

Biological Survey of Eagle Rock Ranch, Park County, Colorado



WARNER COLLEGE
OF NATURAL RESOURCES
COLORADO STATE UNIVERSITY

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.

Colorado Natural Heritage Program
Warner College of Natural Resources
Colorado State University

Report Prepared for:
The Gottenborg Family
Eagle Rock Ranch

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EXECUTIVE SUMMARY

Eagle Rock Ranch is a working cattle ranch and hay operation in the Tarryall Creek Valley, in Park County, Colorado, stewarded by Jean and Dave Gottenborg and family. Eagle Rock Ranch lies within the South Platte River Basin in the Southern Rockies Level III Ecoregion and Grassland Parks Level IV Ecoregion in the South Park Basin. No plants of special conservation concern had been previously recorded for this property, but a mapped Colorado Natural Heritage Program (CNHP) Potential Conservation Area covers a portion of the ranch and a second CNHP Potential Conservation Area was located 1.2 kilometers to the southeast. A baseline inventory for plants, wildlife, and natural plant communities was conducted in the summer of 2023 utilizing visual encounter surveys and targeting rare, at-risk species, and communities.

Eagle Rock Ranch lies in a mostly unfragmented landscape of natural lands, and the open lands of the ranch provide an important corridor for animal and vegetation dispersal. A diversity of habitats, including wetlands, grasslands, and rock outcrops, support a high degree of biodiversity and harbors high quality plant species and five vascular plant species of conservation concern. Four of these plant species are regional endemics, considered to be globally and state vulnerable (G3, see Appendix 2 for criteria). These include Pale Blue-eyed Grass (*Sisyrinchium pallidum*), Colorado Tansy-aster (*Xanthisma coloradoense*), Grassyslope Sedge (*Carex oreocharis*), and Fendler Cloak-fern (*Argyrochosma fendleri*). Rocky Mountain Ragwort (*Packera debilis*), a state imperiled species, was also recorded at the Ranch. Riparian, irrigated, and ground-water fed wetlands on the Ranch support significant wildlife and ecological functions in the arid environment of South Park. Aquatic insects in Tarryall Creek within the ranch from the Ephemeroptera and Trichoptera orders are a testament to the ecological quality of the landscape and the creek's water quality within the ranch. A diverse assemblage of birds and the largely intact bird community are a further indication of good ecological integrity found at the ranch. Four species of wildlife that are either rare or vulnerable in Colorado, that are not tracked by CNHP but that should be considered in conservation planning efforts, included the Acute Bladder Snail (*Physa acuta*), Great Blue Heron (*Ardea herodias*), Olive-sided Flycatcher (*Contopus cooperi*), and Western Tiger Salamander (*Ambystoma mavortium*). The most significant findings were the occurrence of three CNHP tracked species, the Bald Eagle (*Haliaeetus leucocephalus*), Prairie Falcon (*Falco mexicanus*), and Veery (*Catharus fuscescens*).

Care should be taken to avoid excessive disturbance to the landscapes through livestock grazing or ranching operations. Current grazing practices have resulted in a landscape that is in a natural state, supporting an abundance and diversity of wildlife and significant vegetation, including populations of Colorado Tansy-aster and upland grassland habitats of excellent condition. An important consideration for the ranch is to promote management activities supporting movement corridors for the ungulate community. CPW SAM maps indicate that the ranch overlaps important migration corridors for Elk and Pronghorn, contains foraging habitat for those species and for Bighorn Sheep, and potentially Mule Deer. The conservation value of the natural vegetation and wildlife habitat preserved by this working ranch cannot be overstated.

ACKNOWLEDGEMENTS

Funding for this project was supported by a generous donation from Eagle Rock Ranch to the Colorado Natural Heritage Program. Thanks also go to Trista Crook, CNHP Botanist, Stacey Anderson, CNHP volunteer, and CNHP Siegele Conservation Science Interns, River Blessing, Elias Casteneda, and Grant Musgrave for their assistance in the field. Pam Smith, CNHP Botanist, provided critical assistance with plant identification and knowledge related to weed treatment. Trista Crook provided identification of lichen specimens and Stacey Anderson provided identification of and reporting on moss species. Georgia Doyle, CNHP Botanist, and Jeremy Siemers, CNHP Zoology Team Lead, were responsible for integrating results with the CNHP Biotics database.

We would also like to thank the following CNHP staff: Dave Anderson, Amy Greenwell, and Michael Menefee for their administrative and technical support of the project. This project contributed to CNHP's biological assessment of the state of Colorado and contributed important data to CNHP's Biotics Database.

ABOUT CNHP

The Colorado Natural Heritage Program (CNHP) was created in 1979 (then known as the Colorado Natural Features Inventory) to identify and describe areas of statewide and global conservation significance and to educate decision makers regarding the impacts of various land use options. In 1994, CNHP moved from the Museum of Natural History at the University of Colorado to our current home in the Warner College of Natural Resources at Colorado State University. We currently have a staff of over 40 botanists, ecologists, zoologists, spatial analysts, database developers, and conservation planners.

CNHP is Colorado's only comprehensive source of information on the status and location of Colorado's rarest and most threatened species and plant communities. We share information with a wide range of stakeholders in partnerships that work to ensure that Colorado's biodiversity resources are not diminished. CNHP has an enormous impact on conservation in Colorado through these partnerships.

CNHP tracks and ranks Colorado's rare and imperiled species and habitats and provides scientific information and expertise to promote the conservation of Colorado's wealth of biological resources. Our staff scientists conduct inventories for rare animals, plants, wetlands, riparian areas, and plant communities at the scale of a single parcel all the way to an entire county. Identifying and describing locations of Colorado's rarest species and habitats is critical for supporting conservation activities statewide. Information from these projects has been instrumental in some of Colorado's biggest conservation successes over the past 30 years, such as the Mountains-to-Plains project in Larimer County and the enlargement of Great Sand Dunes National Park and Preserve in Southern Colorado (<https://cnhp.colostate.edu/>).

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INTRODUCTION

Eagle Rock Ranch is a working cattle ranch and hay operation in Park County, Colorado stewarded by Jean and David Gottenborg and family. The ranch is comprised of two disjunct parcels (Figure 1, Appendix 1: Legal Description). The northern parcel, approximately 710 acres in size, is in the Tarryall Creek Valley, located off County Road 77, approximately 12 miles southwest of the town of Jefferson, CO. The parcel lies less than a mile upstream of the Tarryall Reservoir and is bordered by the Tarryall Reservoir State Wildlife Area (SWA), owned and managed by Colorado Parks & Wildlife, on the southeast and northwest sides. The parcel is bordered by the Pike National Forest (USFS) lands on the remaining sides. The southern parcel of the ranch, approximately 2,109 acres in size, is located 1.5 miles south of the northern parcel. This parcel is bordered by private lands on the north, west and south sides, and by Pike National Forest on the eastern edge. The northern parcel contains the main house and working ranch buildings, irrigated hay meadows along Tarryall Creek, two agricultural ponds, and stock pond scrapes along Ruby Gulch to the south. Cattle graze both the northern and southern parcels during summer months. Haying occurs in the wet meadow on the northern parcel in late summer.

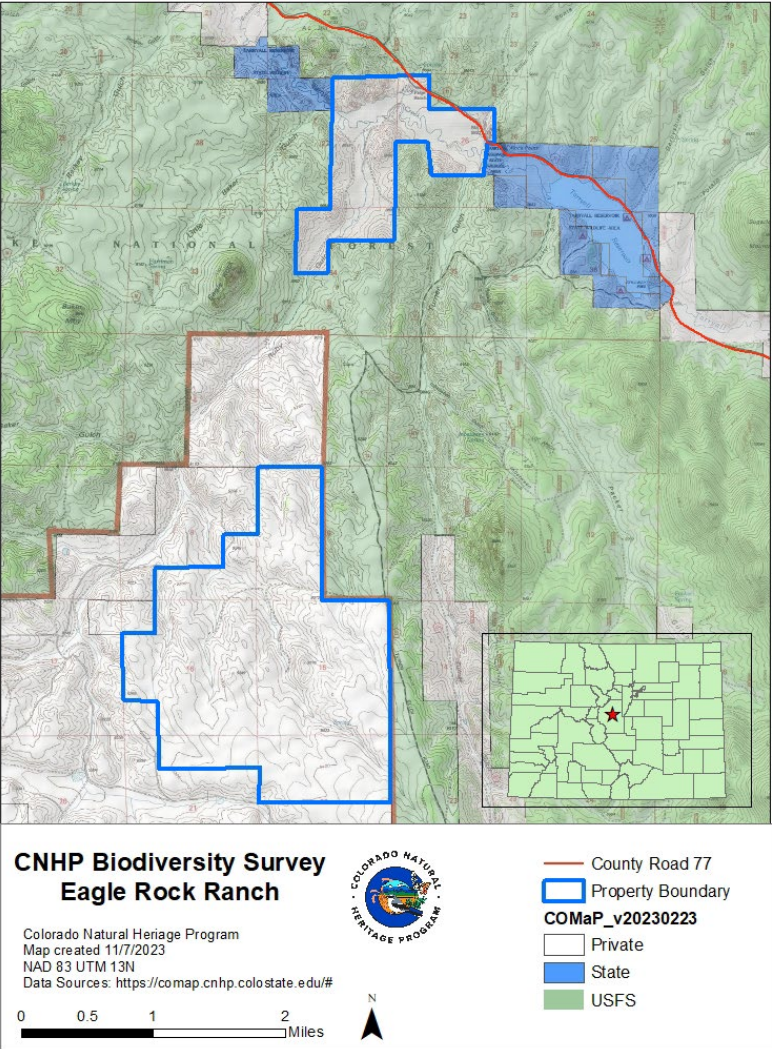


Figure 1. Location of Eagle Rock Ranch in Park County, Colorado.

Site Description

Eagle Rock Ranch lies within the South Platte River Basin in the Southern Rockies Level III Ecoregion and Grassland Parks Level IV Ecoregion (EPA 2023) in the South Park Basin of Colorado. The South Park Basin is a high elevation grassland bounded on the north, east and south by the Front Range, specifically the Tarryall Mountains and Puma Hills to the east and the Black and Thirty-nine Mile Mountains to the south, and on the west by the Mosquito Range (Spackman 2000). The northern parcel of Eagle Rock Ranch lies at an elevation varying from 8,918 – 9,100 ft (2,718 – 2,773 meters) and the southern parcel 9,148 – 9,480 ft (2,788 – 2,889 meters), placing these parcels in the montane life zone (Mutel and Emerick 1992). Soils are from the Guffey series (northern parcel) and Chittum (southern parcel). Guffey soils are moderately deep, well drained, formed in Colluvium over residuum derived from granodiorite and granite (https://soilseries.sc.egov.usda.gov/OSD_Docs/G/GUFFEY.html). Chittum series soils are well drained soils that are shallow to hard bedrock. They are formed in material weathered from sandstone (https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CHITTUM.html). The northern parcel and part of the southern parcel is underlain with biotitic gneiss, schist and migmatite, aged 1,700-1,800 million years old). The southern parcel also is underlain by quartzite, conglomerate and interlayered mica schist and igneous Wall Mountain Tuff, aged 35-36 million years old (Tweto 1979). Eagle Rock, a prominent landmark, lies just southwest of the northern parcel (Figure 2).

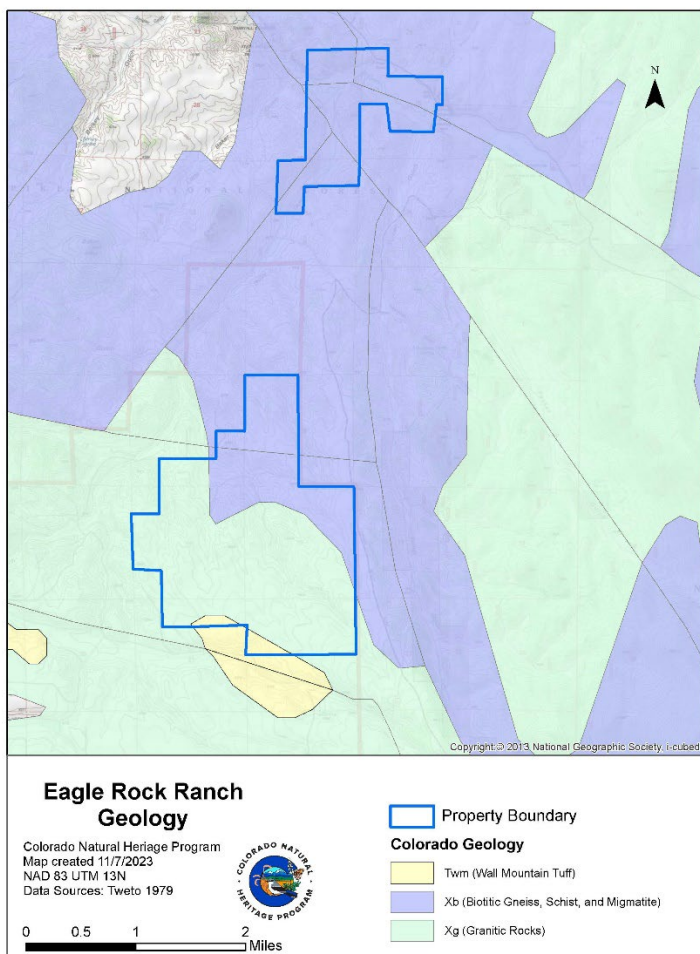


Figure 2. Geology of Eagle Rock Ranch in Park County, Colorado.

No plants of special conservation concern had been previously recorded for this property, but a mapped CNHP Potential Conservation Area ([South Park PCA](#), Very High Biodiversity Significance) covers a portion of the southern parcel and a second CNHP Potential Conservation Areas ([Ruby Creek PCA](#), High Biodiversity Significance) is located 1.2 kilometers to the southeast of the southern parcel (Spackman 2000, 2001). Potential Conservation Areas are created by CNHP based on mapping of rare species and natural plant communities; they highlight areas in the state contributing to Colorado’s biological diversity (Appendix 2). The South Park PCA contains significant biodiversity including extreme rich fens and tracked species of Mountain Plover, Pale Blue-eyed Grass (*Sisyrinchium pallidum*), Colorado Tansy-aster (*Xanthisma coloradoense*) and montane grasslands (*Festuca arizonica* – *Muhlenbergia filiculmis* grassland). The Ruby Creek PCA contains an excellent occurrence of a globally vulnerable plant species, Grassyslope Sedge (*Carex oreocharis*).

Available landcover data products, created from remote sensing using aerial imagery, were used to investigate the ecological systems on the property (Table 1, Figure 3 & 4) (Lowry et al. 2005). Ecological systems are recurring groups of biological communities found in similar physical environments and influenced by similar dynamic processes such as flooding or fire (Decker et al. 2020). For a guide to Colorado’s ecosystems, see <https://www.coloradovirtuallibrary.org/resource-sharing/state-pubs-blog/colorados-ecosystems/>. Landcover in the northern parcel included upland grasslands, hayfields (denoted as Agriculture on Figure 3), and a small component of shrubland and woodland, whereas the southern parcel included a large component of grasslands with pockets of wet meadows, riparian shrubland and sagebrush steppe. Because mapping is based on remote imagery, dominant vegetation is not always correctly identified (e.g., ponderosa pine and Gambel oak were not identified in vegetation surveys on the property, but were identified in the regional, remote imagery data products available for mapping on Figure 3 and 4).

