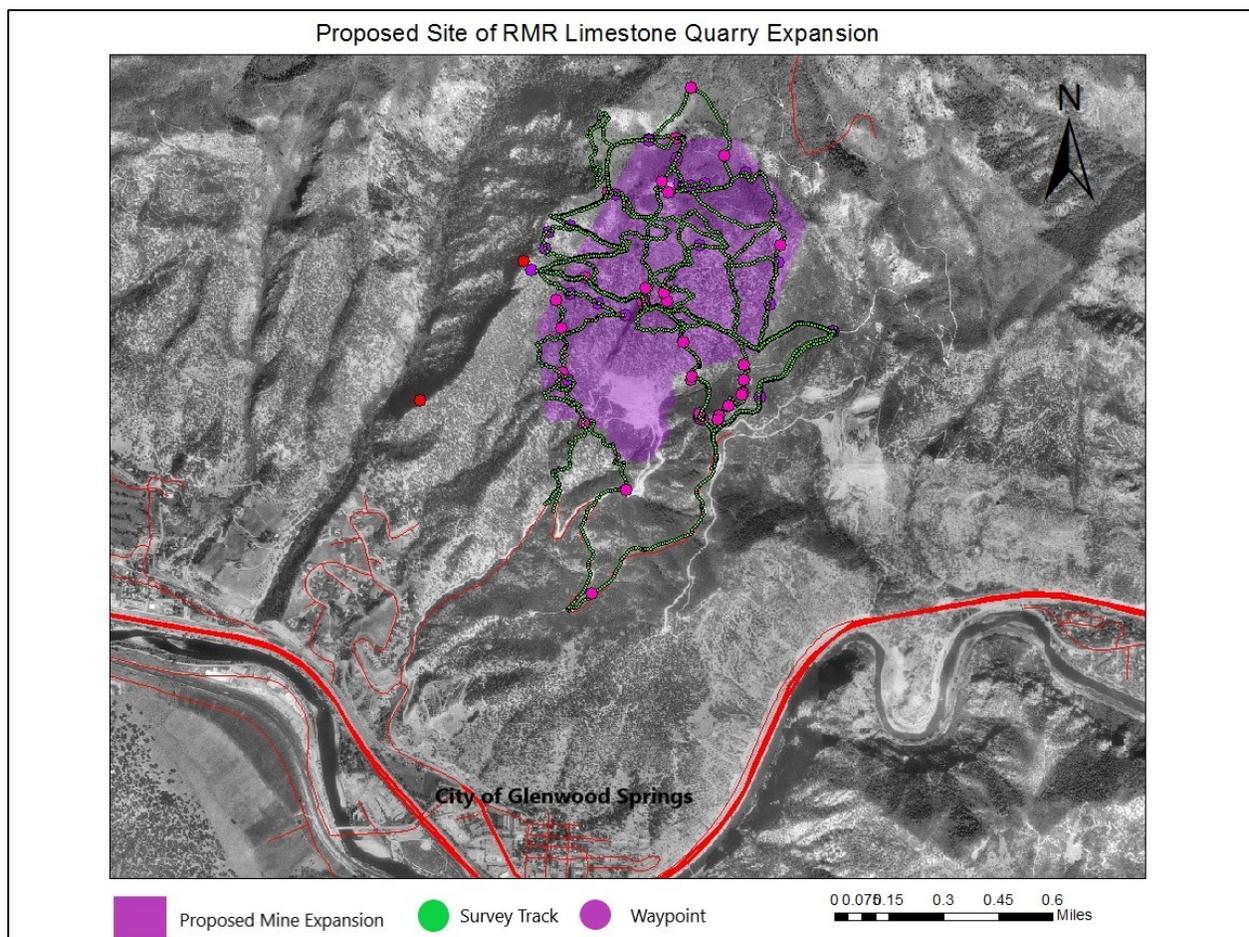


Figure 1. Map of proposed mine expansion and survey area.

Soils on the lower half of the site are classified as Farlow-Rock outcrop – these are steep sites with soils that are weathered from limestone and are well-drained with high runoff (NRCS 2018). Soils on the upper half of the survey site, where slopes are less steep, are generally classified as Cochetopa or Dateman loam derived from sedimentary and volcanic rock (NRCS 2018). Ecological systems and their habitats are determined primarily by soils and climate. Soils and a south-facing aspect have influenced vegetation community characteristics enabling the development of the rich mosaic of habitat types that characterize the survey site and provides important wildlife values.

Wildlife values provided by the habitats at the survey site includes the provisioning of winter habitat for elk, mule deer and bighorn sheep. These south-facing slopes provide access to food and cover during winter – access that is essential for the survival of native ungulates and carnivores such as Canada lynx (*Lynx canadensis*), a federally listed threatened and State listed endangered species.

Seasonal migration between summer and winter habitat is essential to the near- and long-term survivability of many native wildlife species. Currently, connectivity between south-facing slopes, which provide winter habitat, and the Flattops which provide summer habitat, is high, fragmentation is low and habitat quality is high – factors that enable successful migration between summer and winter habitat. Field surveys of the area during 2019 revealed that the proposed quarry expansion is crisscrossed by numerous game trails, indicating the importance of the area to ungulates for forage and migration. Figures 2 – 4 provide mapped elk, mule deer and bighorn sheep summer and winter range and the migratory path between these seasonal habitats (CPW 2018) in relation to location of the proposed quarry expansion.

Potential Canada lynx habitat occurs at the survey site extending north to the Flattops. Potential habitat is defined as those areas having the highest potential of lynx occurrences in the state. These areas usually contain positive, probable, or possible reports of Canada lynx (CPW 2018). Canada lynx were introduced to Colorado in 1999. Currently Canada lynx and their habitat are protected with Federal Threatened and State Endangered species listing. Figure 5 provides mapped potential Canada lynx habitat as determined by Colorado Parks and Wildlife (2018).