Table 1. Landcover classifications by parcel on Eagle Rock Ranch.

Parcel	VEGETATION	SIZE IN ACRES
Northern Parcel	Southern Rocky Mountain Montane-Subalpine Grassland	475
	Agriculture (Irrigated Hay Meadow)	188
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	10
	Rocky Mountain Aspen Forest and Woodland	9
	Rocky Mountain Ponderosa pine Woodland	7
	Rocky Mountain Alpine-Montane Wet Meadow	4
Southern Parcel	Southern Rocky Mountain Montane-Subalpine Grassland	2,142
	Rocky Mountain Gambel Oak-Mixed Shrubland	9
	Rocky Mountain Alpine-Montane Wet Meadow	7
	Rocky Mountain Subalpine-Montane Riparian Shrubland	3
	Rocky Mountain Subalpine-Montane-Limber-Bristlecone Pine Woodland	1
	Inter-Mountain Basins Montane Sagebrush Steppe	1

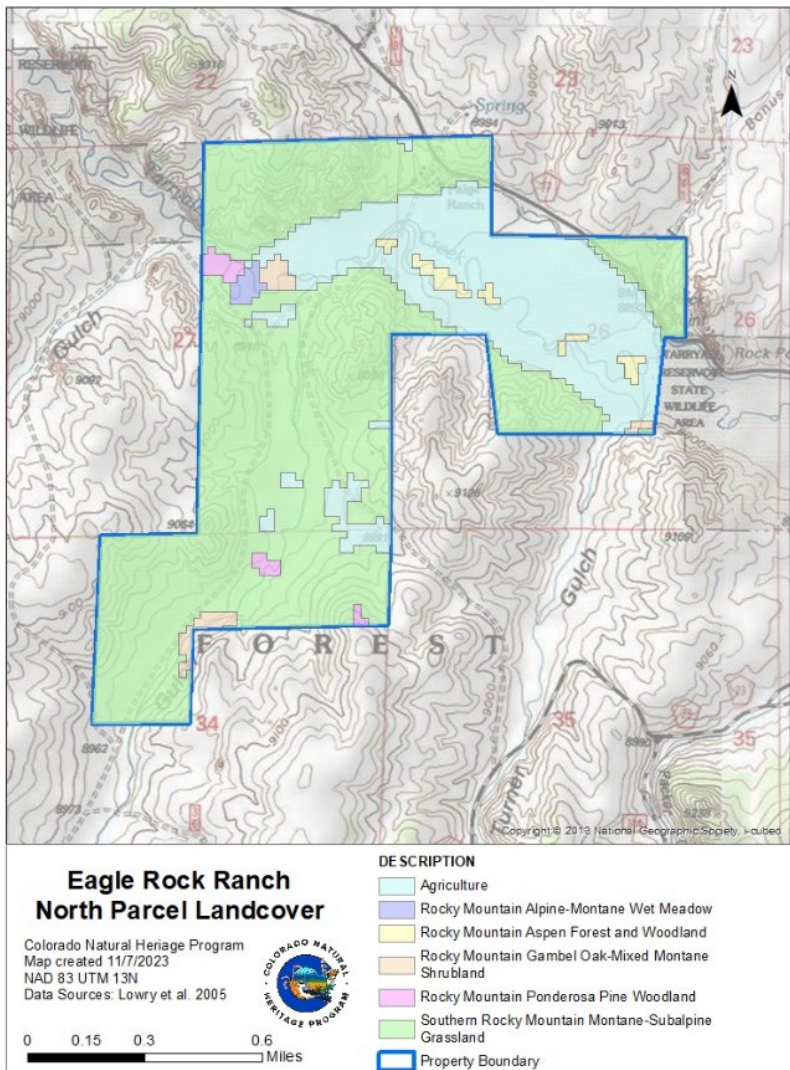


Figure 3. Landcover classification, based on remote imagery, on northern Eagle Rock Ranch parcel.

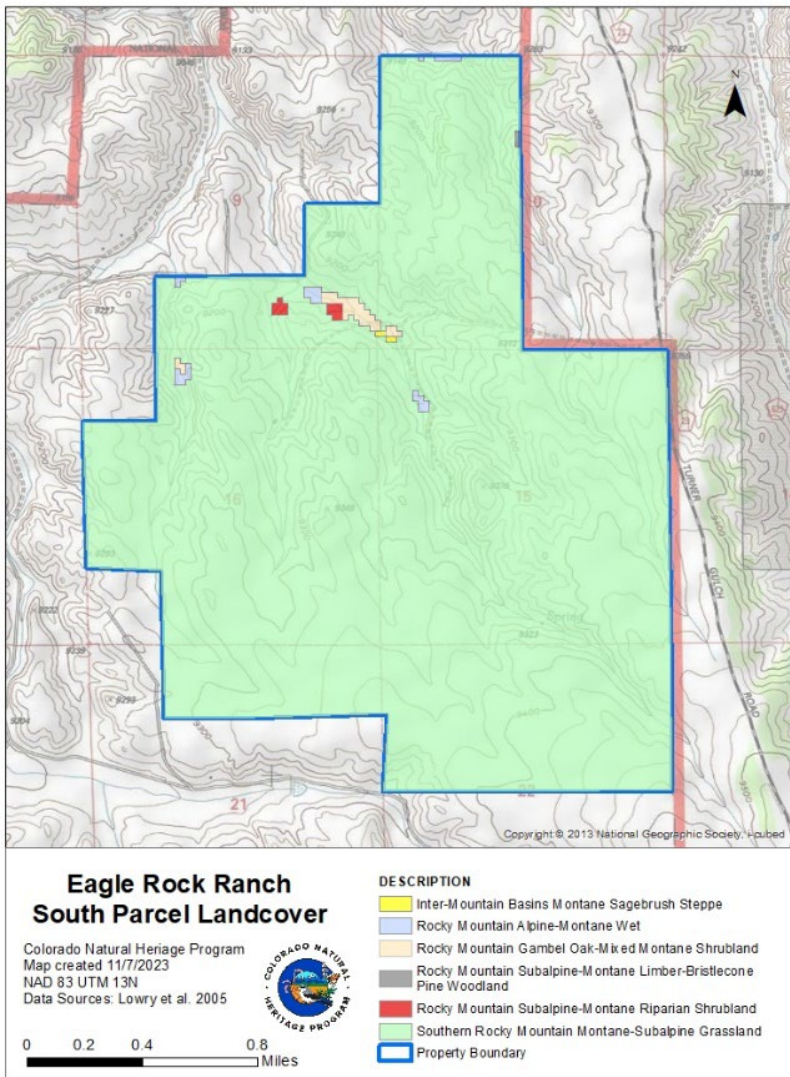


Figure 4. Landcover classification, based on remote imagery, on southern Eagle Rock Ranch parcel.

Remote sensing also identified wetlands on both parcels of the property. Wetland types included Palustrine Wetlands (non-channelized wetlands) with both Emergent Herbaceous and Shrub-Scrub classifications, a small amount of Riverine Shrub-Scrub wetlands (shrub-dominated wetlands in a channelized waterway) and wetlands classified as Ponds (NWI 2019, Cowardin et al. 1979) (Figures 5 and 6). On the north parcel, the irrigated hay meadow and vegetation along Ruby Gulch and Tarryall Creek were identified as wetlands, along with agricultural ponds. On the southern parcels, both emergent herbaceous, shrub-scrub wetlands, and ponds were identified. These wetlands on the southern parcel and wetlands along Ruby Gulch in the northern parcel are particularly important as they are ground-water fed and support significant wildlife and ecological functions in the arid environment of South Park.

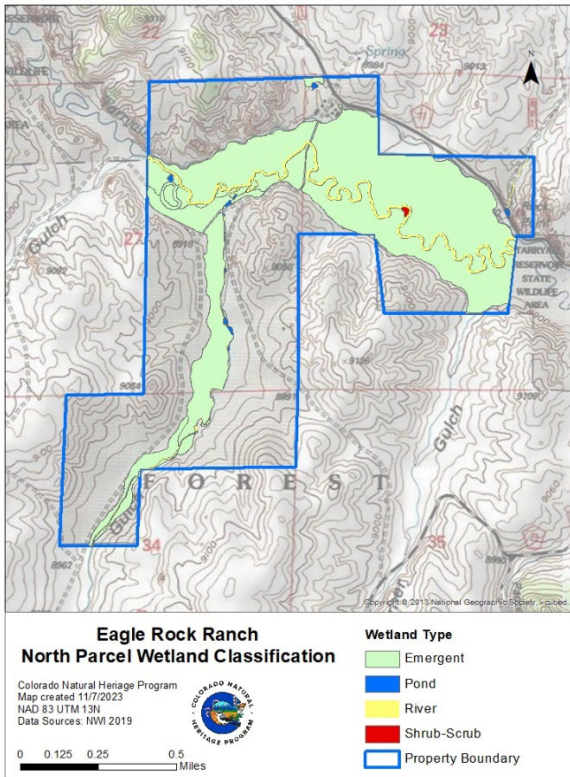


Figure 5. Wetland classification, based on remote imagery, on northern Eagle Rock parcel.

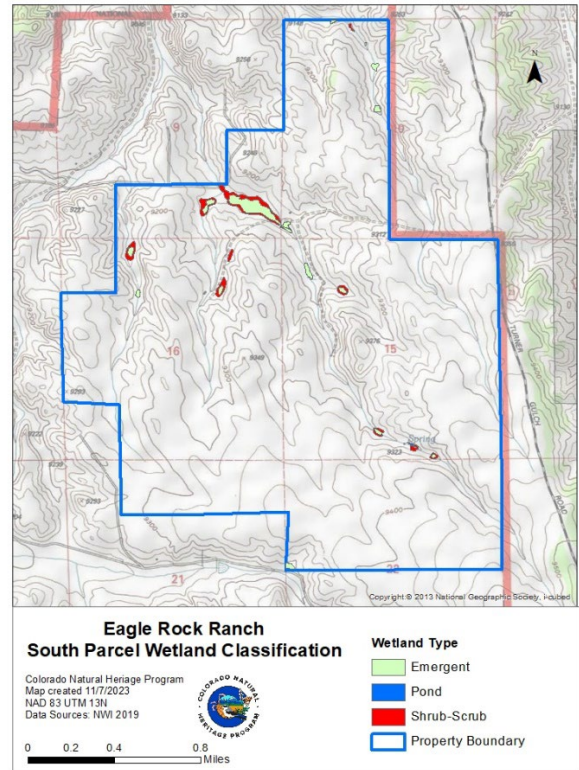


Figure 6. Wetland classification, based on remote imagery, on southern Eagle Rock parcel.

METHODS

A baseline inventory for plants, wildlife, and natural plant communities was conducted utilizing visual encounter surveys and targeting rare, at-risk species, and communities. These surveys involved identifying target survey areas based on aerial imagery and models of [Plants of Greatest Conservation Need](#) (Decker et al. 2023, CPW 2015) prior to field work (Figure 7 and 8), then walking each survey site in the field, recording the species encountered (Cutko 2009). This allowed surveyors to cover a greater area at each site and to perform more extensive search efforts in specific locations most suitable for rare taxon. For example, riparian zones and ponds where the rare amphibians listed in Table 2 would only occur were specifically targeted as were other locations particularly suitable for other wildlife species listed in Table 2. Qualitative encounter surveys were used because they tend to produce significantly more species identifications per unit effort, particularly for rare species, than do quantitative transect surveys (Guralnick et al. 2018, Jetz et al. 2019).

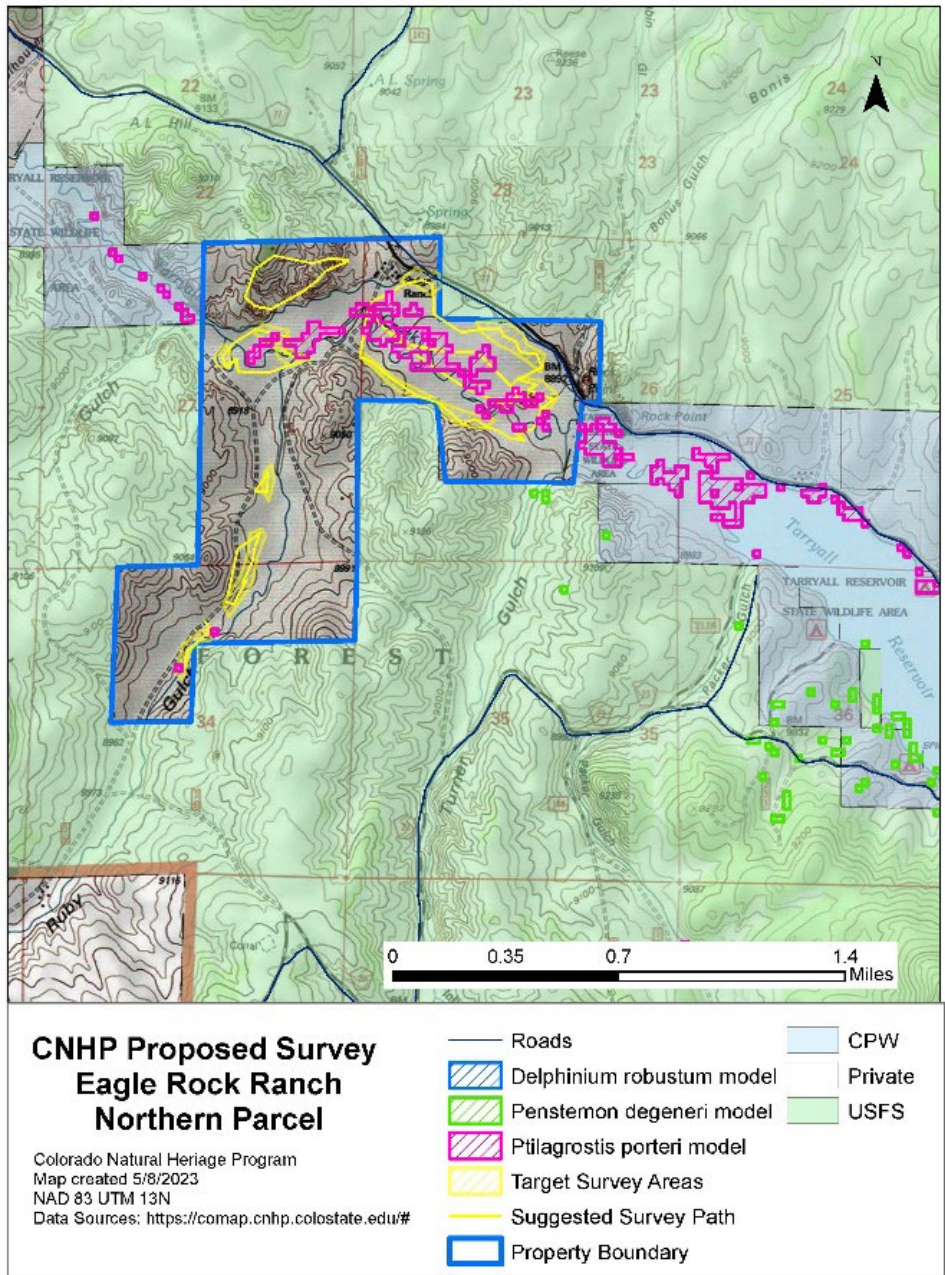


Figure 7. Target survey areas on the northern parcel of Eagle Rock Ranch, identified Spring 2023.