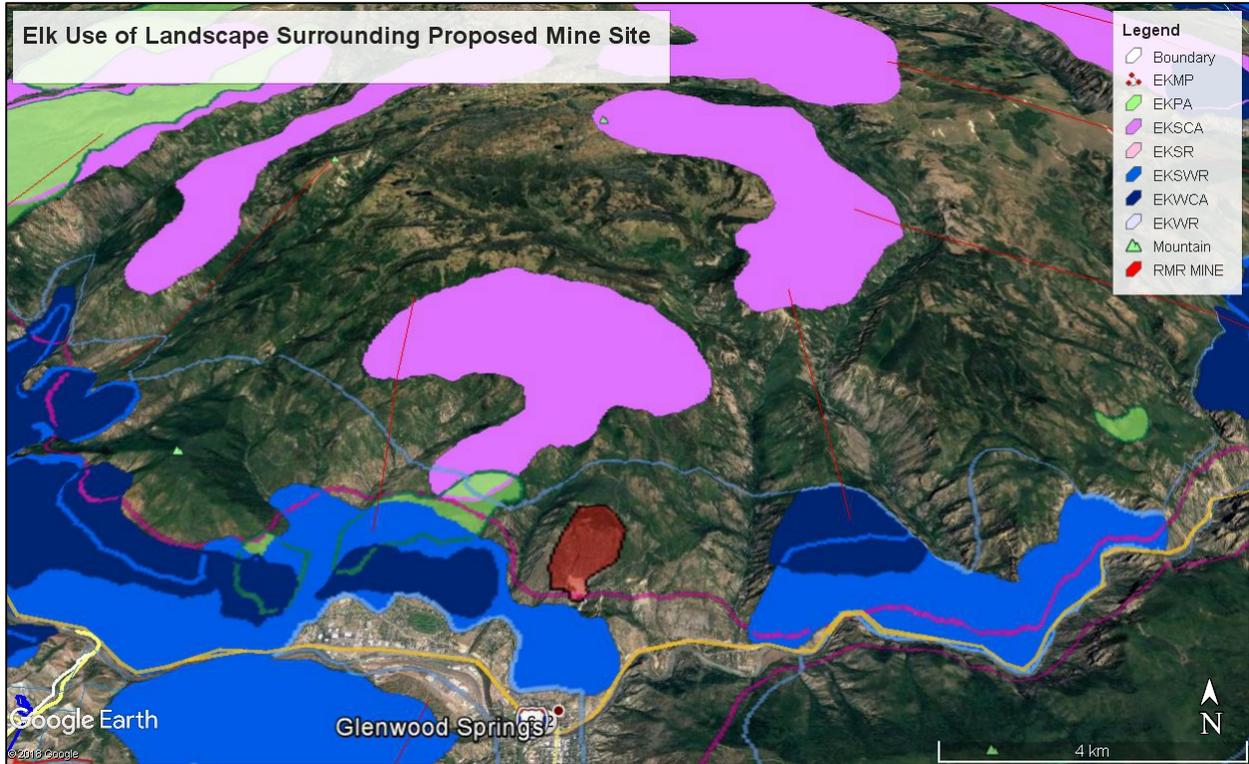


Figure 2. Elk use: Red lines show migratory pathways between summer (pink) and winter (blue) range.

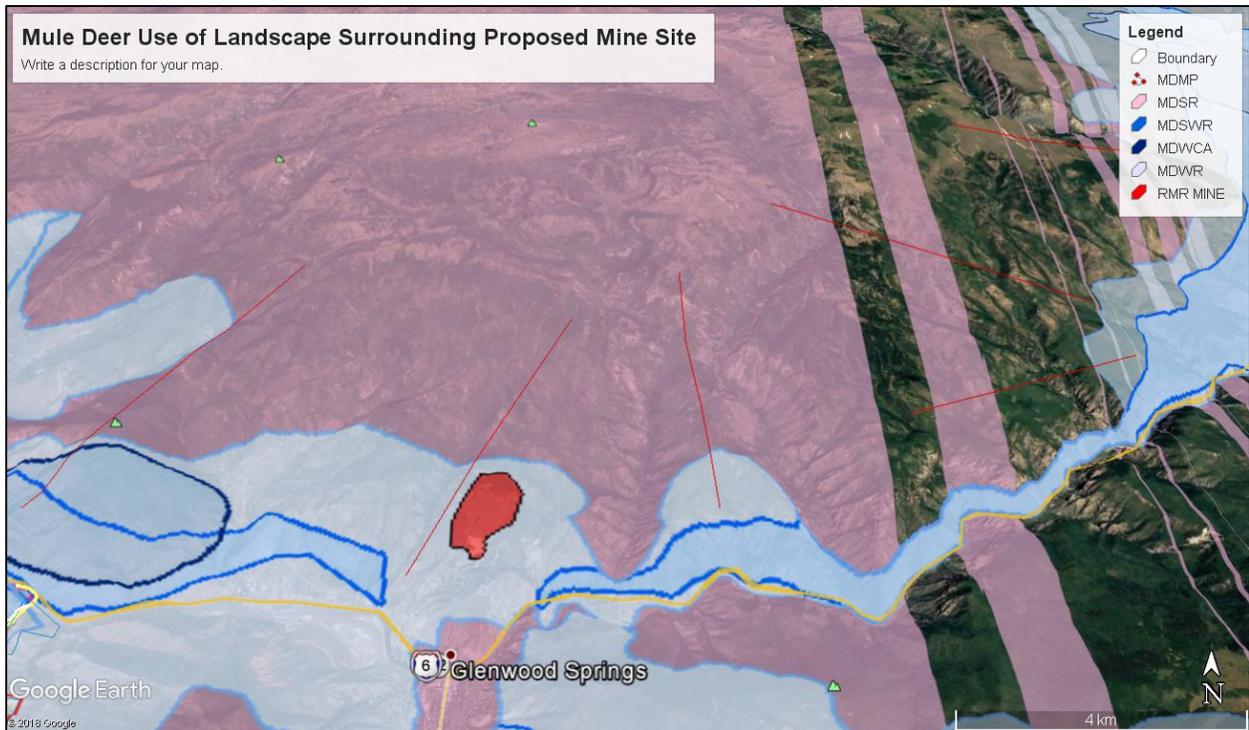


Figure 3. Mule deer use: Red lines show migratory path between summer (pink) and winter (blue) range.

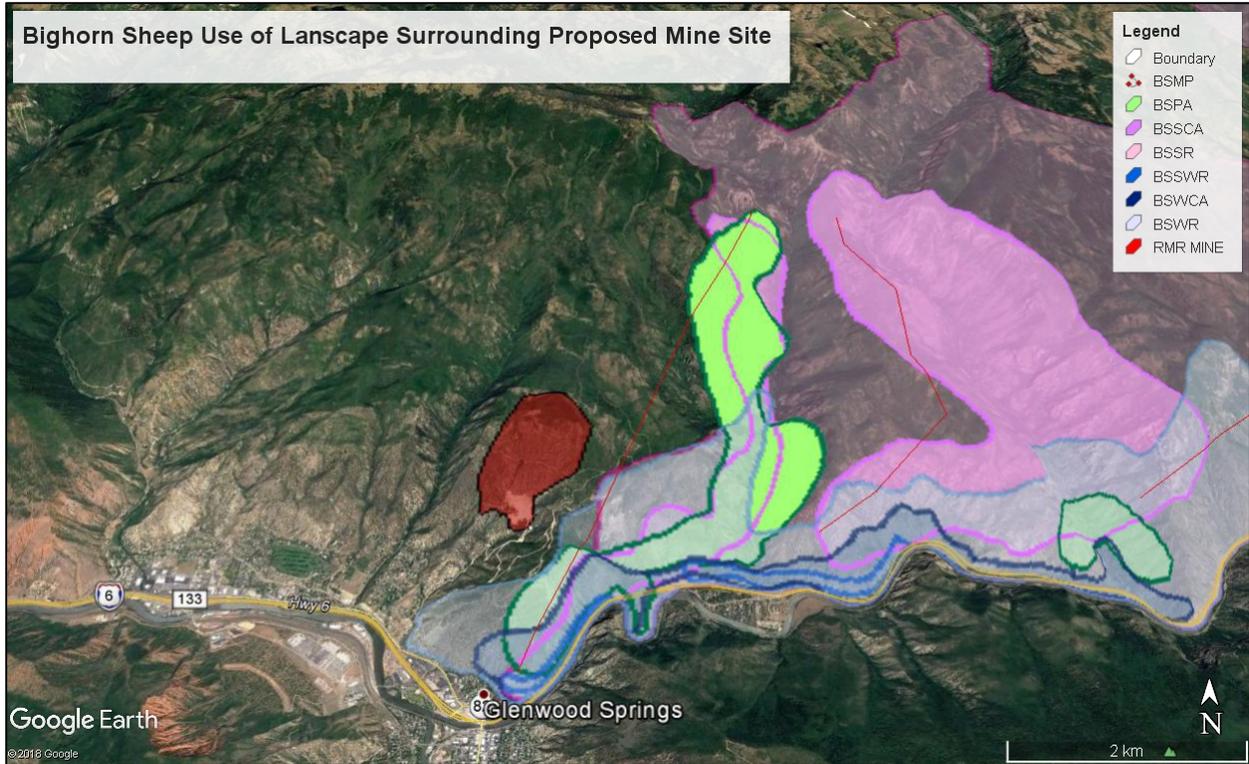


Figure 4. Bighorn sheep: Red lines show migratory path between summer (pink) and winter (blue) range. Bighorn production areas are indicated in green.

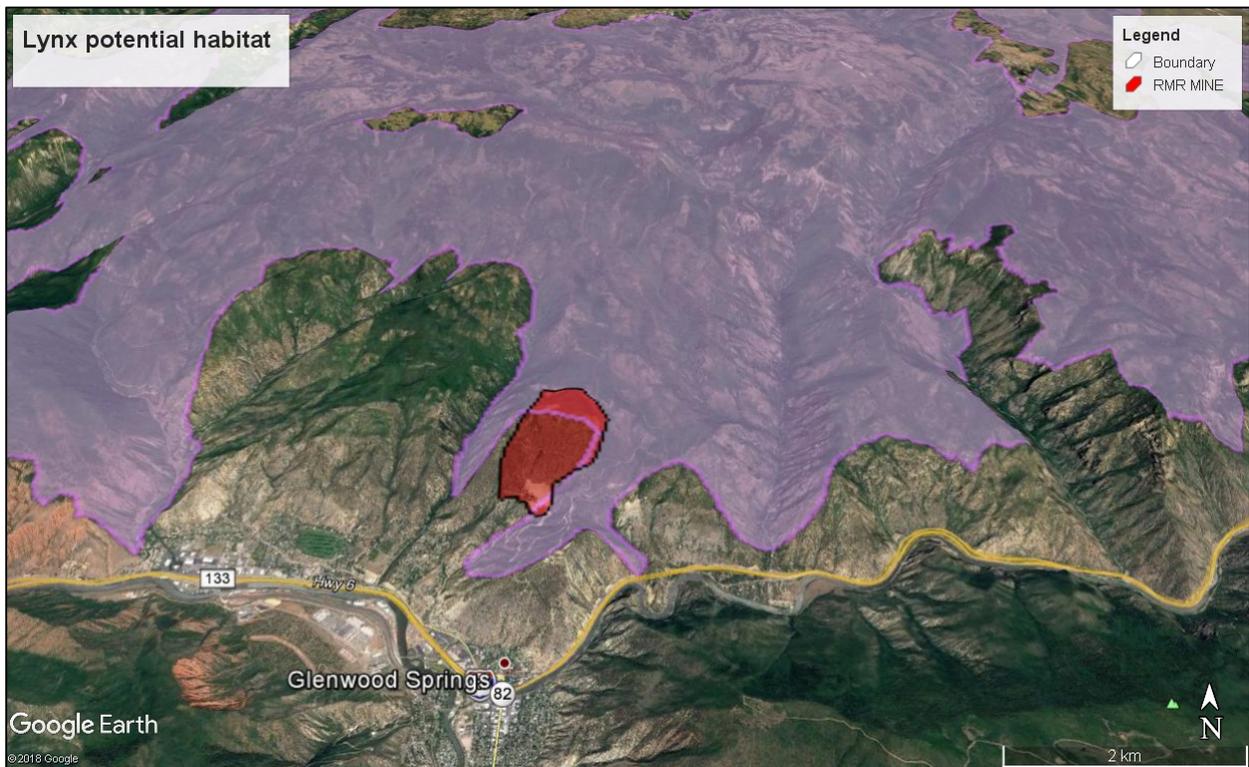


Figure 5. Canada lynx: Potential Canada lynx habitat is indicated in pink.

Additional wildlife values provided by this site include the provisioning of habitat for Townsend's big-eared bat (*Corynorhinus townsendii* ssp. *pallescens*) (G3G4 T3T4 S2, USFS R2 sensitive, Colorado State SWAP Tier 1). This species was documented to occur in limestone caves on nearby slopes as recently as 2006, although the extent of the occurrence was not verified (CNHP Biotics 2018). Townsend's big-eared bat distribution is strongly correlated with the availability of caves and cave-like roosting habitat, with population centers occurring in areas dominated by exposed, cavity forming rock and/or historic mining districts. (Ellison et al. 2004, CPW 2015). Surveys of two caves on BLM lands adjacent to the site were conducted in October 2018, but no bats were observed using the caves at the time; however some evidence of bat use (scattered guano) was found at one of the caves, indicating night roosting or occasional day roosting (Neubaum 2019).

Townsend's big-eared bats are sensitive to disturbance at roosts sites. To secure bat survival, human activity in and near roosts should be minimized or eliminated (Gruver and Keinath 2006). These surveys identified crevices in limestone cliff-faces in the steep canyon that traverses the site that may provide bat habitat (Figure 6).



Figure 6. Limestone outcrops at the survey site, provide potential bat habitat.

METHODS

Field surveys of the proposed limestone quarry expansion area were conducted in July of 2018 and in June of 2019. Global Positioning System (GPS) units were used to track the routes traveled and record locations of any target species found. Photographs were taken to document site conditions throughout these surveys.

Field survey protocols developed by NatureServe for the Natural Heritage Programs were used to document any new occurrences for inclusion in the BIOTICS database. These field survey methods involve collecting data on habitat characteristics relevant to features that are important to the ecology of the target species including landscape context, dominant community type, soil characteristics, disturbance and impacts, and abiotic factors including elevation, topographic position, slope gradient, slope shape, aspect, and light exposure.

Current threats to species viability were assessed at each occurrence. Element Occurrence forms were completed for any observed species that are tracked by CNHP and were ranked according to the NatureServe system that integrates data on size, condition, and landscape context (NatureServe 2006). These records will be used to develop new or update existing element occurrence records for inclusion in the CNHP database. GIS will be used to estimate the acreage of the surveyed areas.

RESULTS

Habitat in the survey area form a complex mosaic of mixed conifer forests, mountain shrublands and aspen woodlands. Singularly, each of these habitats supports a rich diversity of wildlife. When occurring together, the habitat mosaic greatly increases wildlife value. Habitat mosaics provide food and cover resources to a greater richness of native wildlife and for greater extent of time during the year and throughout a species' life cycle.

The mosaic of habitats that characterize the survey site includes steep limestone cliffs and talus slopes that occur at lower elevations of the survey site. These lower-elevation habitats are a mosaic of pinyon-juniper woodlands, and oak and mountain shrublands with outcrops of limestone cliffs which are often covered by a dense layer of rock spiraea (*Petrophyton caespitosum*). At slightly higher elevations, habitat transitions to a mosaic of Douglas fir forest and oak shrublands. At the highest elevations of the survey site, and as soil moisture increases, habitat is characterized by aspen woodlands with a dense shrub canopy of mesic mountain shrublands with serviceberry, chokecherry and snowberry with a lush herbaceous understory. Table 1 provides a list of the dominant natural communities and their ecological condition.

HABITAT QUALITY throughout the site currently is moderate to high with regard to providing ecosystem services including the provisioning of food and cover resources for native wildlife. Winter is an especially vulnerable time of year for wildlife. Accessible and secure winter habitat is critical to the survivability of most native wildlife species. The survey site has been identified by Colorado Parks and Wildlife (CPW 2018) as elk winter range and is directly adjacent to elk

severe winter range (Figure 2). As indicated by CPW mapping, the survey site also provides winter range for mule deer (Figure 3) and bighorn sheep winter range. Bighorn production areas are directly adjacent to the proposed mine expansion (Figure 4).

ECOLOGICAL CONDITION was assessed by considering parameters of ecosystem viability (Neely et al. 2001). Currently the overall condition of the site is good to excellent (Table 1) providing essential ecological functions including but not limited to carbon sequestration, water storage and wildlife provisioning. Viability ranking is based on three factors, size of the ecosystem, condition of the ecosystem and the character of the surrounding landscape. Although the size of the survey site is small, and consequently the size of the habitats surveyed are small, these habitats are well connected across the landscape, which effectually enlarges their extent and value to ecosystem processes.