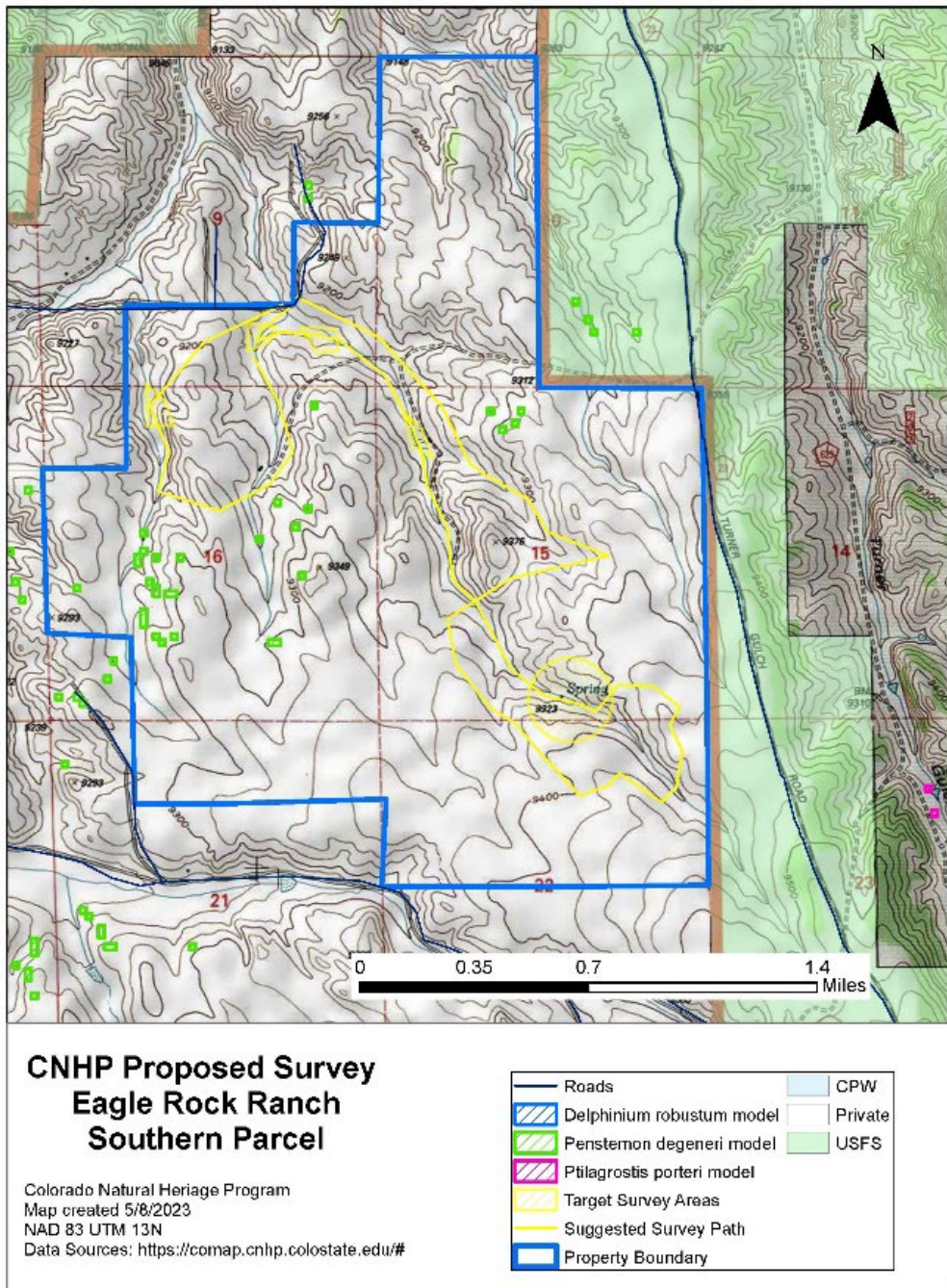


Figure 8. Target survey areas on the southern parcel of Eagle Rock Ranch, identified Spring 2023.

Wildlife Surveys: Methods

A target list of rare wildlife with potential to occur on the ranch was prepared using information from a literature review and data from the Colorado Natural Heritage Program Biotics database (Colorado Natural Heritage Program 2023a). The list of the animal target species developed for this survey is provided in Table 2.

Table 2. Surveyed ranch parcels rare wildlife target list. “FT” indicates Fully Tracked by CNHP and “WL” indicates Watchlisted by CNHP. See Appendix 2 for an explanation of Status column.

SCIENTIFIC NAME	COMMON NAME	TRACKING STATUS	STATUS
Amphibians			
<i>Anaxyrus boreas</i> pop. 1	Boreal Toad (Southern Rocky Mountain Population)	FT	G4T1T2QS1
<i>Lithobates pipiens</i>	Northern Leopard Frog	FT	G5S3
Birds			
<i>Accipiter gentilis</i>	Northern Goshawk	WL	G5S23B
<i>Aegolius funereus</i>	Boreal Owl	FT	G5S2
<i>Aquila chrysaetos</i>	Golden Eagle	WL	G5S3B
<i>Athene cunicularia</i>	Burrowing Owl		
<i>Buteo regalis</i>	Ferruginous Hawk	FT	G4S3B, S4N
<i>Catharus fuscescens</i>	Veery	WL	G5S3B
<i>Charadrius montanus</i>	Mountain Plover	FT	G3S2B
<i>Charadrius nivosus nivosus</i>	Western Snowy Plover		G3T3S1B
<i>Falco mexicanus</i>	Prairie Falcon	WL	G5S4B, S4N
<i>Falco peregrinus anatum</i>	American Peregrine Falcon		G4T4S2B
<i>Haliaeetus leucocephalus</i>	Bald Eagle	FT	G5S3B, S3N
<i>Lagopus leucura</i>	White- tailed Ptarmigan	FT	G5S4
<i>Leucosticte australis</i>	Brown-capped Rosy-Finch	FT	G4S3B, S3N
<i>Pelecanus erythrorhynchos</i>	American White Pelican	FT	G4S1B
<i>Phalaropus tricolor</i>	Wilson's Phalarope	FT	G5S4B, S4N
<i>Plegadis chihi</i>	White- faced Ibis	FT	G5S2B
Fish			
<i>Etheostoma exile</i>	Iowa Darter	FT	G5S3
<i>Oncorhynchus clarkia</i>	Cutthroat Trout	FT	G5S4
Lepidoptera			
<i>Chelis brucei</i>	A Tiger Moth	FT	G4
<i>Ethmia orestella</i>	A Glass Miner Moth	FT	GNR
<i>Hesperia leonardus montana</i>	Pawnee Montane Skipper	FT	G4T1
<i>Ochrotrichia susanae</i>	Susan's Purse-making Caddisfly	FT	G1
<i>Oeneis alberta</i>	Alberta Arctic	FT	G5
<i>Oeneis polixenes</i>	Polixenes Arctic	FT	G5
<i>Pictetiella expansa</i>	A Stonefly	FT	G3G4
<i>Polites rhesus</i>	Rhesus Skipper	FT	G4
<i>Pyrgus xanthus</i>	Xanthus Skipper	FT	G3
<i>Suwallia wardi</i>	A Stonefly	FT	G3
Mammals			
<i>Corynorhinus townsendii pallescens</i>	Townsend's Big- eared Bat Subsp	FT	G4T3T4S2
<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	FT	G3?S5
<i>Lasionycteris noctivagans</i>	Silver- haired Bat	FT	G3G4S3S4
<i>Lasiurus cinereus</i>	Hoary Bat	WL	G3G4S3S4B
<i>Lynx canadensis</i>	Lynx	FT	G5S1
Odonata			
<i>Lestes alacer</i>	Plateau Spreadwing	FT	G5S2S3

Systematic ground searches were conducted by CNHP Wildlife Biologist John Sovell on July 12 and 13, 2023. The systematic ground searches consisted of surveying each of the two ranch parcels (Figure 1).

The investigator walked each survey site at a slow pace to find amphibians, song birds, mammals, raptors, raptor sign (nests, whitewash, prey remains, molted feathers, plucking posts), reptiles, and insects. Butterflies were captured when possible with a sweep net and identified to species. Search efforts in specific habitats most suitable for rare taxon were emphasized during the ground surveys.

Field notations were recorded in a field notebook during the field survey. The information recorded included the location, date, UTM coordinates (collected in NAD 83, Zone 13) for any observations of CNHP tracked wildlife, active or inactive raptor nests, and signs of raptor activity including the occurrence of whitewash.

To evaluate trends over time in the bird community at the ranch between the current year's survey and any future surveys, we calculated a Bird Index of Biotic Integrity (IBI) (O'Connell et al. 2003). Avian guilds, or groups of species fulfilling similar roles in the environment, are diverse and can be utilized for assessing response to environmental changes and ecosystem stressors. These guilds can be defined based on foraging behavior and substrate, nesting substrate, migratory distance, and various other life history traits. An example is the Bald Eagle (*Haliaeetus leucocephalus*) fulfilling the role of an apex predator that feeds on fish living in shallow waters as well as rabbits, ground squirrels, raccoons, and young deer. Changes in ecological condition can variably impact avian guilds, resulting in alterations to the bird community (Johnson 2014). Indices of bird biological integrity (IBIs), yield a quantitative metric that can be used to define the ecological integrity of a sampled area based on the avian community present. IBIs assume that changes in habitat quality or extent, upon which a specific guild is dependent, result in corresponding changes in the representation of that guild within the overall bird community. Within the IBI, guilds are ranked based on specialization, with specialist guilds receiving higher weight over generalist guilds. This ability to use the bird community to reflect ecological condition, particularly in urban areas where impacts can be multi-faceted, provides a valuable and informative indicator for monitoring programs (Johnson 2014).

The bird IBI used here is based on the methodology developed for bird communities of the mid-Atlantic Highlands. It is important to note that the bird IBI was modified from O'Connell et al. (2003) to reflect the land-use and habitat types found on the ranch (e.g., grasslands, shrublands, riparian areas, and rocky ridges). Specialist guilds included in the IBI tend to be associated with extensive grass, tree, and riparian cover. Therefore, higher IBI scores reflect bird communities associated with aspects of mature grasslands, shrublands, riparian area, function, and composition. For example, sites with higher bird IBI scores consist of a bird community with more grassland and riparian-dependent species, ground gleaners, long distance migrants, and single-brooded or open ground nesters (i.e., specialists) but with fewer omnivores, exotic/non-natives, nest predators/brood parasites, temperate migrants, and resident species (i.e., generalists). The biotic or ecological "condition" described by the bird IBI then moves along a disturbance gradient from relatively intact, extensive, mature grass, shrub, and riparian land with high IBI scores to more disturbed, developed, or urban areas with low IBI scores. The response guilds incorporated into the bird IBI are listed in Table 3. An extensive discussion for why these guilds are chosen over others can be found in Appendix E of Marshall et al. (2016).

The IBI score represents the sum of the rank scores; scores determined by the proportion of species detected in each specialist and generalist guild at the ranch. An example of the ranking protocol for one specialist and one generalist guild are presented in Table 4. The integrity represented by the IBI score is based upon a theoretical bird community of the highest integrity at the ranch receiving a maximum IBI

score of 58 and the theoretical minimum community, a score of 13.5, which corresponds to species from “specialist guilds” being detected at their highest ranked proportion and species from “generalist guilds” being detected at their lowest ranked proportion (Table 4). These two scores are standardized by dividing by the maximum score of 58 to give a range from 0.23 to 1. Threshold levels for bird IBI scores were defined by O’Connell et al. (2003) who established thresholds that include four categories of condition corresponding to the proportional species richness of each specialist and generalist guild. For the bird IBI score at the ranch these thresholds include the following categories:

- naturalistic (highest integrity) – score of 0.81-1.00;
- largely intact (high integrity) – score of 0.62-0.80;
- moderately disturbed (medium integrity) – score of 0.43-0.61; and
- humanisitic (low integrity) – score of 0.23-0.42.

Table 3. Bird species guilds used to calculate IBI scores.

Biotic Integrity Element	Guild Category	Response Guild	Number of Species in Guild	Guild Classification
Functional	Trophic	omnivore	16	generalist
	Insectivore Foraging Behavior	ground gleaner	9	specialist
		aerial screener	5	specialist
Compositional	Origin	exotic/non-native	0	generalist
	Migration Status	resident	12	generalist
		temperate migrant	17	generalist
		Tropical migrant	5	
	Number Of Broods	single-brooded	13	specialist
	Population Limiting	nest predator/brood parasite	4	generalist
Structural	Nest Placement	ground nester	11	specialist
		shrub nester	6	generalist
	Primary Habitat	grassland dependent	3	specialist
		riparian obligate	7	specialist

Table 4. Guilds and ranking system for two of the six trophic guilds used to calculate bird IBI scores based on O'Connell et al. (2003). The specialist guild is indicated with an asterisk (*) and the other is a generalist guild.

Guild	Proportion of species detected	Rank
omnivore	0.000 - 0.290	5.0
	0.291 - 0.410	4.0
	0.411 - 0.480	3.0
	0.481 - 0.580	2.0
	0.581 - 1.000	1.0
bark prober*	0.000 - 0.060	1.5
	0.061 - 0.110	3.0
	0.111 - 0.170	4.0
	0.171 - 1.000	5.0

Plant Surveys: Methods

Prior to conducting fieldwork, we developed a target list of vascular plant species of special conservation interest developed from data from literature review, the Colorado Natural Heritage Program Biotics database (Colorado Natural Heritage Program 2023a), and a project report using CODEX (Colorado Natural Heritage Program 2023b). The list of target plant species and plant communities developed for this survey is provided in Table 5. Additionally, identification of bryophyte and lichen species encountered was targeted. Systematic ground searches were conducted by CNHP Botanist Jessica Smith with CNHP Siegele Conservation Science interns and bryologist Stacey Anderson, a CNHP volunteer, on June 8, 2023, and again by CNHP Botanist Jessica Smith and CNHP Botany Technician, Trista Crook, July 12 – 14, 2023. Survey dates were chosen to maximize the number of plant species detectable across a range of phenological states.

Table 5. Surveyed rare plant community and plant survey target list. If available, hyperlinked scientific names link to the online Colorado Rare Plant Guide (Colorado Natural Heritage Program 2023c) or NatureServe Explorer Profile (NatureServe 2023). See Appendix 2 for an explanation of the Status column.

SCIENTIFIC NAME	COMMON NAME	FAMILY	STATUS
Plants			
Argyrochosma fendleri	Fendler Cloak-fern	Pteridaceae	G3/S3
Asclepias hallii	Hall's Milkweed	Apocynaceae	G3/S3
Astragalus bodinii	Bodin's Milkvetch	Fabaceae	G4/S2
Astragalus leptaleus	Park Milkvetch	Fabaceae	G3G4/S2
Carex oreocharis	Grassyslope Sedge	Cyperaceae	G3/S3
Delphinium robustum	Wahatoya Creek Larkspur	Ranunculaceae	G2G3/S2?, SWAP Tier 2
Lomatogonium rotatum	Marsh Feltwort	Gentianaceae	G5/S2
Packera debilis	Rocky Mountain Ragwort	Asteraceae	G4/S2S3
Penstemon degeneri	Degener Beardtounge	Plantaginaceae	G2G3/S2S3, SWAP Tier 2, BLM, USFS
Primula eagalikensis	Greenland Primrose	Primulaceae	G4G5/S2

SCIENTIFIC NAME	COMMON NAME	FAMILY	STATUS
<i>Ptilagrostis porteri</i>	Porter Feathergrass	Poaceae	G2/S2, SWAP Tier 2, USFS
<i>Salix candida</i>	Silver Willow	Salicaceae	G5/S2, USFS
<i>Salix myrtilifolia</i>	Mountain Willow	Salicaceae	G5/S1, USFS
<i>Salix serissima</i>	Autumn Willow	Salicaceae	G5/S1, USFS
<i>Sisyrinchium pallidum</i>	Pale Blue-eyed Grass	Iridaceae	G3/S3, BLM
<i>Solidago ptarmicoides</i>	Prairie Goldenrod	Asteraceae	G5/S2
<i>Xanthisma coloradoense</i>	Colorado Tansy-aster	Asteraceae	G3/S3, USFS
Plant Communities			
<i>Carex aquatilis</i> – <i>Carex utriculata</i> Wet Meadow	Montane Wet Meadows	N/A	G4/S4
<i>Dasiphora fruticosa</i> ssp. <i>floribunda</i>/ <i>Deschampsia cespitosa</i> Wet Shrubland	Montane Riparian Shrubland	N/A	G4/S4
<i>Festuca arizonica</i> – <i>Muhlenbergia filiculmis</i> Grassland	Montane Grasslands	N/A	GU/S3
<i>Kobresia myosuroides</i> – <i>Thalictrum alpinum</i> Fen	Extreme Rich Fens	N/A	G2/S2
<i>Kobresia simpliciuscula</i> – <i>Trichophorum pumilum</i> Fen	Extreme Rich Fen	N/A	G2/S2
<i>Pinus aristata</i>/<i>Ribes montigenum</i> Woodland	Upper Montane Woodlands	N/A	G3/S2
<i>Salix monticola</i>/<i>Carex aquatilis</i> Wet Shrubland	Montane Riparian Willow Carr	N/A	G3/S3
<i>Salix monticola</i>/<i>Carex utriculata</i> Wet Shrubland	Montane Riparian Willow Carr	N/A	G3/S3
<i>Salix monticola</i>/<i>Mesic forbs</i> Wet Shrubland	Montane Riparian Willow Carr	N/A	G4/S4
<i>Salix monticola</i>/<i>Mesic graminoids</i> Wet Shrubland	Montane Riparian Willow Carr	N/A	G3/S3

Data collected on vegetation composition was used, along with a spatial analysis of the property, to assess the ecological integrity of wetlands on the southern and northern parcels using the [Ecological Integrity Assessment](#) (EIA) framework (Lemly et al. 2016) using a chosen assessment area. Additionally, the assessment area’s ecological integrity was also assessed using the quality of the vegetation with a [Floristic Quality Assessment](#) (FQA) (Smith et al. 2020, Rocchio 2007). The FQA assessment uses a “C-value” (Coefficient of Conservatism) which has been assigned to almost all species in Colorado by a panel of botanical experts. C-values range from zero to ten, with lower values assigned to plant species which tolerate disturbance and are more likely to be found in an environment altered from pre-European settlement conditions. Non-native species have been assigned a zero. Species assigned a ten are believed to be obligate species to high-quality natural areas. The EIA and FQA scores were used to compare the quality of Eagle Rock Ranch wetlands to other similar wetlands with plot data in the CNHP wetlands plot database (<https://cnhp.colostate.edu/cwic/>). Plot data was available for the CPW SWA to the east of Eagle Rock Ranch from a 2005 survey ([CNHP Wetland Plots Database, Plot 2-42 20050815](#)). This CPW parcel to the east is hayed but not grazed. A species list was also in the riparian wet meadow directly west of Eagle Rock Ranch on the CPW SWA parcel on 7/14/2023; this parcel is neither grazed nor hayed (D. Gottenborg, personal communication).

RESULTS

All the observed wildlife species were globally common (G5 or G4 NatureServe global rank) and most were also common in Colorado (S5 or S4 state rank). However, six species recorded during field surveys are rare or vulnerable in Colorado (S2 or S3 state rank). These six species included three CNHP tracked species, the Bald Eagle (*Haliaeetus leucocephalus*), Prairie Falcon (*Falco mexicanus*), and Veery (*Catharus fuscescens*); and three species not tracked by CNHP, the Acute Bladder Snail (*Physa acuta*), Great Blue Heron (*Ardea herodias*), and Western Tiger Salamander (*Ambystoma mavortium*) (Table 6 and Figure 9). CNHP tracked species are those species that have been identified as being the most at risk and most in need of inventory, protection, research, and management. Additionally, three birds observed at the ranch are considered Common Birds in Steep Decline, species identified by Partners in Flight (PIF) as still numerous or widely distributed, but that are experiencing troubling long-term declines (Table 6). PIF is a cooperative effort among federal, state, and local government agencies that identifies and assesses species of conservation 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). Most of the rare birds are probably nesting on ranch property, but it is unlikely that either of the two identified raptors are nesting on site, but rather are probably finding suitable foraging habitat on the ranch. The raptors are also probably utilizing the surrounding adjacent lands for foraging and potentially nesting.

Table 6. Rare bird species observed at Eagle Rock Ranch during field surveys.

COMMON NAME	SCIENTIFIC NAME	CNHP [*] RANK	LOCATION	TRACKING STATUS
Rare or Vulnerable Species in Colorado				
Bald Eagle	<i>Haliaeetus leucocephalus</i>	G5S3B, S3N	North Parcel in Ruby Gulch	fully tracked
Prairie Falcon	<i>Falco mexicanus</i>	G5S4B, S4N	Off Ranch east of South Parcel	watch listed
Veery	<i>Catharus fuscescens</i>	G5S3B	Tarryall Creek wet meadow	watch listed
Olive-sided Flycatcher	<i>Contopus cooperi</i>	G4S3S4B	North Parcel – south end in Ruby Guch	Not tracked
Great Blue Heron	<i>Ardea herodias</i>)	G5S3	North Parcel – south of Tarryall Creek	not tracked
Western Tiger Salamander	<i>Ambystoma mavortium</i>	G5S3	Ruby Gulch developed pond and developed pond on South Parcel near coral	not tracked
Acute Bladder Snail	<i>Physa acuta</i>	G5S2	Ruby Gulch developed pond	not tracked
Common Birds In Steep Decline				
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	G5S5B,S4N	North parcel – north end	not tracked
Horned Lark	<i>Eremophila alpestris</i>	G5S5B	North Parcel in Ruby Gulch	not tracked
Pine Siskin	<i>Spinus pinus</i>	G5S5	North Parcel – south end in highlands	not tracked

*Information on the Global, State, and Federal rankings is provided in Appendix 2.

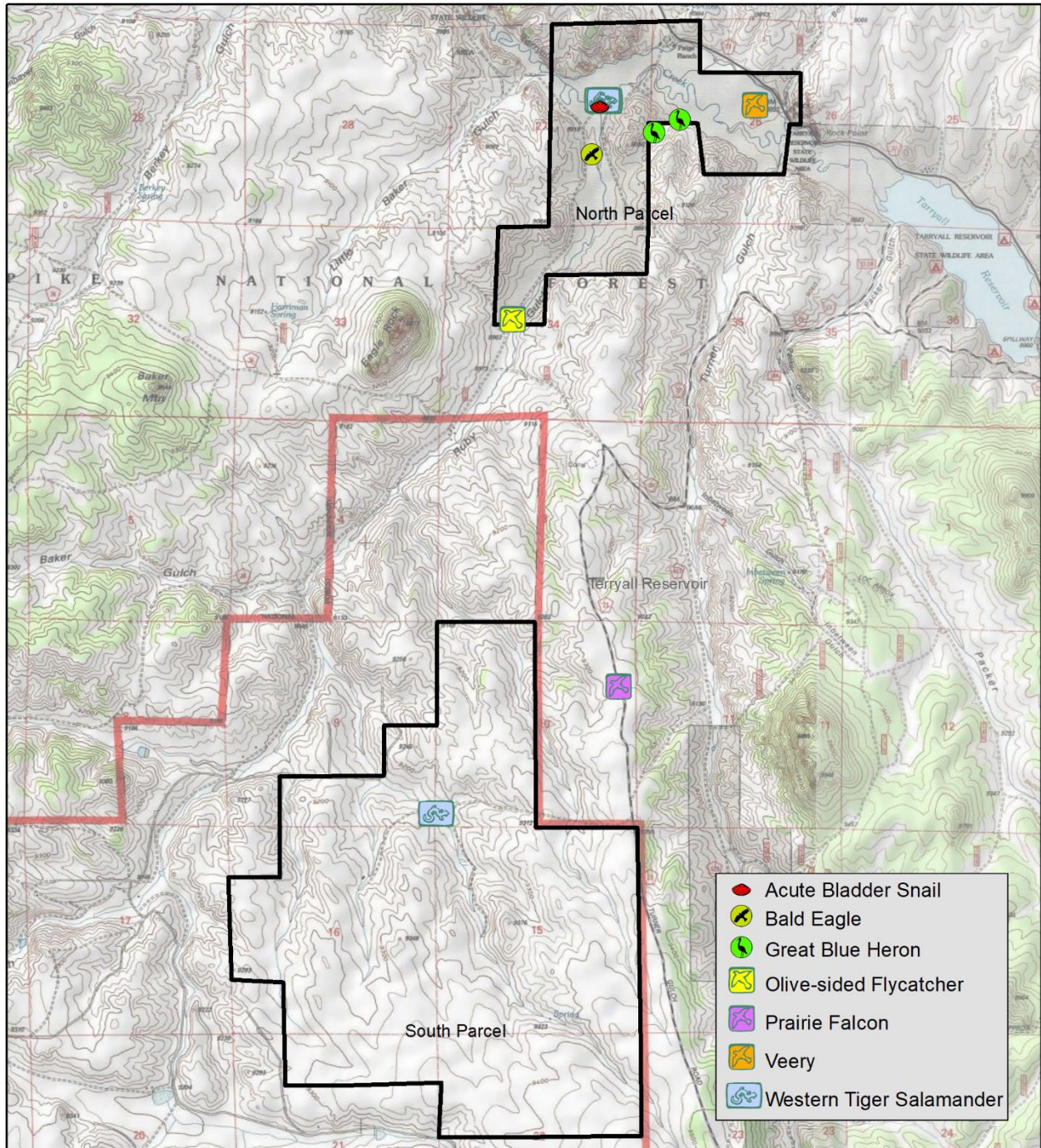


Figure 9. Rare and vulnerable wildlife species recored at Eagle Rock Ranch.

Five plant species of conservation concern were observed in the survey areas (Table 7). These species are all considered to be globally and state vulnerable, although the Rocky Mountain Ragwort (*Packera debilis*) is considered globally, apparently secure.

Table 7. Rare plant species observed at Eagle Rock Ranch.

Scientific Name	COMMON NAME	Status*	LOCATION	CNHP TRACKING STATUS
<i>Argyrochosma fendleri</i>	Fendler Cloak-fern	G3/S3	Northern Parcel	Fully Tracked
<i>Carex oreocharis</i>	Grassyslope Sedge	G3/S3	Northern and Southern Parcel	Fully Tracked
<i>Packera debilis</i>	Rocky Mountain Ragwort	G4/S1	Southern Parcel	Fully Tracked
<i>Sisyrinchium pallidum</i>	Pale Blue-eyed-grass	G3/S3, BLM Sensitive	Northern and Southern Parcel	Fully Tracked
<i>Xanthisma coloradoense</i>	Colorado Tansy-aster	G3/S3, USFS Sensitive	Northern and Southern Parcel	Fully Tracked

*Information on the Global, State, and Federal rankings is provided in Appendix 2.

Wildlife Resources

There was a total of 81 animal species recorded at the ranch including 36 birds, 30 insects, 8 mammals, 3 fish, 2 amphibians, and 2 mollusks. The six species of greatest conservation need as identified by CNHP tracking status or by PIF are listed in Table 6. Additionally, there were four species of wildlife that are either rare (S2) or vulnerable (S3) in Colorado that are not tracked by CNHP, but that should be considered in conservation planning efforts including the Acute Bladder Snail (*Physa acuta*) (G5S2), Great Blue Heron (*Ardea herodias*) (G5S3B), Olive-sided Flycatcher (*Contopus cooperi*) (G4S3S4B), and Western Tiger Salamander (*Ambystoma mavortium*) (G5S3S4). There are also probably numerous small mammals from the order Rodentia as evidenced by their grass cuttings observed by field researchers. Also, a number of additional bats might occupy the ranch but surveying for small mammals and bats was restricted by the funds available for completing the project.

Breeding populations of the Bald Eagle are considered at low risk of extinction on a global scale but at extreme risk of extirpation within Colorado (G5S1B) while the Prairie Falcon is at low risk both globally and within Colorado (G5S4B). Breeding populations of the Veery are at low risk of global extinction, but at moderate risk of extirpation in Colorado (G5S3B). The Acute Bladder Snail, Great Blue Heron, and Western Tiger Salamander are all considered at low risk of extinction on a global scale (G5), but at high (S2) or moderate (S3B, S3S4) risk of extirpation within Colorado.

Amphibian Community

The Chorus Frog (*Pseudacris maculata*) was found at the ranch in a cattle pond at the end of Ruby Gulch just prior to its confluence with Tarryall Creek. They are probably common at this pond but verifying that would require further surveys. Chorus frogs have a very low probability of extinction (G5S5). The Western Tiger Salamander (*Ambystoma mavortium*) was the only other amphibian found at the ranch and it is a common species with a moderate risk of extirpation in Colorado (G5S3G4).

Bird Community

There was a total of 36 bird species documented at the ranch by CNHP researchers. The previously discussed raptors and the Veery were the most at-risk species observed on the ranch. Species activity

maps from the Colorado Parks and Wildlife (2023) indicate the ranch includes habitat for three birds tracked by CNHP, but that were not observed during field surveys (Table 8).

Table 8. Avian species tracked by Colorado Natural Heritage Program within range of Eagle Rock Ranch, but not observed in surveys.

COMMON NAME	SCIENTIFIC NAME	CNHP * RANK	TRACKING STATUS
Brown-capped Rosy-Finch	<i>Leucosticte australis</i>	G4S3B, S4N	fully tracked
Burrowing Owl	<i>Athene cunicularia</i>	G4S4B	watch listed
Mountain Plover	<i>Charadrius montanus</i>	G3S2B	watch listed

The bird IBI score for the ranch was 0.71, indicating a bird community that is largely intact. There was a high proportion of insectivores present from the aerial screener and ground gleaner specialist guilds at the ranch (39 percent). An intact bird community would have a minimum of 19 percent of its species represented by insectivores. With two times that many insectivores the population at the ranch is impressive. There is also a high percentage of specialized ground nesting bird species at the ranch. An intact bird community would have a minimum of 11 percent of its species represented by ground nesters while the number at the ranch was 32 percent. There also were no nest predator-brood parasitic species represented at the ranch. A highly disturbed humanistic bird community would have 18 percent or more of its species represented by nest predators-brood parasites.

Bat Community

Bats probably occupy the ranch but surveying for bats was restricted by available resources. Species activity maps from the Colorado Parks and Wildlife (2023) verify habitat for three bat species tracked by CNHP that are of conservation need. The Hoary Bat (*Lasiurus cinereus*) which ranges just east of the ranch, the Silver-haired Bat (*Lasionycteris noctivagans*) and Townsend’s Big-eared Bat subspecies (*Corynorhinus townsendii pallescens*) both with ranges throughout the ranch (Figure 10).