CONSERVATION of Colorado's natural communities was assessed by Colorado's Biodiversity Score Card (Rondeau 2011) which ranks species and natural communities as either effectively conserved, moderately conserved, weakly conserved or under conserved. Under conserved or weakly conserved species and communities would greatly benefit from conservation action and although the urgency is not as great, moderately to effectively conserved species and communities would also benefit from conservation action (Rondeau 2011). Two of the dominant communities at this site, oak and mountain mahogany shrublands are weakly conserved while pinyon-juniper woodlands are moderately conserved (Table 1).

Complex ecosystems with a diversity of vegetation communities, such as occur at this site, provide the foundation for a rich suite of wildlife species. By providing food and cover throughout the seasons of the year, the south-facing slopes of this site are especially valuable to native ungulates and carnivores. Table 1 lists the native communities that occur at this site. Native mammal species documented to use the survey site include, but are not limited to black bear, mountain lion, long-tailed weasel, coyote, elk, mule deer and bighorn sheep (Appendix 1).

PINYON-JUNIPER WOODLANDS occur on the lower-elevation slopes across this site (Figure 7). These woodlands are in good condition; tree density is appropriately low (<600 trees per ha on steep sites); understory vegetation is dominated by native plants; herbaceous undergrowth is present although percent cover is declining in some areas and some native perennial increasers are present; non-natives annuals (*Bromus tectorum*) are only rarely present and then typically only in disturbed areas such as along roadcuts; microbial crusts are intact in at least 80% of the occurrence and soil erosion is accelerated only in small patches throughout the occurrence; the survey site is surrounded on three sides by very large areas of natural vegetation that are well connected with the larger, natural landscape; and, although several historic 4wd roads traverse the site these are revegetating and contribute only minimally to fragmentation impacts (Neely et al. 2001). Old-growth juniper (*Juniperus scopulorum*) woodlands occur throughout the site providing an indication of long-term ecological development and viability.

These woodlands provide essential habitat for many common mammal and bird species. Mule deer depend on pinyon-juniper woodlands for cover, shelter and forage during severe winters

and elk use this habitat for winter and spring range (Mutel and Emerick 1992, Fitzgerald et al. 1994). Carnivores observed at this site include mountain lion and bobcat. Remote rocky areas and cliffs provide protected areas where these carnivores find den sites (Mutel and Emerick 1992). Bird species commonly observed at this site include Woodhouse Jay, Wild Turkey, Chipping Sparrow, and Black-throated Gray Warbler. Sensitive bird species such as Pinyon Jay, Juniper Titmouse and Gray Vireo were also documented to occur in these woodlands.



Figure 7: Pinyon-juniper woodlands occur in a complex mosaic with montane shrublands.

MONTANE SHRUBLANDS at this site are characterized by two codominant shrubs, Gambel oak and mountain mahogany, form a complex habitat mosaic. These shrublands rapidly recycle nutrients into fruits, seeds and leaves providing animals with an abundance of food (Mutel and Emerick 1992). Gambel oak and mountain mahogany are ecologically important species providing food and shelter for many wildlife species (Simonin 2000 and Gucker 2006). Mountain mahogany is typically rated as highly valuable or excellent forage for big game including mule deer and elk (Gucker 2006). Gambel oak provides forage and nest sites for a large diversity of bird species including wild turkeys which forage on acorns and is also highly valuable winter forage for elk (Simonin 2000).

These shrublands are ranked in good to excellent condition (Figure 8). Native species are dominant and are comprised of an even distribution of all age classes; although non-native species are present they contribute < 5% total cover; native increaser species (*Yucca*, *Artemisia frigida*, and *Opuntia* spp.) have less than 5% relative cover; some invasive plant species are present but contribute < 3% cover; plant species richness is moderately high, and native (non-increaser) grasses are dominant. Adjacent systems surrounding the shrublands retain much connectivity allowing natural ecological processes (e.g., fire), and species migrations to occur. Few non-natural barriers are present; surrounding landscape to the north, east and west has at least 90% native and unaltered landscape with very little to no urban development or agriculture, and little to no industrial forestry. Although several historic 4wd roads traverse the site, these are rarely if ever used and are revegetating, thus contribute only minimally to fragmentation impacts (Neely et al. 2001).

Native wildlife species observed in these shrublands included small mammals such as voles, ground squirrels, and long-tailed weasels, native megafauna including elk, mule deer and black bear. Breeding bird abundance was high in these shrublands and included several sensitive bird species such as Virginia's Warbler and Lazuli Bunting.



Figure 8. Montane shrublands here provide an abundance of wildlife forage, cover and breeding habitat.

ASPEN WOODLANDS occupy moist swales across the upper half of the site. These woodlands are ranked in good condition (Figure 9). These small patches of aspen woodlands are small but occur as a mosaic of aspen plant associations with a diverse age class structure present within these communities; invasive exotics are present but with very low cover; ground cover is > 65%; natural microrelief is undisturbed and soil erosion is not accelerated by anthropogenic activities. Connectivity with the surrounding landscape is high to the north, east and west, and is characterized by high quality plant communities and numerous game trails.

Aspen forests are one of Colorado's most species-rich ecological systems (Rondeau et al. 2011). These woodlands provide an abundance of protective cover and forage resources, and in the west provide habitat for over 50 species of wild mammals (Mutel and Emerick 1992). Elk and mule deer rely on these woodlands as do black bears, and meso-predators such as long-tailed weasels. Breeding bird diversity is high and several sensitive species were documented here including Olive-sided Flycatcher and Band-tailed Pigeon.

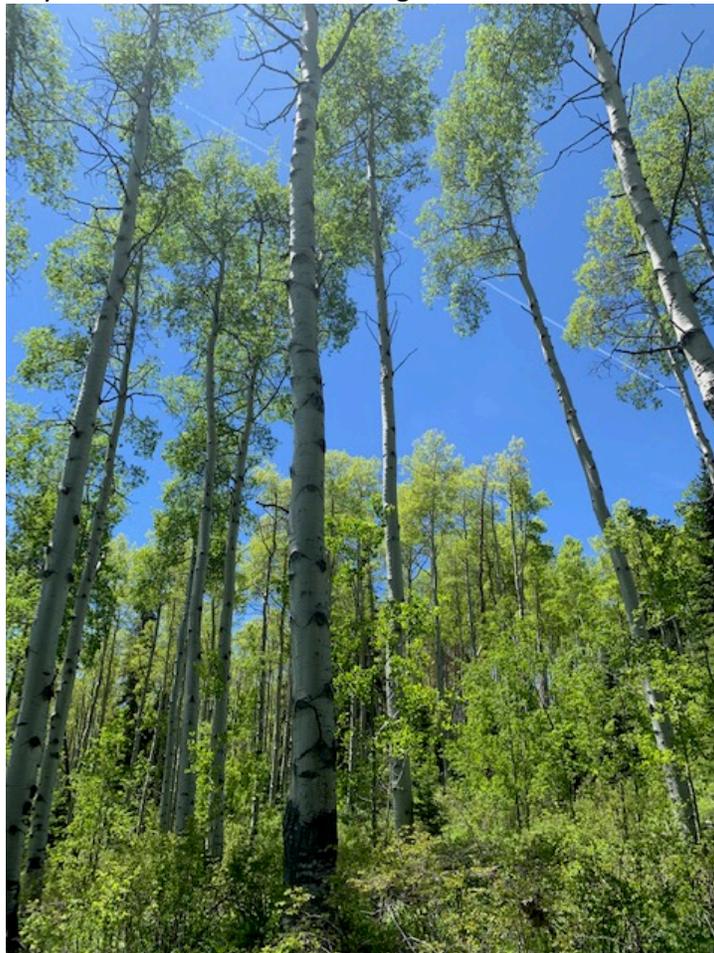


Figure 9. Aspen Woodlands provide habitat for many species and mammals and breeding birds.