All three of these bats have a moderate risk of extinction globally (G3G4 or G4T3T2) and within Colorado, the Hoary and Silver-haired bats have a moderate risk of extirpation (S3S4) while the Townsend’s Big-eared Bat has a high risk of extirpation (S2).

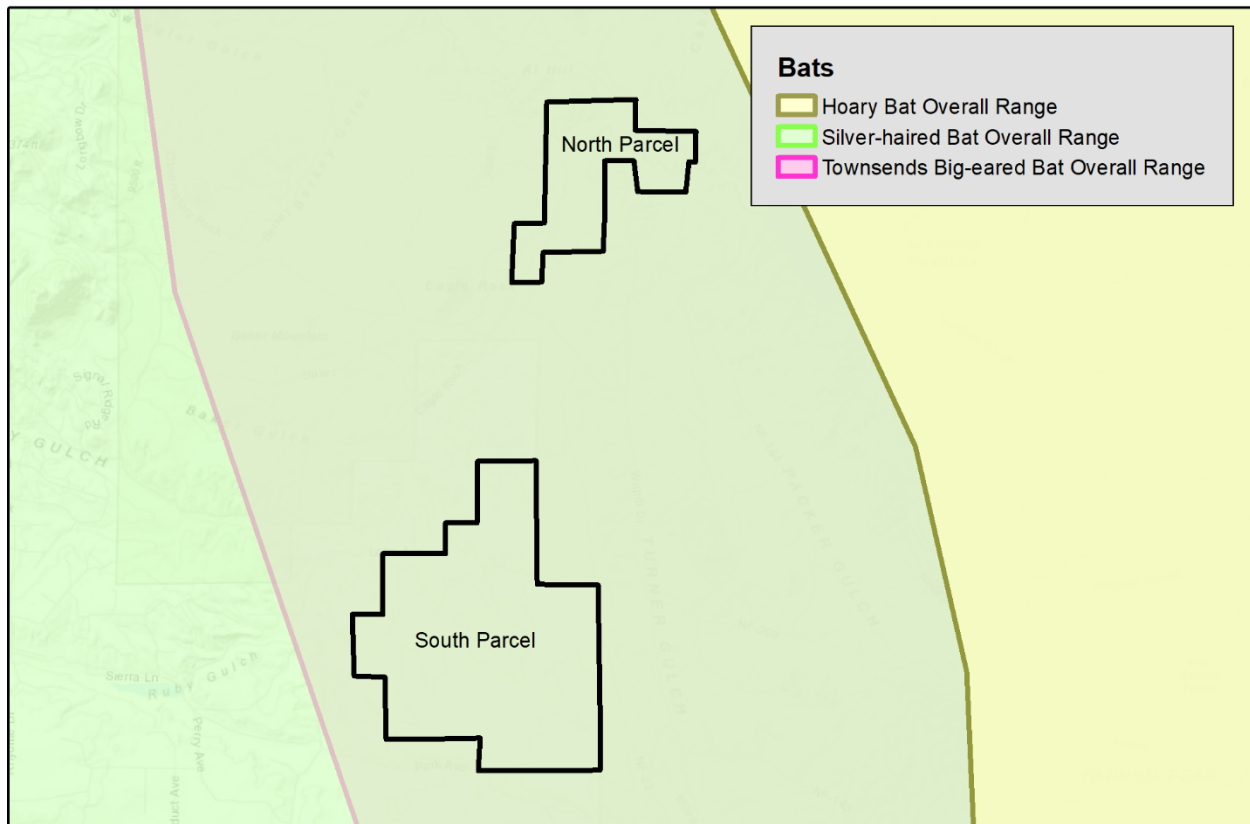


Figure 10. Activity maps of bat species tracked by CNHP within the area of Eagle Rock Ranch (Colorado Parks and Wildlife 2023).

Fish Community

There were three species of fish verified from locations adjacent to the ranch and found on iNaturalist. They included the Brook Trout (*Salvelinus fontinalis*), Rainbow Trout (*Oncorhynchus mykiss*), and Northern Pike (*Esox lucius*). All three of these species are nonnatives that have been introduced to Colorado and consequently are not species of conservation concern.

Insect Community

There was a total of 68 insect specimens handled during completion of the field work at the ranch representing at least 10 orders, 21 families and 30 species. Additionally, there were 3 specimens that could only be identified to genus and another 7 that were identifiable only to family.

Of the 21 families in total recorded at the ranch, the largest proportion were represented at the ranch's north parcel, 15 families, with 8 families represented at the south parcel. The north parcel's total was enhanced by the number of aquatic macroinvertebrates recorded from the Tarryall Creek riparian zone. Of the 10 orders recorded at the ranch, the greatest number of families were represented in the orders Lepidoptera (butterflies and moths) and Coleoptera (beetles and weevils) (Figure 11).

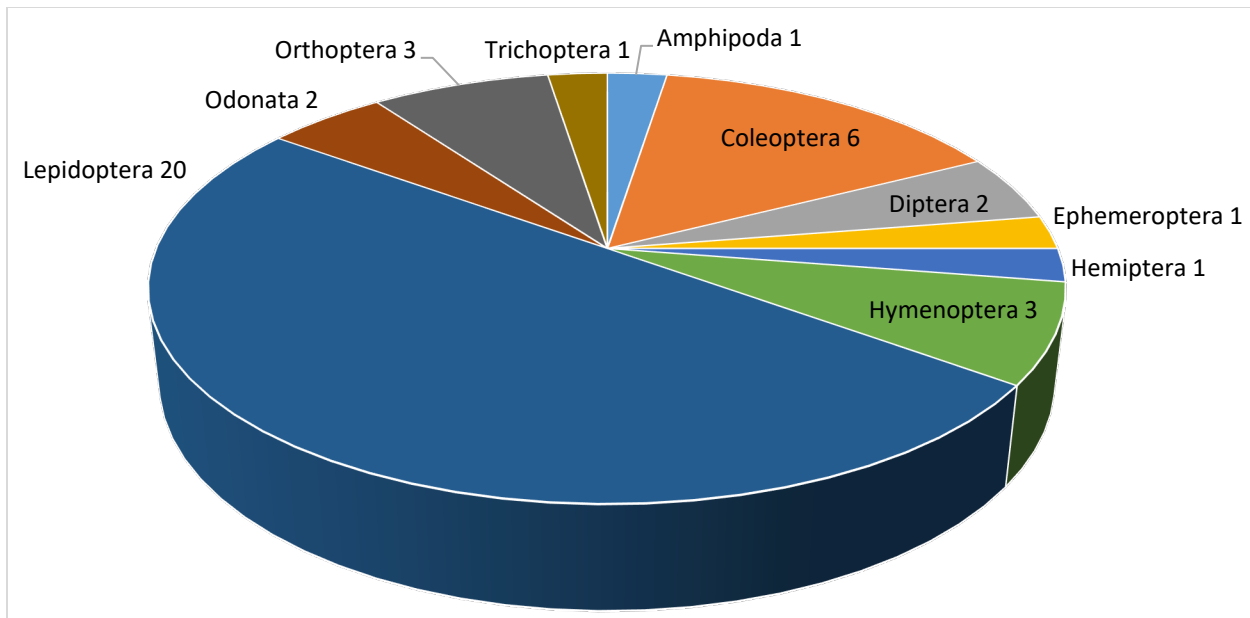


Figure 11. The number of families represented in each order of hexapods present at Eagle Rock Ranch.

The survey effort dedicated to aquatic invertebrates was limited; nonetheless, several species were identified at the ranch. These included one amphipod (Order Amphipoda), three mollusk species—Acute Bladder Snail (*Physa acuta*) (Basommatophora), Marsh Pondsail (*Ladislavella elodes*) (Basommatophora), and an unknown peaclam species (*Pisidium* sp.) (Veneroida). Additionally, a predaceous diving beetle (*Dystiscus* sp.), aquatic whirligig beetles (*Gyrinus* sp.) (Coleoptera), and a backswimmer (*Notonecta kirbyi*) (Hemiptera) were identified. All these species were recorded either at the developed pond at the bottom of Ruby Gulch or the developed pond near the corral on the south parcel of the ranch.

Macroinvertebrates found in Tarryall Creek near the ranch’s eastern boundary included caddisflies (Trichoptera) and mayflies including a small minnow mayfly (Ephemeroptera). Notably, no stoneflies (Plecoptera) were collected. Stoneflies, which along with the Ephemeropteran and Trichopteran insects, or the EPT macroinvertebrate assemblage, and the Basommatophoran mollusks are considered some of the most sensitive of all aquatic invertebrates (Chang et al. 2014). The absence of Plecopterans suggests a potential impact of historical agricultural activities on the Tarryall Creek watershed.

Macroinvertebrates can provide valuable information about the health of a stream and are commonly used as bioindicators in freshwater ecosystems. A diverse and abundant macroinvertebrate community usually indicates a healthy stream ecosystem with good ecological integrity. Different species of macroinvertebrates have different tolerance levels to pollution and environmental stress (Doods and Whiles 2019). Consequently, assessing the types of macroinvertebrates present can offer insight into the water quality of a stream. Pollution-tolerant species may dominate in degraded or polluted environments, while sensitive species may be absent (Doods and Whiles 2019).

No insect species found are listed either as federally endangered or threatened under the Endangered Species Act. Also, none are designated as candidate species for listing nor were any of the insects recorded at the ranch tracked by CNHP.

Mammal Community

A total of 8 mammals were identified at the ranch through either visual observation of individuals, scat, or tracks during completion of the field work representing at least 4 orders and 8 families. The most commonly encountered species were the Northern Pocket Gopher (*Thomomys talpoides*) and Wyoming Ground Squirrel (*Urocitellus elegans*). Mounds of the Northern Pocket Gopher were found throughout both parcels of the ranch and numerous burrows of Wyoming Ground Squirrel were also found throughout both parcels. Other mammals with ranges that overlap the ranch as defined by CPW SAM maps and that are tracked by CNHP, but that were not observed during field surveys include the Dwarf Shrew (*Sorex nanus*) (G4S2) and Gunnison's Prairie Dog (*Cynomys gunnisoni*) (G3?T2QS2) which are both fully tracked by CNHP.

Ungulates

Walking surveys identified evidence of Elk including scat and browsed vegetation in some locations suggesting occupancy of the ranch by Elk. Scat was particularly high in frequency in the northwest and central portions of the ranch's north parcel. There was also a high frequency of Elk scat at the southeast corner of the ranch's south parcel. Species activity maps (SAM) from the Colorado Division of Wildlife (CPW) (2023) indicate the ranch includes habitat important to Elk, particularly supporting summer range and concentration areas during the winter months (Figure 12) (CPW 2018). Elk winter concentration areas are defined as that part of the winter range where Elk density is at least 200 percent greater than the surrounding winter range density for five winters out of ten from the first heavy snowfall to spring green-up. Elk severe winter range is defined as habitat where 90 percent of the individuals are located when the annual snow pack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten (Colorado Parks and Wildlife undated). Elk movement corridors are also present on the ranch with Elk apparently crossing the extreme east portion of the ranch's north parcel.

Evidence of Mule Deer (*Odocoileus hemionus*) activity on the ranch was minimal, however species activity maps from Colorado Parks and Wildlife (2023) verify habitat for Mule Deer is present, particularly winter and summer range (Figure 13). Mule Deer summer range includes landscapes where 90% of the individuals are located between spring green-up and the first heavy snowfall. Mule Deer winter range includes landscapes where 90 percent of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up. Maintaining the ecological integrity of grass and shrublands will benefit Mule Deer, promoting the viability of their populations on the ranch.

Like Mule Deer, Pronghorn activity on the ranch was minimal with evidence of Pronghorn activity restricted to the observation of scat, but only at the ranch's south parcel. The CPW does indicate that habitat for Pronghorn is present with the south parcel supporting a Pronghorn concentration area (Figure 14). Pronghorn concentration areas are defined as that part of the overall range where densities are at least 200% greater than the surrounding area during a season other than winter. Pronghorn movement corridors are also present on the ranch with Pronghorn apparently migrating through both of the ranch parcels. Maintaining the ecological integrity of grass and shrublands will benefit Pronghorn, promoting the viability of their populations on the ranch.

Habitat for Bighorn Sheep (*Ovis canadensis*) is also present on the extreme northeast portion of the ranch's north parcel as indicated by the CPW SAM maps (Figure 15). There is both summer and winter range for Bighorn Sheep in this area of the ranch including both severe winter range and a winter

concentration area. Summer range is range where 90% of the individuals are located between spring green-up and the first heavy snowfall and winter range is where 90 percent of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up. Severe winter range is that part of the winter range where 90% of the individual animals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten. A Bighorn Sheep winter concentration area is that part of the winter range where densities are at least 200% greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten.

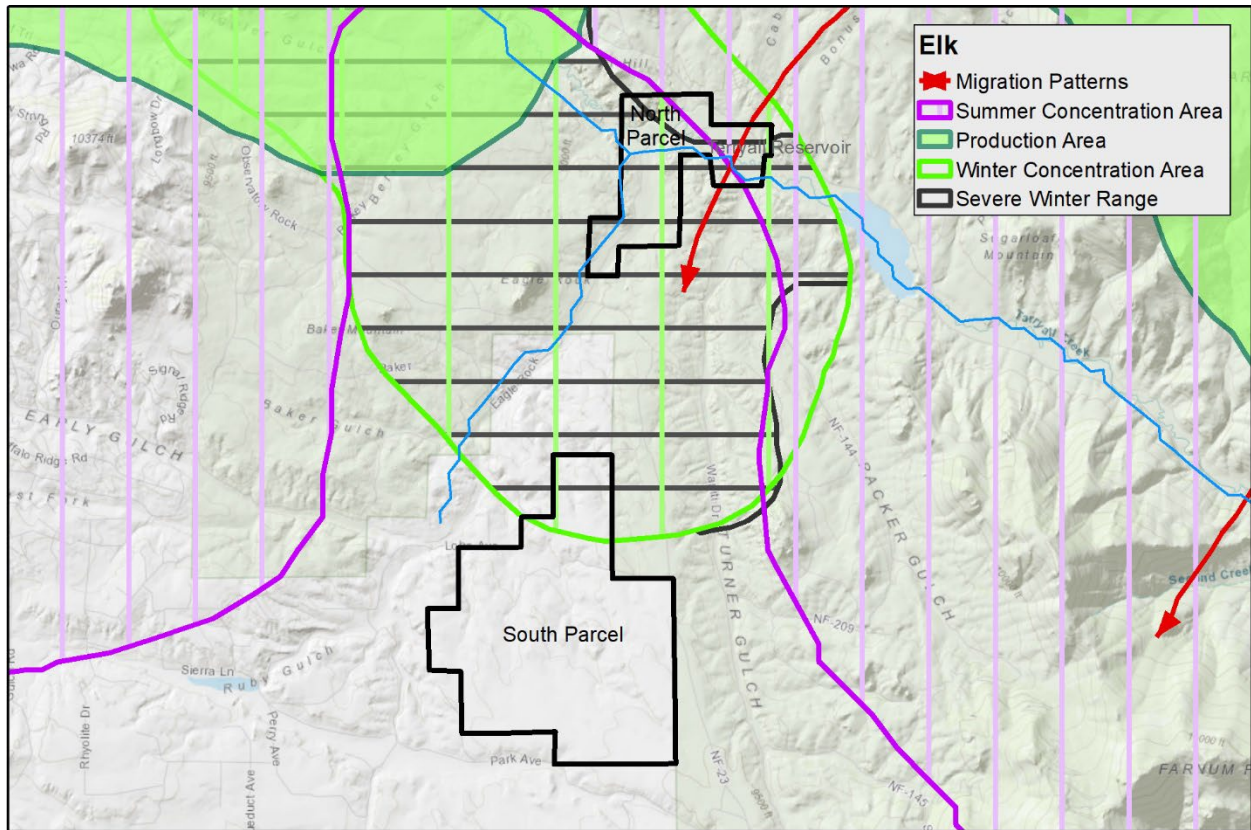


Figure 12. Elk activity maps within the area of Eagle Rock Ranch (Colorado Parks and Wildlife 2023).

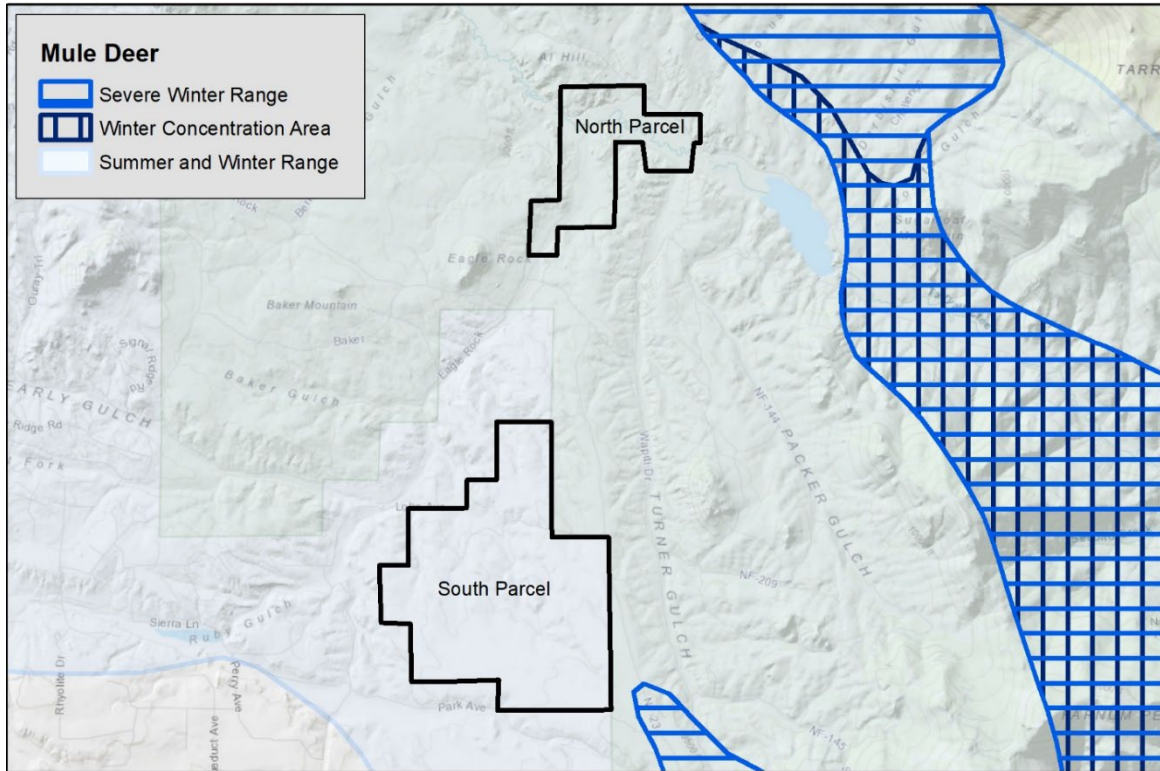


Figure 23. Mule Deer activity maps within the area of Eagle Rock Ranch (Colorado Parks and Wildlife 2023).

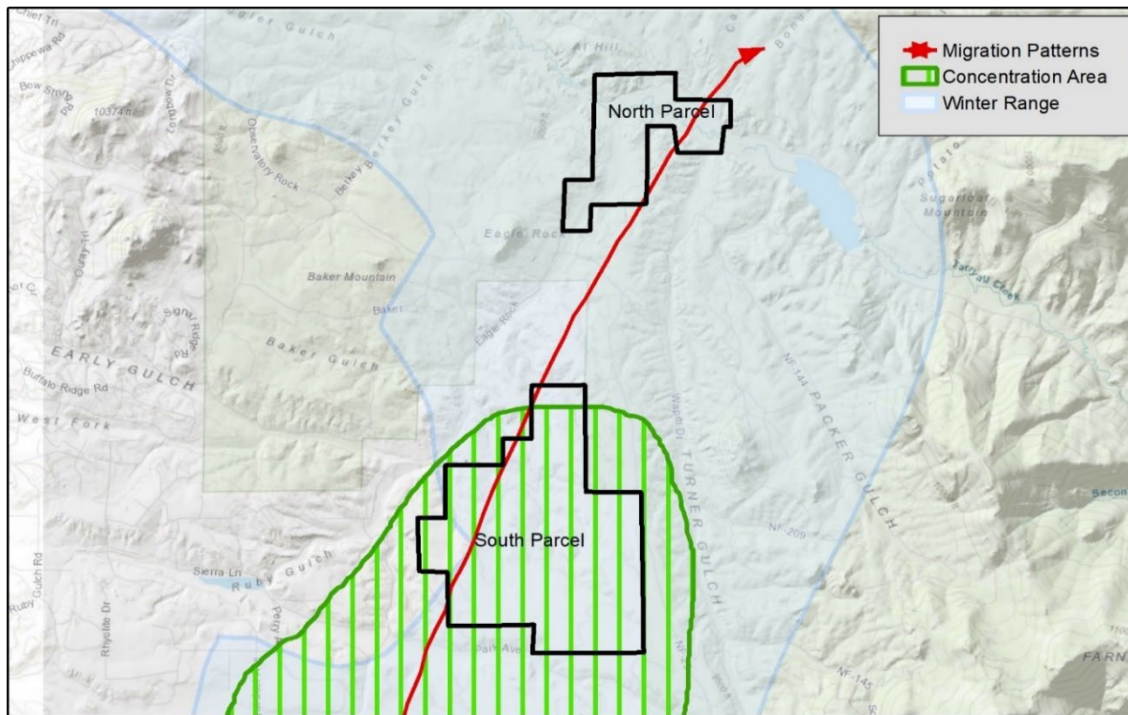


Figure 34. Pronghorn activity maps within the area of Eagle Rock Ranch (Colorado Parks and Wildlife 2023).

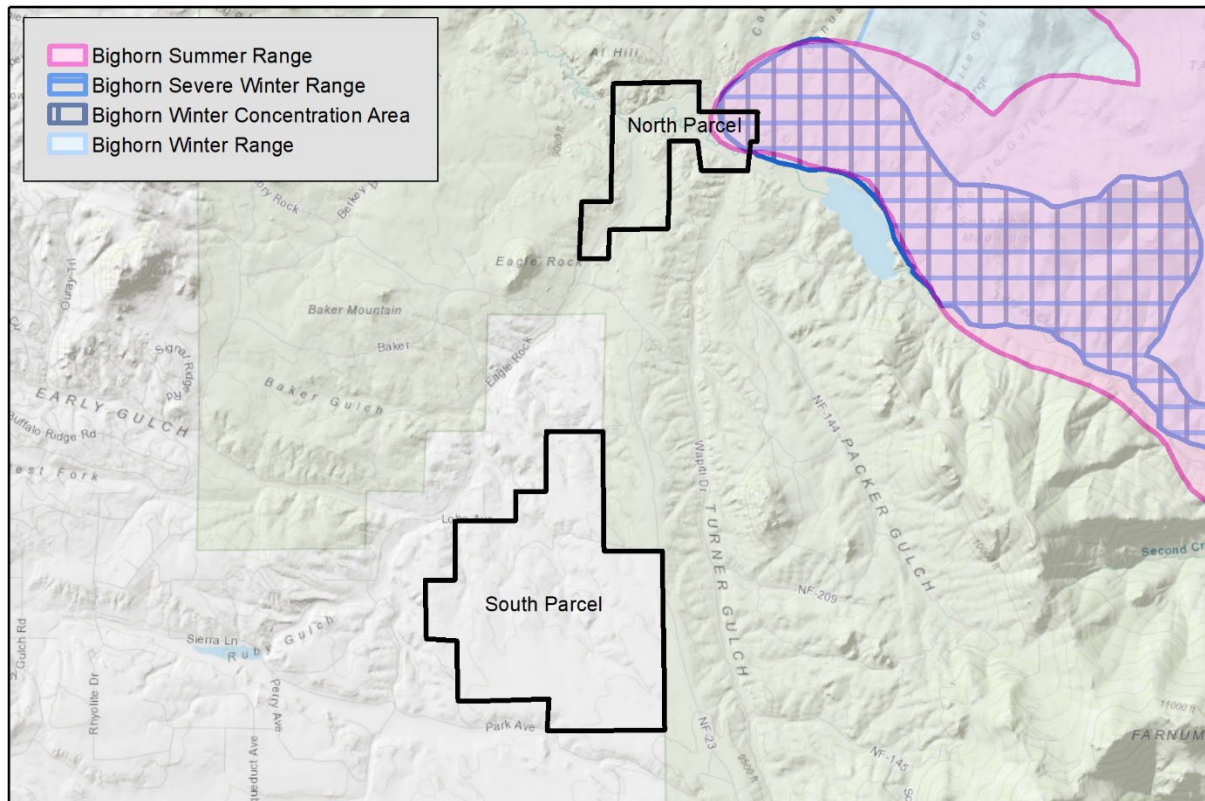


Figure 15. Bighorn Sheep activity maps within the area of Eagle Rock Ranch (Colorado Parks and Wildlife 2023).

Vegetation Resources

Plant Species and Rare Plants

In total, we identified 158 vascular plant taxa known from 45 plant families across the ranch (Appendix 3). Eleven percent of the flora were non-native species (17 non-native species) and only three species on the Colorado Noxious Weed List were encountered, Canada Thistle (List B, north and south parcel), White Top (List B, North parcel) and Quackgrass (List B, north and south parcel). The average C-value across all plant species identified was 5.06, indicating on average plant species which were equally found in natural and non-natural areas. Forty-five plant species identified on Eagle Rock Ranch had a C-value greater than or equal to 7, indicating that 32% of the flora was obligate to natural areas but can sustain some habitat degradation. Only one plant species, Rocky Mountain Ragwort (*Packera debilis*) had a C-value of 10 and is considered to be obligate to high-quality natural areas. Several more species had a C-value of nine, including wetland vegetation on the southern parcel in a non-irrigated wet meadow (Hall's Sedge (*Carex hallii*) and Silvery Primrose (*Primula incana*)), wetland vegetation on the northern parcel in the irrigated wet meadow (Moss Gentian (*Gentiana fremontii*), Moss Rush (*Juncus bryoides*), and Northern Sweetgrass (*Anthoxanthum nitens*), and upland species (Brittle Bladderfern (*Cystopteris fragilis*), Bristlecone Pine (*Pinus aristata*). Additionally, an orchid species, Northern Green Orchid (*Platanthera aquilonis*), was observed in the irrigated wet meadow on the northern parcel.

Five rare plant species, tracked by CNHP, were encountered (Figure 16, Appendix 4). A new location of the Fendler Cloak-fern (*Argyrochosma fendleri*) was recorded on the rocky outcrops behind the ranch

house, with one plant observed. Occurrences of the Grassyslope Sedge (*Carex oreocharis*) were recorded on both the northern and southern parcels in the herbaceous uplands above wetlands. On the northern parcel, a handful of individuals of Grassyslope Sedge were encountered when surveying upland hill sides, both to the south of the hayfield and north of hayfield behind the ranch house; on the southern parcel, a large population of this species was recorded, covering a travel path 1.6 miles long with thousands of individuals. The full extent of this population was not recorded in the time allotted to survey but given the size and vigor of population and natural landscape context, we consider it to have excellent viability (A-ranked occurrence, see Appendix 4). A second mapped occurrence of Grassyslope Sedge exists 1.2 kilometers to the south on USFS lands; given contiguous habitat between these two areas, we consider this to be one large occurrence, and given the size and vigor, we believe this to be the best known occurrence of Grassyslope sedge in the state of Colorado. The Ruby Creek Potential Conservation Area (PCA) mapped by CNHP in 2000 was expanded to include habitat for this species on the southern parcel of Eagle Rock Ranch (Figure 17).

Similarly, the southern parcel supported a widespread population of Colorado Tansy-aster (*Xanthisma coloradense*), with plants scattered throughout the occurrence. The plants were in excellent to good condition, with no more than 200 individuals estimated, although the full extent of this population was not recorded in the time allotted to survey. This occurrence was ranked a Good to Fair (BC-ranked occurrence) due to low numbers of individuals encountered but excellent to good population condition and landscape context. On the northern parcel, a handful of individuals of Colorado Tansy-aster were encountered when surveying upland hill sides to the south of the hay meadow. Hillsides above Ruby Gulch on the northern parcel are also very likely to support this species.

Two wetland plants of special conservation concern were observed during surveys. Occurrences of the Pale Blue-eyed Grass (*Sisyrinchium pallidum*) were recorded on both the northern parcel, in the eastern hayfield, and the southern parcel in two locations. The northern parcel supported at least 40 stems of the species and was ranked a Fair occurrence (C-ranked occurrence) due to low numbers of observed individuals and altered disturbance regime from haying. The southern parcel supported at least 100 stems of the species and was ranked a Fair occurrence (C-ranked) due to low number of individuals, significant pugging from cattle hooves in the habitat and limited connected habitat with significant hydrology to support this species. A second tracked wetland plant, Rocky Mountain Ragwort (*Packera debilis*), was also observed with the Pale Blue-eyed Grass in one location on the southern parcel. Approximately 40 individuals were observed, and the occurrence was ranked Fair to Poor (CD-ranked).