DOUGLAS FIR FORESTS occur on the lower slopes of the site and are ranked in good condition (Figure 10). Most old-growth, pristine Douglas fir forests have been destroyed by lumbering activities (Mutel and Emerick 1992) but remnants of old growth Douglas fir forests remain at this site. There is little evidence of past logging disturbance over a major proportion of the occurrence and much of the stand is > 100 years old; non-native species are present but with low to moderate frequency in the understory and have low percent cover. Landscape surrounding the occurrence to the north, east and west is dominated by large areas of natural vegetation; connectivity of adjacent systems allows natural ecological processes, e.g., fire and species migrations to occur; few unnatural barriers are present and only few small roads occur in the surrounding landscape.

These forests provide habitat for numerous native mammals including pine squirrels and pine marten, a forest-sensitive species, as well as for the more common mule deer and elk. Numerous bird species breed here including Western Tanager, Mountain Bluebird, Clark's Nutcracker, Williamson's Sapsucker, and Red-naped Sapsucker.



Figure 10: Douglas fir forests are dense, cool stands on south-facing slopes of the proposed mine site.

Table 1. Dominant natural communities at the survey site, their condition and their viability score.

COMMUNITY	VIABILITY SCORE (Condition + Size + Landscape Context) (Neely et al. 2001)	CONSERVATION SCORE (Rondeau et al. 2011)
Pinyon –Juniper Woodlands	Condition: B-rated Size: B-rated Landscape: B-rated	Moderately conserved
Rocky Mountain Gambel Oak – Mixed Montane Shrubland	Condition: A-rated Size: B-rated Landscape: B-rated	Weakly conserved
Rocky Mountain Lower Montane – Foothill Shrubland (Mountain mahogany shrublands;)	Condition: B-rated Size: B-rated Landscape: B-rated	Weakly conserved
Rocky Mountain Aspen Forest and Woodland	Condition: B-rated Size: C-rated Landscape: B-rated	Moderately conserved
Rocky Mountain Dry-Mesic and Mesic Montane Mixed Conifer Forest and Woodland (Douglas fir forest)	Condition: B-rated Size: C-rated Landscape: B-rated	Moderately conserved

NATIVE PLANT SPECIES RICHNESS is an indicator of system stability and resilience. Plant species richness is high with at least 114 native plant species (Appendix 3). Eight introduced species were encountered at the site and were typically with low density occurring along disturbed areas such as road cuts. The presence of a mosaic of habitat types, each supporting a characteristic suite of species, enables this moderately high species richness. Although only one occurrence of a rare plant species was discovered at the site, silverleaf milkvetch (*Astragalus argophyllus* var. *martinii*) (G5T4 S1), other rare species may be present. For instance, another rare species, juniper tumble-mustard (*Thelypodopsis juniperorum*), occurs near this site in similar habitat.

BIRD SPECIES COMPOSITION AND DIVERSITY is an indicator of habitat quality. Moderately high bird species diversity at this site indicates the high value of this site for breeding bird species. A total of 56 breeding bird species were identified during these surveys. The Shannon-Wiener index of biological diversity incorporates species abundance and richness to calculate breeding bird diversity at this site. Diversity values range from 0 to 5 with 5 being highest diversity and 0 lowest. Breeding bird diversity at this site as calculated by the Shannon-Wiener index of biologic diversity was 3.59637 – supporting the assessment that this habitat is important to the survivorship of local populations of native breeding bird species.

Appendix 2 provides a list of bird species encountered at the site. Several of these species are included species on the North American Bird Conservation Initiative (NABCI) Watch List and are listed by Colorado Partners in Flight as “priority species” (NABCI 2016, Colorado PIF 2000). Additionally, several of the species encountered at the site are included in Colorado’s State

Wildlife Action Plan (SWAP) which identifies species of greatest conservation need. These species are grouped into Tier 1 and Tier 2 categories, reflecting a relative degree of conservation priority with Tier 1 species having the highest priority.

Three golden eagles, two adults and one sub-adult, were observed flying over the proposed mine-site expansion area on 3 of 5 survey days, suggesting that a nest site was likely nearby. Although the golden eagle nest was not located, cliff outcrops throughout the site provide potential golden eagle nest habitat.

Many of the bird species encountered at the site are habitat specialists and rely on specific habitats for their breeding success and survival. NABCI has categorized each species' overall Conservation Concern status as low, moderate, or high. High concern species (score 14 to 20) were those included on their Watch List; Moderate concern were species score > 8 but not high enough to warrant inclusion on the Watch List; Species were considered low concern if their Conservation Score was 8 or less. The Watch List includes 432 species with conservation concern scores of 14 or higher (or with a concern score of 13 and a steeply declining population trend)—these are the species most at risk of extinction without significant conservation actions to reverse declines and reduce threats.

Several breeding bird species that were documented at the site are included on NABCI's list of High Conservation Concern. These species include Band-tailed pigeon, Olive-sided flycatcher, Virginia's warbler, Gray vireo, Plumbeous vireo and Black-throated gray warbler. Colorado Partners in Flight (PIF) identifies priority species based on determining which species and habitats are most in need of conservation. Several of PIF's priority species were documented at the survey site including Green-tailed towhee, Dusky grouse, Broad-tailed hummingbird and Mac Gillivray's warbler.

Several breeding bird species encountered at this site are also included on the Colorado SWAP. These species included Golden eagle, Juniper titmouse, Lazuli bunting, Band-tailed pigeon, Cassin's finch, Olive-sided flycatcher, Pinyon jay, and Virginia's warbler. Appendix 2 summarizes bird species documented at the survey site, their primary habitat, conservation scores and SWAP ranks.

DISCUSSION

Currently, the habitat mosaic that characterizes the survey area, in combination with high connectivity to adjacent public lands on the Flattops, provides important food and cover resources for native wildlife including breeding habitat for Neotropical migrant bird species, winter habitat for elk and mule deer, year-round habitat for carnivores including mountain lion and bobcat, and omnivores such as black bear, and potential habitat for Canada lynx, a federally ESA listed Threatened and state listed Endangered species.

THREATS to wildlife and ecosystem processes and function from the proposed mine expansion emanate from at least three primary factors: direct habitat destruction and consequent habitat loss, habitat fragmentation, and edge effects. Habitat destruction will result in declining populations of those species that currently require this habitat including elk, mule deer, big horn, and numerous breeding bird species. Habitat fragmentation from the mine site expansion and from increased road use will create barriers that reduce daily and seasonal migration potential, disabling access to critical forage, cover and breeding resources (Figure 11). Edge effects, which result from fragmentation, extend the zone of disturbance from 100m to 400m beyond the footprint of the alteration (Laurance et al. 2011), also contributing to habitat loss for those species, such as bighorn sheep, elk and mule deer, that cannot tolerate the altered environmental conditions or the increased human disturbance resulting from edge effects (Rogan and Lacher 2018).