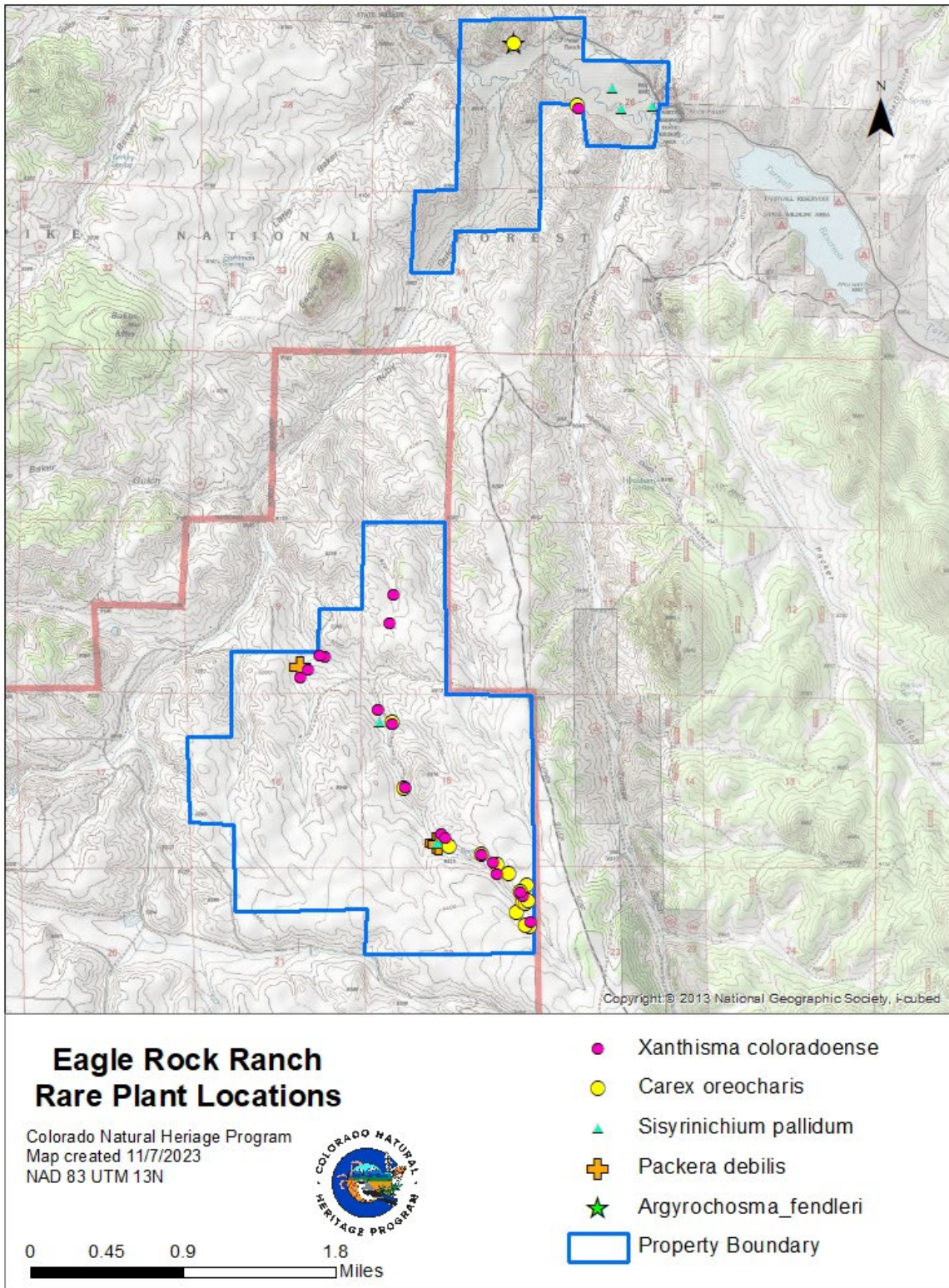


Figure 16. Rare Plant Locations at Eagle Rock Ranch.

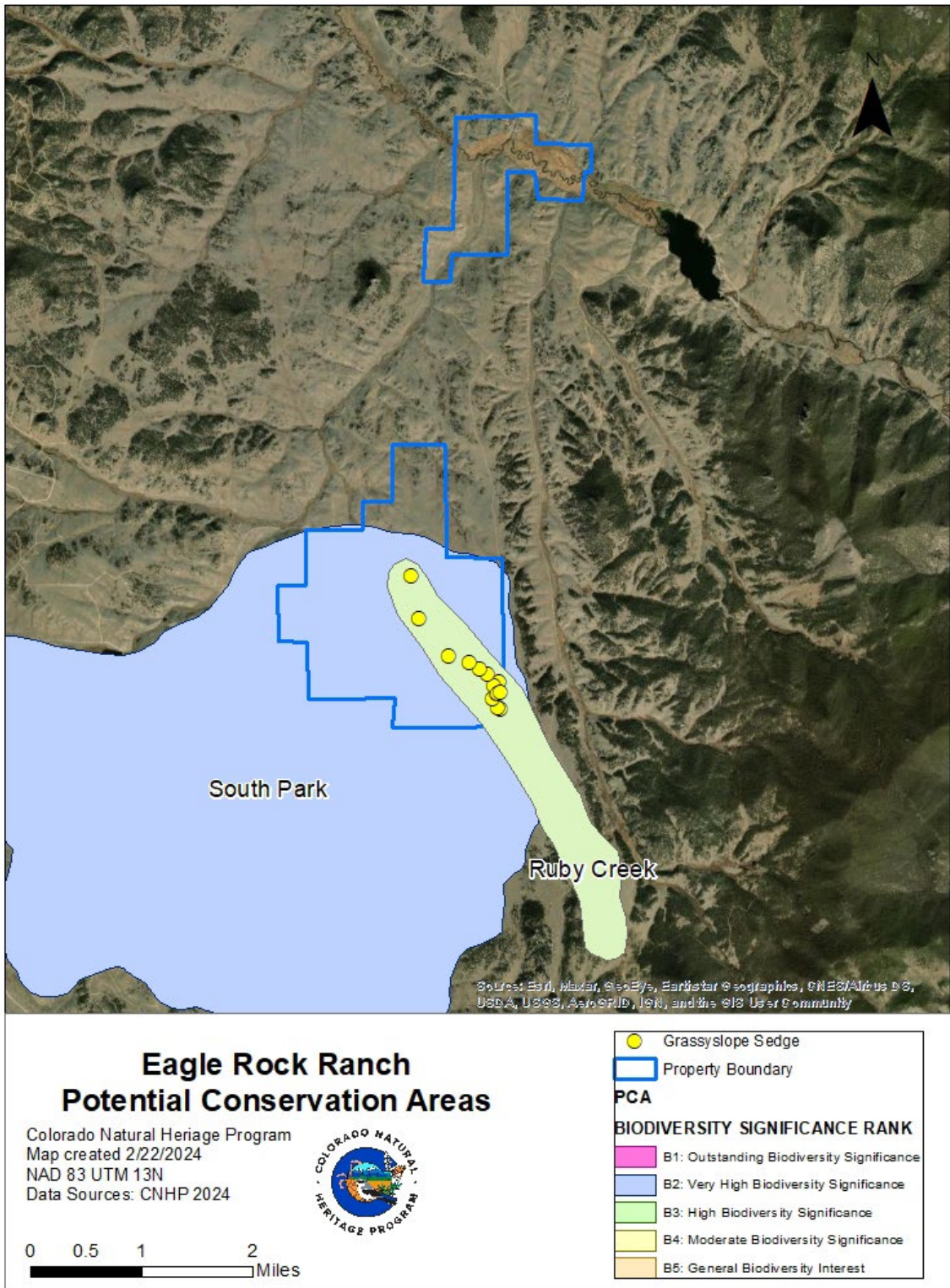


Figure 47. Potential Conservation Areas delineated by CNHP at Eagle Rock Ranch.

Ecological Systems and Natural Plant Communities

Before agricultural conversion, the hay meadow in the northern parcel (Figure 18, 19) most likely would have been classified as a Rocky Mountain Subalpine-Montane Riparian Shrubland. For a description of this ecosystem see: <https://cnhp.colostate.edu/projects/ecological-systems-of-colorado/details/?elementID=365209&wetland=1>. These are seasonally flooded shrublands, lying adjacent to ephemeral, intermittent or perennial stream channels, with short to tall willows, including Geyer Willow (*Salix geyeriana*), Mountain Willow (*Salix monticola*), Booth's Willow (*Salix boothii*), Drummond's Willow (*Salix drummondiana*) and other shrub species. Native graminoids (grasses and sedges) would include Water Sedge (*Carex aquatilis*), Beaked Sedge (*Carex utriculata*), Fowl Mannagrass (*Glyceria striata*), and Tufted Hairgrass (*Deschampsia cespitosa*), among others. These graminoid species were commonly present at Eagle Rock Ranch, with *Glyceria grandis* rather than *Glyceria striata*, in the irrigated wet meadow, along with strips of Mountain Willow (*Salix monticola*), and other willows including, Tea-leaf Willow (*Salix planifolia*), Bluestem Willow (*Salix irrorata*) and Dusky Willow (*Salix melanopsis*) along Tarryall Creek (Appendix 3). Human alterations to this wetland include irrigation, which has likely expanded the extent of the wetland and lengthened the period of saturation, as well as the leveling of topographic variations as a result of haying equipment being used and the presumed introduction of [Meadow Foxtail](#) (*Alopecurus pratensis*), an introduced forage grass, which is a dominant species.

No plant communities of conservation concern were delineated in the northern parcel irrigated wet meadow, although small areas showed dominance of Water Sedge (*Carex aquatilis*) and Beaked Sedge (*Carex utriculata*), which form common wetland vegetation throughout the mountain west (NatureServe 2023). This wetland ecosystem, with the altered hydroperiod, is providing important habitat for wildlife and plants with significant hydrology supporting globally vulnerable species such as the Pale Blue-eyed Grass (*Sisyrinchium pallidum*). Microtopography in this wetland creates variations in hydrology, resulting in higher species diversity. Drier areas in the hayfield were vegetated by large stands of [Arctic Rush](#) (*Juncus arcticus* var. *balticus*), with scattered Rocky Mountain Iris (*Iris missouriensis*), both considered to be increaser species, as they are not palatable to cattle. Wetter areas supported Fewflower Spikerush (*Eleocharis quinqueflora*) and Beaked Sedge (*Carex utriculata*) and slightly higher areas by the creek supported the willows, shrubby cinquefoil (*Dasiphora fruticosa*), stands of Golden Banner (*Thermopsis montana*) and Yellow Indian Paintbrush (*Castilleja septentrionalis*). A diversity of forbs, such as Pale Agoseris (*Agoseris glauca* var. *glauca*), Moss Gentian (*Gentiana fremontii*), Meadow Lousewort (*Pedicularis crenulata*), Elephant's Head (*Pedicularis groenlandica*), Darkthroat Shooting Star (*Primula pauciflora*) and Marsh Marigold (*Caltha chionophila*) were scattered throughout the irrigated wet meadow, supporting pollinators.



Figure 58. Irrigated wet meadow in northern parcel, with a dominant mix of Meadow Foxtail and Sedges.



Figure 69. Irrigated wet meadow in northern parcel, with a scattered forbs, Meadow Lousewort and Tobacco Root.

Ecosystems with a less dominant component of shrubs are considered a Rocky Mountain Alpine – Montane Wet Meadow. Wetlands located in the Ruby Creek drainage on the northern parcel and the drainages on the southern parcel (Figure 20, 21) fall into this category. These systems are comprised of similar graminoid species as listed above for the Rocky Mountain Subalpine – Montane Riparian Shrubland. These systems are found in areas with low-velocity surface or subsurface flows of water in areas where the soil is seasonally saturated. Water tables are high in the early growing season and then draw down by the end of the season preventing the soil from being permanently saturated and forming organic soils characteristic of fens (i.e., groundwater formed wetland with greater than 40 cm deep peat formation). For a description of this ecosystem see: <https://cnhp.colostate.edu/projects/ecological-systems-of-colorado/details/?elementID=365193&wetland=1>. No plant communities of conservation concern were delineated in this ecosystem. Dominant vegetation included a native species mix of sedges (*Carex* spp.), including Water Sedge (*Carex aquatilis*), Beaked Sedge (*Carex utriculata*), and Hall’s Sedge (*Carex hallii*). Forbs of note included Silvery Primrose (*Primula incana*), Darkthroat Shooting Star (*Primula pauciflora* var. *pauciflora*), Pale Blue-eyed Grass (*Sisyrinchium pallidum*) and Rocky Mountain Ragwort (*Packera debilis*) (Appendix 3). These ground-water fed ecosystems are particularly important in the arid environment of South Park in supporting biodiversity of plant and wildlife habitat.

The ecotone between the wet meadows and uplands in both parcels were commonly vegetated with a montane riparian shrubland community of Shrubby Cinquefoil and Tufted Hairgrass ([*Dasiphora fruiticosa* ssp. *floribunda*/Deschampsia cespitosa Wet Shrubland](#)). This is a plant community which is widespread in the Rocky Mountains on stream terraces above channels, on drier edges of wetlands and valley bottoms (NatureServe 2023).



Figure 20. Southern parcel landscape with Rocky Mountain Montane Wet Meadows and *Dasiphora fruiticosa* ssp. *floribunda*/Deschampsia cespitosa Wet Shrubland interspersed in arid grassland.



Figure 21. Rocky Mountain Montane Wet Meadow in the southern parcel.

An Ecological Integrity Assessment of wetlands of the irrigated wet meadow in the northern parcel and a representative wet meadow in the southern parcel was completed (Figure 22).

The irrigated wet meadow of the northern parcel received a C+ for Ecological Integrity and the wetland assessed in the southern parcel received a B- (Appendix 5). Both wetlands were in a setting with mostly contiguous natural land cover with moderate grazing the primary land use in the surrounding area. The southern parcel wetland was surrounded by a natural buffer, whereas the northern irrigated wet meadow has a compromised buffer with County Road 77. The Mean C-value of the two assessment areas were similar (4.7: Northern Parcel; 5.1: Southern Parcel), although it is difficult to compare as the northern assessment area was much larger than the southern, and by default, has a greater number of species (44 species: Northern Parcel, 18 species: Southern Parcel). The northern parcel had a dominant component of non-native vegetation, Meadow Foxtail (*Alopecurus pratensis*), which reduced the vegetation score of this wetland. Invasive plant cover was low for both assessment areas; noxious weeds included only scattered Canada Thistle (*Cirsium arvense*) in the southern parcel and White Top (*Lepidium draba*) in the ditches in the northern parcel. Of the list of species in the assessment areas, 23% of species in the irrigated wet meadow on the northern parcel are non-native, and in the assessed wet meadow on the southern parcel, 17%. For reference, the percentage of non-native species in the Colorado flora statewide is 15.7% (Ackerfield 2022).

In the northern parcel irrigated wet meadow, the native species expected for the Rocky Mountain Montane Wet Meadow ecosystem are present but somewhat reduced due to dominance of Meadow Foxtail, and native species indicative of anthropogenic disturbance, such as the increaser species, Arctic Rush, are present. In the southern wetland, sedges and Tufted Hairgrass are dominant in this wetland,

with a moderate component of Shrubby Cinquefoil. Some species indicative of intermediate moist conditions are present (e.g., Yarrow, Arctic Rush, Canada Thistle). This wetland has some remnant, high quality plant species with high C-values, such as Rocky Mountain Ragwort (*Packera debilis*), a plant of conservation concern, and Hall’s Sedge (*Carex hallii*) and Silvery Primrose (*Primula incana*). However, this wetland is also impacted by cattle and other ungulates. Heavy use by ungulates can contribute to soil alteration in the form of raised hummocks or “pugging,” which alters hydrology by channeling water flow in the interspaces and drying the tops of the hummocks. Restoring hummocks can be difficult. Removing cattle from wetlands permanently or when soils are wet will allow the ground to rest and vegetation may reestablish, making the sides of hummocks less sheer. Elk are generally not responsible for causing pugging, as they typically travel and do not congregate in a manner like cattle. Fully vegetated hummocks are not detrimental to a site and are preferable to invasive restoration practices where heavy machinery has been used to level hummocks. The wetland also contains a noxious weed, Canada Thistle, and Arctic Rush, a native increaser species avoided by cattle grazing. Hydrology in the southern parcel was in a natural condition, although again cattle pugging is impacting the hydroperiod and disturbing the soil by creating hummocks (Figure 23). Irrigation in the northern parcel has altered the natural flow of water in that assessment area.