Conservation of breeding bird species depends on conserving habitat in a natural and functional condition and minimizing anthropogenic habitat disturbance and loss. For instance, Pinyon Jays are now uncommon with their populations having declined by 85% between 1970 and 2014 earning them a “watchlist” categorization from the NABCI; the greatest threat to Pinyon Jays is the loss of their obligate pinyon-juniper woodland habitat. Virginia’s Warbler numbers declined by 46% between 1970 and 2014 earning them a “watchlist” categorization by the NABCI; survivability is impacted by mining, road construction, hiking trails, fire, conversion of rural areas to urban subdivisions, and intentional alteration of habitat to enhance livestock grazing disturb nesting, resting, and foraging habitat. This warbler depends on relatively narrow range of relatively xeric mid-elevational habitat, specifically deciduous shrubs such as oak as well as pines and junipers (Olson et al. 1999). Gray Vireo populations remain small and of low abundance which earned this specie a “watchlist” categorization by the NABCI; in the West, including Colorado, this vireo’s breeding habitat, piñon-juniper woodlands, have been extensively cleared resulting in the loss of breeding habitat (Barlow et al. 1999). Golden Eagle populations have been impacted by urbanization, mine development, agricultural development, and changes in wildfire regimes which compromise nesting and hunting grounds (Kochert et al. 2002).

Breeding adult and sub-adult Golden Eagle survival directly affects population growth and even small reductions in breeding adult survival causes population declines (Collopy et al. 2017). Survival and reproduction in Golden Eagles is influenced substantially by the distribution and availability of prey resources - primarily rabbits, hares, ground squirrels, and prairie dogs. (Collopy et al. 2017, Kochert et al. 2002). Thus, restoring and maintaining these prey populations is an important factor in Golden Eagle population survival. Management of healthy eagle populations requires maintaining prey habitat in foraging areas by protecting shrub communities within 3 km of nests (Kochert et al. 2002).

In recent years, Golden Eagles have emerged as a conservation concern in the United States, particularly in the West (Collopy et al. 2017). Golden Eagles are protected under the Bald Eagle and Golden Eagle Protection Act (16 U.S.C. 668-668d). The Act prohibits "taking" bald or golden eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at,

poison, wound, kill, capture, trap, collect, molest or disturb."Disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment (USFWS 2019).



Figure 11. Road-induced habitat fragmentation creates barriers to migration.

Further, habitat loss and fragmentation are the greatest near-term threat to biodiversity (Rogan and Lacher 2018). Cumulative effects from these impacts are negatively impacting wildlife populations across Colorado but especially on our West slope and especially from development-induced habitat, alteration, loss and fragmentation. The proposed mine expansion would perpetuate these habitat losses and the losses of native biological diversity.

The elk population in the Eagle Valley — from Vail Pass to Glenwood Canyon — is down nearly 40 percent from what it was in 2002 (Vail Daily 2018); As explained by Bill Andree, CPW wildlife manger, the biggest issue affecting the local elk population is disruption – “it is becoming increasingly difficult for animals to find respite from humans”. Causes for elk population declines suggest that those habitats that are currently undisturbed have especially high value for wildlife. Habitat at the proposed mine site expansion precludes human disturbance while still providing important food and cover resources, rendering this site especially valuable to wildlife.

As high-quality natural habitats are increasingly altered by anthropogenic development, those that remain unaltered become ever more essential to the long-term survivability of Colorado’s native wildlife. Currently, this site continues to provide high quality wildlife habitat and is consequently important to the survivability of numerous native wildlife species from Neotropical migrant breeding bird species to big game species such as elk and mule deer and native carnivores such as mountain lion.



Figure 12. Habitat at the proposed mine site provides high quality resources that support a moderately high diversity of native wildlife. In the face of increasing anthropogenic habitat alteration these habitats become all the more critical to sustain native biodiversity

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Appendix 1. Mammal species documented to occur at the survey site, 2019.

Order	Mammal Species	Primary Habitat in Colorado (Fitzgerald et al. 1994)	Conservation Designation
Artiodactyla	Bighorn sheep (<i>Ovis canadensis</i>)	Steep terrain dominated by grass & low shrubs	NA
Artiodactyla	Elk (<i>Cervus elaphus</i>)	Semi-open forest & forest edges	NA
Artiodactyla	Mule deer (<i>Odocoileus hemionus</i>)	All ecosystems but especially shrublands.	NA
Carnivora	Black bear (<i>Ursus americanus</i>)	Montane shrublands and forests & subalpine forests	NA
Carnivora	Bobcat (<i>Felis rufus</i>)	Broken terrain of foothills and canyonlands especially in pinyon-juniper and montane forests	NA
Carnivora	Coyote (<i>Canis latrans</i>)	Shrublands	NA
Carnivora	Long-tailed weasel (<i>Mustela frenata</i>)	All habitat types	NA
Carnivora	Mountain lion (<i>Felis concolor</i>)	Rough, broken foothills and canyon country	NA
Carnivora	Pine marten (<i>Martes americana</i>)	Montane, lodgepole and spruce-fir forest	WRNF Sensitive
Carnivora	Striped skunk (<i>Mephitis mephitis</i>)	Most habitats (except for alpine tundra)	NA
Chiroptera	Bat spp. 2 (<i>Myotis</i> spp.)	Observed in Douglas fir forest	NA?
Chiroptera	Bat spp.1 (<i>Myotis</i> spp.)	Observed in Montane shrubland	NA?
Lagomorpha	Nuttall's cottontail (<i>Sylvilagus nuttallii</i>)	Montane shrublands on the edge of Pinyon-juniper conifer woodlands	NA
Rodentia	Golden-mantled ground squirrel (<i>Spermophilus lateralis</i>)	Open woodlands, shrublands, mountain meadows & forest edges	NA
Rodentia	Least chipmunk (<i>Tamias minimus</i>)	Montane shrublands and woodlands	NA
Rodentia	Northern pocket gopher (<i>Thomomys talpoides</i>)	Aspen groves	NA
Rodentia	Pine squirrel (<i>Tamiasciurus hudsonicus</i>)	Subalpine and montane conifer forests (except Ponderosa)	NA
Rodentia	Rock squirrel (<i>Spermophilus variegatus</i>)	Rocky hillsides, in pinyon-juniper woodlands & montane shrublands	NA

Appendix 2. Bird species documented at the survey site 2019.

Concern scores of 14 or higher, or with a concern score of 13 are the species most at risk of extinction without significant conservation actions to reverse declines and reduce threats (NABCI 2016).

BIRD SPECIES	PRIMARY BREEDING HABITAT IN COLORADO (Kingery 1998)	Count	CONSERVATION CONCERN SCORE (NABCI 2016)	State Wildlife Action Plan (SWAP)	CNHP Rank
American crow	Farms, forest edges, open woodlands and parks	2	6	NA	NA
American robin	Urban habitat to krummholz	4	5	NA	NA
Band-tailed pigeon	Coniferous and mixed forest and aspen stands	4	13	Tier 2	S4B
Black-billed magpie	Open country and range over sagebrush, croplands and pastures	4	9	NA	NA
Black-capped chickadee	Upland deciduous (aspen, pure or mixed stands with no more than 50% conifers)	13	7	NA	NA
Black-chinned hummingbird	Pinyon-juniper	6	10	NA	NA
Black-headed grosbeak	Pinyon-juniper woodlands, oak shrublands, aspen, ponderosa pine	16	9	NA	NA
Black-throated gray warbler	Pinyon-juniper	9	13	NA	NA
Blue-gray gnatcatcher	Pinyon-juniper woodlands	39	9	NA	NA
Broad-tailed hummingbird	Montane forests and shrublands	6	12	NA	NA
Bushtit	Pinyon-juniper woodlands and (shrublands)	12	11	NA	NA
Cassin's finch	Mountain coniferous forests with closed canopies	6	13	Tier 2	G5 S5
Chipping sparrow	Less disturbed coniferous woodlands	5	8	NA	NA
Clark's nutcracker	Mountain coniferous forests with closed canopies	17	11	NA	NA

BIRD SPECIES	PRIMARY BREEDING HABITAT IN COLORADO (Kingery 1998)	Count	CONSERVATION CONCERN SCORE (NABCI 2016)	State Wildlife Action Plan (SWAP)	CNHP Rank
Common raven	Cliffs and rocky outcrops in mountain forests	5	6	NA	NA
Cordilleran flycatcher	Moist montane and subalpine forests	2	11	NA	NA
Dark-eyed junco	Coniferous forest	6	8	NA	NA
Dusky flycatcher	Shrublands and aspen stands	12	11	NA	NA
Dusky grouse	Nearly all types of forest with open canopies and a shrub understory	1	11	NA	NA
Golden eagle	Cliffs for nest habitat and open habitat for foraging	3	10	Tier 1	S3S4B, S4N
Gray vireo	Pinyon-juniper woodlands	1	14	Tier 2	G4 S2B
Green-tailed towhee	Mountain shrublands (mountain mahogany, scrub oak, snowberry, serviceberry and chokecherry)	2	11	NA	NA
Hermit thrush	Coniferous forest	8	6	NA	NA
House wren	Aspen or deciduous riparian woodlands	10	5	NA	NA
Juniper titmouse	Pinyon-juniper woodlands	5	11	Tier 2	G5 S4
Lazuli bunting	Moist shrublands	6	9	Tier 2	G5 S4
MacGillivray's warbler	Montane carr (mid-elevation willow and alder thickets)	2	12	NA	NA
Mountain chickadee	Coniferous forest and aspen woodland	11	10	NA	NA
Mourning dove	Wide habitat choices from croplands to pinyon-juniper woodlands	4	7	NA	NA
Northern flicker	Wide habitat from aspen to rural habitats	1	9	NA	NA
Olive-sided flycatcher	Remote coniferous forests with snags and conifers	4	13	Tier 2	G4 S3S4B
Orange-crowned warbler	Shrublands	9	9	NA	NA
Pine siskin	Coniferous forest	7	10	NA	NA
Pinyon jay	Pinyon-juniper woodlands	30	14	Tier 2	G5 S5

BIRD SPECIES	PRIMARY BREEDING HABITAT IN COLORADO (Kingery 1998)	Count	CONSERVATION CONCERN SCORE (NABCI 2016)	State Wildlife Action Plan (SWAP)	CNHP Rank
Plumbeous vireo	Pinyon-juniper woodlands	6	13	NA	NA
Common Poorwill	Shrublands, pinyon-juniper woodlands	1	10	NA	NA
Red-breasted nuthatch	Upland coniferous (mountain conifer forests with closed canopies)	1	6	NA	NA
Red-naped sapsucker	Aspen groves	2	9	NA	NA
Red-tailed hawk	Generalist	3	6	NA	NA
Sharp-shinned hawk	Woodlands	1	7	NA	NA
Spotted towhee	Oak shrubland	31	8	NA	NA
Steller's jay	Coniferous forest	1	11	NA	NA
Townsend's solitaire	Open coniferous forest	7	10	NA	NA
Tree swallow	Aspen woodlands	7	10	NA	NA
Turkey vulture	Widespread	2	5	NA	NA
Violet-green swallow	Open woodlands	3	9	NA	NA
Virginia's warbler	Oak shrubland	22	14	Tier 2	G5 S5
Warbling vireo	Upland deciduous (aspen, pure or mixed stands with no more than 50% conifers)	17	9	NA	NA
Western tanager	Coniferous woodlands, aspen forests and oak shrublands.	14	9	NA	NA
White-breasted nuthatch	Coniferous woodlands including pinyon-juniper woodlands and open ponderosa pine forests.	1	6	NA	NA
Western wood-peewee	Upland deciduous (aspen, pure or mixed stands with no more than 50% conifers)	7	11	NA	NA
White-throated swift	Rocky cliffs determine where these swifts breed	13	11	NA	NA

BIRD SPECIES	PRIMARY BREEDING HABITAT IN COLORADO (Kingery 1998)	Count	CONSERVATION CONCERN SCORE (NABCI 2016)	State Wildlife Action Plan (SWAP)	CNHP Rank
Wild turkey	Forest generalist	2	7	NA	NA
Woodhouse jay	Pinyon-juniper	1	9	NA	NA
Yellow warbler	Riparian deciduous woodlands and shrublands	2	8	NA	NA
Yellow-rumped warbler	Conifer and aspen forests	2	6	NA	NA

Appendix 3. Vascular plant species documented at the survey site, July 2018.

VASCULAR PLANT SPECIES

Scientific Name	Common Name	Family	Origin*
Trees			
<i>Juniperus osteosperma</i>	Utah juniper	Cupressaceae	N
<i>Juniperus scopulorum</i>	Rocky Mountain Juniper	Cupressaceae	N
<i>Pinus edulis</i>	Pinyon pine	Pinaceae	N
<i>Populus angustifolia</i>	Narrowleaf cottonwood	Salicaceae	N
<i>Populus tremuloides</i>	Quaking aspen	Salicaceae	N
<i>Pseudotsuga menziesii</i>	Douglas fir	Pinaceae	N
<i>Ulmus pumila</i>	Siberian elm	Ulmaceae	N
Shrubs/Subshrubs			
<i>Amelanchier utahensis</i>	Utah serviceberry	Rosaceae	N
<i>Arctostaphylos uva-ursi</i>	Bearberry	Ericaceae	N
<i>Artemisia dracunculus</i>	Wild tarragon	Asteraceae	N
<i>Artemisia ludoviciana</i>	Sagewort	Asteraceae	N
<i>Cercocarpus montanus</i>	Mountain mahogany	Rosaceae	N
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	Asteraceae	N
<i>Juniperus communis var. depressa</i>	Common juniper	Cupressaceae	N
<i>Mahonia repens</i>	Oregon grape	Berberidaceae	N
<i>Paxistima myrsinites</i>	Mountainlover	Celastraceae	N
<i>Philadelphus microphyllus</i>	Mock orange	Hydrangeaceae	N
<i>Prunus virginiana var. melanocarpa</i>	Native chokecherry	Rosaceae	N
<i>Quercus gambelii</i>	Gambel's oak	Fagaceae	N

Scientific Name	Common Name	Family	Origin*
<i>Petrophytum caespitosum</i>	Tufted rockmat	Rosaceae	N
<i>Ribes cereum</i>	Wax currant	Grossulariaceae	N
<i>Ribes inerme</i>	Whitestem gooseberry	Grossulariaceae	N
<i>Rosa woodsii</i>	Wood rose	Rosaceae	N
<i>Rubus idaeus spp. melanolasius</i>	Red raspberry	Rosaceae	N
<i>Symphoricarpos rotundifolius</i>	Snowberry	Caprifoliaceae	N
Graminoids			
<i>Bouteloua gracilis</i>	Blue grama	Poaceae	N
<i>Bromopsis canadensis</i>	Fringed brome	Poaceae	N
<i>Bromus inermis</i>	Smooth brome	Poaceae	I
<i>Bromus tectorum</i>	Cheatgrass	Poaceae	I
<i>Carex geyeri</i>	Elk sedge	Cyperaceae	N
<i>Carex praegracilis</i>	Clustered field sedge	Cyperaceae	N
<i>Elymus elymoides</i>	Squirrel tail	Poaceae	N
<i>Elymus trachycaulus</i>	Slender wheatgrass	Poaceae	N
<i>Festuca arizonica</i>	Arizona fescue	Poaceae	N
<i>Hesperostipa comata</i>	Needle-and- thread grass	Poaceae	N
<i>Koeleria macrantha</i>	Junegrass	Poaceae	N
<i>Nassella viridula</i>	Green needlegrass	Poaceae	N
<i>Oryzopsis hymenoides</i>	Indian ricegrass	Poaceae	N
<i>Pascopyrum smithii (Agropyron)</i>	Western wheatgrass	Poaceae	N
<i>Poa spp</i>	Bluegrass	Poaceae	N
<i>Poa bulbosa</i>	Bulbous bluegrass	Poaceae	I
<i>Poa pratensis</i>	Kentucky bluegrass	Poaceae	I
<i>Poa secunda</i>	Sandberg bluegrass	Poaceae	N
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass	Poaceae	N
Perennial Forbs			
<i>Achillea lanulosa</i>	Yarrow	Asteraceae	N
<i>Aconitum columbianum</i>	Monkshood	Helleboraceae	N
<i>Adenolinum lewisii (Linum)</i>	Wild flax	Linaceae	N
<i>Agastache urticifolia</i>	Nettleleaf giant hyssop	Lamiaceae	N

Scientific Name	Common Name	Family	Origin*
<i>Agoseris glauca</i>	Pale agoseris	Asteraceae	N
<i>Allium acuminatum</i>	Tapertip onion	Alliaceae	N
<i>Amerosedum lanceolatum</i>	Stonecrop	Crassulaceae	N
<i>Antennaria dimorpha</i>	Two-form pussytoes	Asteraceae	N
<i>Antennaria parvifolia</i>	Small leaf pussytoes	Asteraceae	N
<i>Aquilegia coerulea</i>	Colorado blue columbine	Ranunculaceae	N
<i>Arnica cordifolia</i>	Heartleaf arnica	Asteraceae	N
<i>Artemisia ludoviciana</i>	White sage	Asteraceae	N
<i>Astragalus argophyllus</i> var. <i>martinii</i>	Silverleaf milkvetch	Fabaceae	N
<i>Balsamorhiza sagittata</i>	Balsamroot	Asteraceae	N
<i>Boechera</i> spp.	Rockcress	Brassicaceae	N
<i>Calochortus gunnisonii</i>	Mariposa lily	Calochortaceae	N
<i>Castilleja linariifolia</i>	Narrowleaf Indian paintbrush	Scrophulariaceae	N
<i>Chaenactis douglasii</i>	Douglas pincushion	Asteraceae	N
<i>Chamaesyce</i> spp.	Sandmat	Euphorbiaceae	
<i>Chorispora tenella</i>	Blue mustard	Brassicaceae	I
<i>Cirsium clavatum</i> var. <i>osterhoutii</i>	Aspen thistle	Asteraceae	N
<i>Cirsium tracyi</i>	Tracy's thistle	Asteraceae	N
<i>Claytonia lanceolata</i>	Western spring beauty	Montiaceae	N
<i>Collinsia parviflora</i>	Blue-eyed Mary	Plantaginaceae	N
<i>Comandra umbellata</i> subsp. <i>pallida</i>	Comandra	Santalaceae	N
<i>Cymopterus planosus</i>	Rocky Mountain spring parsley	Apiaceae	N
<i>Eremogone congesta</i>	Ballhead sandwort	Alsiniaceae	N
<i>Delphinium nuttallianum</i>	Nuttall's larkspur	Ranunculaceae	N
<i>Erigeron flagellaris</i>	Running fleabane	Asteraceae	N
<i>Erigeron speciosus</i>	Aspen fleabane	Asteraceae	N
<i>Eriogonum lonchophyllum</i>	Spearleaf buckwheat	Polygonaceae	N
<i>Eriogonum umbellatum</i>	Wild buckwheat	Polygonaceae	N
<i>Erodium cicutarium</i>	Filaria	Geraniaceae	I
<i>Erythronium grandiflorum</i>	Avalanche lily	Liliaceae	N
<i>Fragaria virginiana</i> subsp. <i>glauca</i>	Mountain strawberry	Rosaceae	N
<i>Frasera speciosa</i>	Monument plant	Gentianaceae	N

Scientific Name	Common Name	Family	Origin*
<i>Galium septentrionale</i>	Northern bedstraw	Rubiaceae	N
<i>Geranium viscosissimum</i>	Sticky purple geranium	Geraniaceae	N
<i>Geum triflorum (Erythrocoma triflora)</i>	Prairie smoke	Rosaceae	N
<i>Helianthella quinquenervis</i>	Aspen sunflower	Asteraceae	N
<i>Heliomeris multiflora</i>	Showy goldeneye	Asteraceae	N
<i>Heracleum sphondylium subsp. montanum</i>	Cow parsnip	Apiaceae	N
<i>Heterotheca villosa</i>	Hairy false goldenaster	Asteraceae	N
<i>Ipomopsis aggregata</i>	Scarlet gilia	Polemoniaceae	N
<i>Ligusticum porteri</i>	Osha	Apiaceae	N
<i>Lithospermum ruderales</i>	Western stoneseed	Boraginaceae	N
<i>Lupinus argenteus</i>	Silvery lupine	Fabaceae	N
<i>Lomatium dissectum</i>	Giant lomatium	Apiaceae	N
<i>Lygodesmia grandiflora</i>	Largeflower skeletonweed	Asteraceae	N
<i>Mertensia brevistyla</i>	Shortstyle bluebells	Boraginaceae	N
<i>Oenothera caespitosa</i>	Evening primrose	Onagraceae	N
<i>Orobanche uniflora</i>	Broomrape	Orobanchaceae	N
<i>Osmorhiza occidentalis</i>	Western sweet cicely	Apiaceae	N
<i>Packera multilobata</i>	Lobeleaf groundsel	Asteraceae	N
<i>Packera streptanthifolius</i>	Rocky Mountain groundsel	Asteraceae	N
<i>Pedicularis bracteosa</i>	Payson's lousewort	Orobanchaceae	N
<i>Penstemon osterhoutii</i>	Osterhout's penstemon	Plantaginaceae	N
<i>Penstemon strictus</i>	Rocky Mountain penstemon	Scrophulariaceae	N
<i>Phacelia heterophylla</i>	Varileaf phacelia	Boraginaceae	N
<i>Physaria floribunda</i>	Pointtip twinpod	Brassicaceae	N
<i>Phlox multiflora</i>	Mountain phlox	Polemoniaceae	N
<i>Psilochenia acuminata</i>	Tapertip hawksbeard	Asteraceae	N
<i>Solidago velutina</i>	Threenerve goldenrod	Asteraceae	N
<i>Streptanthus cordata var. cordata</i>	Heartleaf twistflower	Brassicaceae	N

Scientific Name	Common Name	Family	Origin*
<i>Thalictrum fendleri</i>	Fendler meadowrue	Thalictraceae	N
<i>Valeriana edulis</i>	Edible valerian	Valerianaceae	N
<i>Vicia americana</i>	American vetch	Fabaceae	N
<i>Viola vallicola</i>	Lanceleaf violet	Violaceae	N
<i>Virgulaster ascendens</i>	Longleaved aster	Asteraceae	N
<i>Zigadenus elegans</i>	Death camas	Menyanthaceae	N
Cacti			
<i>Opuntia fragilis</i>	Brittle prickly pear	Cactaceae	N
<i>Echinocereus triglochidiatus</i>	King's crown cactus	Cactaceae	N
<i>Pediocactus simpsonii</i>	Mountain cactus	Cactaceae	N
Annual/Biennial Forbs			
<i>Alyssum alyssoides</i>	Yellow alyssum	Brassicaceae	I
<i>Androsace septentrionalis</i>	Rock jasmine	Primulaceae	N
<i>Machaeranthera tanacetifolia (Dieteria)</i>	Biennial tansy aster	Asteraceae	N
<i>Sisymbrium altissimum</i>	Tall tumbled mustard	Brassicaceae	I
Origin:			
N-Native			
I-Introduced			