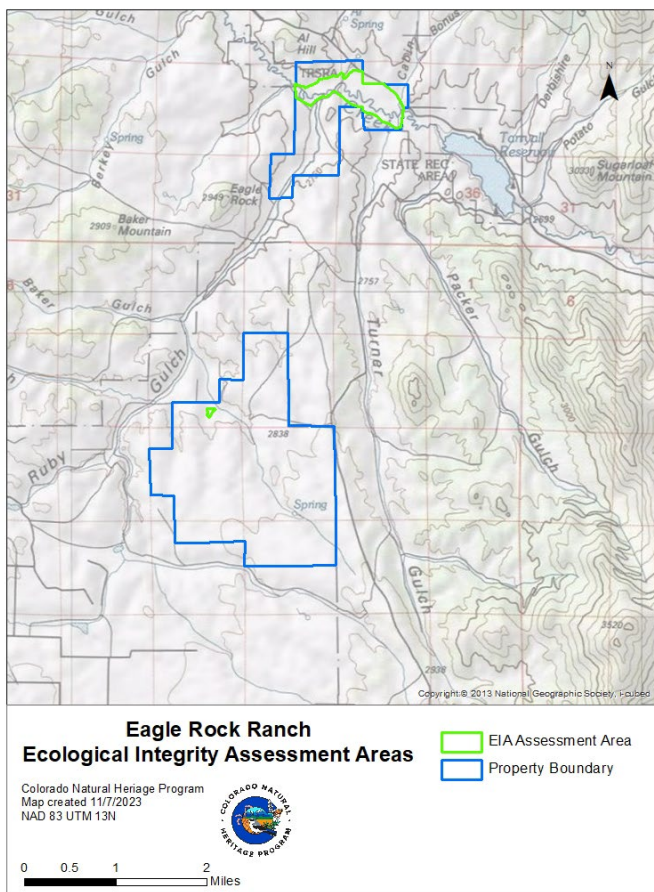


Figure 22. Location of Assessment Areas chosen for the Ecological Integrity Assessment for wetlands on the northern and southern parcels of Eagle Rock Ranch.



Figure 73. Formation of hummocks in wetlands in the Southern Parcel.

On the adjacent CPW SWA, to the east of Eagle Rock Ranch, a wetland assessment plot had been sampled by CNHP in 2005. The plot was located 0.5 mile from the Eagle Rock Ranch border, just to the northwest of Tarryall Creek Reservoir. This plot was in what was described as a Rocky Mountain Subalpine-Montane Riparian Shrubland (see Appendix 5 for plot report). The vegetation in this plot was like the vegetation in the irrigated wet meadow of the northern parcel of Eagle Rock Ranch, with 12 of the 27 species in the plot list overlapping with the species list of Eagle Rock Ranch (44%). One noxious weed, Canada Thistle, was recorded in the plot and Meadow Foxtail was present but at low cover. Of the species listed in the plot, 11% (3 of 27 species) were non-native. The Mean C-value was 4.4, comparable but slightly lower than the values at Eagle Rock Ranch.

A species list of the vegetation directly west of the Eagle Rock Ranch on the CPW SWA was created on 7/14/2023 during the CNHP visit. This habitat was an emergent wet meadow on the banks of Tarryall Creek, with upland and wetland vegetation interspersed, and as such, not directly comparable to the Eagle Rock Ranch irrigated wet meadow. Many of the plants noted overlapped with Eagle Rock Ranch (30 of 41 species, 73%), with similar common wetland species. The Mean C-value was again comparable to the plot at Eagle Rock Ranch, but slightly lower at 4.00. Twenty-two percent of the plant species list

was non-native, with only one noxious weed, Canada Thistle, observed. The topography of the site appeared superficially more varied than the irrigated wet meadow adjacent to Eagle Rock Ranch, likely a result of the haying operation.

The upland, grassland hillsides of Eagle Rock Ranch were in excellent ecological condition and of sufficient size and with connectivity to surrounding landscapes to provide significant habitat value (Figure 24). Although no plant communities of conservation concern were delineated in these habitats, the vegetation was of high quality, with only native species noted and a mean C value of 5.93 on the northern and 5.57 on the southern parcel. Species indicative of a high-quality, undisturbed landscape included Bristlecone Pine (*Pinus aristata*, C-value of 9), and Grassslope Sedge (*Carex oreocharis*, C-value of 8). On the northern parcel, several additional high quality plant species were observed in grasslands, including Parry's Oatgrass (*Danthonia parryi*), White River Kittenails (*Syntherisma plantaginea*), and Pretty Draba (*Draba streptocarpa*) (see Appendix 3). Areas heavily used by cattle on the southern parcel, for example where cattle congregate to access water, showed signs of use such as cattle trailing and an abundance of Fringed Sage (*Artemisia frigida*), an increaser species (Figure 25). Grasslands in general are regarded as the most imperiled ecosystems in North America (Knopf and Samson 1997), and Eagle Rock Ranch supports high-quality, representative grasslands characteristic of South Park and the inter-mountain basins of Colorado.

In general, the habitat mosaic of wetlands and uplands on Eagle Rock Ranch provides significant habitat for plants and wildlife, including pollinators. With a strong component of native plants in the vegetation, little habitat fragmentation, and support of ecological processes with intact wetlands, the Ranch provides a key connectivity link to adjacent open spaces owned and managed by CPW and USFS.



Figure 84. Large, high quality grassland on Eagle Rock Ranch South Parcel.



Figure 95. Increased dominance of Fringed Sage in areas disturbed by cattle use.

DISCUSSION

The results of the Eagle Rock Ranch survey indicate that the ranch supports a highly diverse and abundant assemblage of wildlife within a landscape of good ecological integrity. The abundance of animal species recorded from the ranch is indicative of the quality of the ranch's habitat. Maintaining or improving upon the quality of the ranch's habitats is recommended. Care should be taken to avoid excessive disturbance to the landscapes through livestock grazing or ranching operations. Current grazing practices have resulted in a landscape that is in a natural state, supporting an abundance and diversity of wildlife. The occurrence of aquatic insects in Tarryall Creek within the ranch from the Ephemeroptera and Trichoptera orders or the EPT macroinvertebrate assemblage is a testament to the ecological quality of the landscape and the creek's water quality within the ranch (Braccia et al. 2023). The diverse assemblage of birds and the largely intact bird community as defined by the calculated Bird IBI score is a further indication of good ecological integrity found at the ranch. An important consideration for the ranch is to promote management activities supporting movement corridors for the ungulate community found at the ranch. CPW SAM maps indicate that the ranch overlaps important migration corridors for Elk and Pronghorn, contains foraging habitat for those species and for Bighorn Sheep, and potentially Mule Deer.

Five vascular plant species of conservation concern were identified at the Ranch. These species, except for Rocky Mountain Ragwort (*Packera debilis*) are globally and state vulnerable, with between 20 - 100 populations known in the world. Rocky Mountain Ragwort is apparently secure globally, but imperiled in

the state of Colorado, with approximately 35 occurrences recorded in six counties in central Colorado. This species ranges into Idaho, Montana, and Wyoming. Threats to this species includes alterations to hydrology, invasive species such as Canada Thistle and Musk Thistle, and residential development (CNHP 2023b). Although this species has a Coefficient of Conservatism value (C-value) of 10, indicating it is obligate to natural areas relatively unaltered from pre-European settlement, this species has been recorded from other areas sustaining cattle grazing and pugging. The long-term impacts of cattle grazing on this species are unknown. Of the four vulnerable plants species of concern, none are endemic to Colorado. Pale Blue-eyed Grass (*Sisyrinchium pallidum*) and Colorado Tansy-aster (*Xanthisma coloradoense*) are also known from Wyoming, and Grassyslope Sedge (*Carex oreocharis*) and Fendler Cloak-fern (*Argyrochosma fendleri*) range across western states to the north and south and are considered to be regional endemics. As a wetland species, Pale Blue-eyed Grass faces many of the same threats as Rocky Mountain Ragwort, including alteration of wetland habitat through peat mining and water diversion projects. Few threats have been identified for the upland species, Fendler Cloak-fern and Grassyslope Sedge, particularly for Fendler Cloak-fern, as occurrences have mostly been documented in remote, rocky sites. Upland species in the South Park area, including Colorado Tansy-aster, do face threats from increased motorized and non-motorized recreation and hiking, trail or road construction, reservoir expansion, housing development, domestic livestock activities and invasive species invasion (NatureServe 2023, CNHP 2023b).

Of invasive species recorded at the ranch, only Canada Thistle is a minor concern, and only in the non-irrigated wet meadows on the southern parcel. Canada Thistle prefers moist soils, and hydrologic conditions on the southern parcel appear to be suitable for this species, whereas the irrigated wet meadow on the northern parcel appears to be too wet for a large invasion. Maintaining healthy rangelands, through preventing bare ground caused by overgrazing, is believed to be the best control strategy for this species (Colorado Department of Agriculture 2015). The first goal in any successful landscape management of weeds is to protect intact habitats from disturbances. Intact habitats are resilient to weed infestations, and disruptions to native landscapes to treat targeted weed species may result in the introduction of more weeds or an increase in the footprint of existing weeds (Pritekel et al. 2006, Nicholas et al. 2008). Because disturbance is what initially leads to weed invasions, simply removing a weed without eliminating the disturbance rarely results in a successful treatment and may result in opening up a disturbed soil to a secondary invasion of a new or the same weed (Pearson et al. 2016, Pearson and Ortega 2009). Non-native species tend to decrease over time without treatment in natural areas with a diverse assemblage of native species (Kowarik 2008). In most cases where a species is targeted for elimination, treatment only temporarily removes the species, or it is replaced by a different weedy species. Removal of the target weed often not only results in a secondary invasion by other non-native exotic species but there is simplification (reduced biodiversity) of the site. A non-native plant still performs the same functions as native species in terms of structure and food for wildlife, filtration of runoff, and providing buffer lands. Considerations of the disturbance to soils, impacts to wildlife, and potential harm to significant vegetation resources and plants of conservation concern should be considered in weed treatment decisions (Tu et al. 2001, Kowarik 2008, Pearson and Ortega 2009, Potts et al. 2010, Smith et al. 2015, Mui and Panjabi 2016).

It is a testament to the conservation-minded management at Eagle Rock Ranch that the populations of Colorado Tansy-aster and upland habitats observed are in excellent condition with high quality plant species and an absence of non-native species recorded. Additionally, Eagle Rock Ranch supports

significant habitat and harbors high quality plant species in wetlands on the ranch. Thirty-two percent of the flora across the ranch had Coefficient of Conservatism values in the upper tier (7 or above), and populations of significant native species such as Moss Gentian (*Gentiana fremontii*) and Northern Green Orchid (*Platanthera aquilonis*) are persisting in irrigated wet meadow habitat on the northern parcel and Silvery Primrose (*Primula incana*) and Hall's Sedge (*Carex hallii*) in wet meadows on the southern parcel. Threats to wet meadow ecosystems in the West include hydrologic and vegetation alteration and landscape fragmentation. Additionally, global climate change is altering the snowmelt-driven hydrology of intermountain basins, causing unprecedented snowpack declines, springtime warming, and increased rainfall versus snowfall (CNHP 2023d). These threats elevate the importance of the conservation of natural wetlands in the South Park landscape. Cattle pugging in wet meadows in the southern parcel of Eagle Rock Ranch is altering the hydrology of these wetlands, reducing the connection between vegetation at top of the hummock and groundwater. Additionally, cattle congregation adjacent to riparian areas on the southern parcel is causing conversion of dominance of native grass and sedges to dominance by Fringed Sage. However, these impacts are minimal in degrading the quality of vegetation and animal assemblages supported by these habitats and minimal in the face of the pressure of development across Colorado. Eagle Rock Ranch lies in a mostly unfragmented landscape of natural lands, and the open lands of the ranch provide an important corridor for animal and vegetation dispersal. The conservation value of the natural vegetation and wildlife habitat preserved by this working ranch cannot be overstated.

RECOMMENDATIONS

Eagle Rock Ranch contains natural areas that provide important habitat for plants and wildlife. The diverse vegetation types found on ranch each support a unique suites of species, with plants and smaller or less mobile animals more-or-less confined to a single type, while larger animals range across multiple vegetation types during their lives. The foremost consideration is protecting the plant and wildlife habitat that currently occurs on the ranch. The focus should be on conserving the current condition of the habitat that exists and protecting intact habitat from fragmentation by fence lines or other disturbance. Based on our observations and the rare plant, plant community, and animal occurrences, we recommend the following:

- 1) Protect the grassland, riparian communities, and wet meadows and avoid excessive disturbance to the landscape in general. For the Grassyslope sedge population on the southern parcel, leave habitat intact and avoid concentrated grazing in this area.
- 2) Select a season for riparian area and wetland grazing that avoids critical periods for streambanks and riparian vegetation (Maestas et al. 2023). Critical periods include late spring and early summer due to high soil moisture and fragility of streambanks and late fall due to heavy shrub utilization.
- 3) Remove cattle from wetlands on the southern parcel as possible, especially when the ground is wet, to allow for revegetation and lessening of hummocks (<https://extension.colostate.edu/topic-areas/agriculture/managing-cattle-impacts-when-grazing-on-wet-soils-1-634/>).

- 4) Install wildlife friendly fencing and/or expand upon the installation of seasonally removeable fence lines which the ranch initiated in the year of our surveys.
- 5) Time hay-cutting with nesting season in mind (Gruntorad et al. 2021). For increased wildlife nesting, delay haying until July 15 or later. This will allow ground-nesting birds time to hatch their broods. The nesting period for songbirds using pastures begins in early to mid-April and can continue through August.
- 6) Approach containment or treatment of Canada Thistle with great caution. Minimizing bare ground and supporting native vegetation by preventing overgrazing and avoiding aggressive weed treatment is the best course of action. Tracking the extent and dominance of Canada Thistle in wet meadows over time is also recommended. If treatment is determined to be necessary, hand-pulling is not recommended due to the creation of root fragments and stimulation of the growth of new plants (CO Department of Agriculture 2015). Herbicides should also not be a first choice, and if they are employed, treatments may be necessary for 1-3 years. Soil damage due to overspray, trampling, and off-road vehicle use to access sites should be minimized. Monitoring of treatments should be done within the same season to assess success; if monitoring is not possible, treatment should not be undertaken. A host-specific pathogenic rust fungus (*Puccinia punctiformis*) has shown potential to reduce the spread of Canada Thistle infestations and may be available as a treatment (CO Department of Agriculture 2023).
- 7) Conduct further surveys, especially at additional times of year such as spring and late summer, to identify a more complete list of plants and wildlife present in the open space areas. The Grassyslope sedge population on the southern parcel could be further delineated with additional mapping.
- 8) Survey for aquatic insects to help elucidate the significance and condition of the ecological communities found in wetland and riparian areas.
- 9) Identify pollinators and other factors affecting the reproductive ecology and long-term viability of the rare plants as well as those with a high floristic quality index.
- 10) Install bat boxes to support the conservation of bats at Eagle Rock Ranch.

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APPENDIX 1

LEGAL DESCRIPTION OF EAGLE ROCK RANCH

LEGAL DESCRIPTION
EAGLE ROCK RANCH

Township 9 South, Range 74 West, 6th P.M.
Park County, Colorado

Section 26: SW/4NE/4,
 S/2NW/4,
 NW/4NW/4,
 NE/4SW/4,
 NW/4SE/4 less 10 acres

Section 27: E/2

Section 34: E/2NW/4,
 N/2NE/4

Containing 710 acres, more or less and also known as 14709 County
Road 77, Jefferson, CO
(Park County Assessor Schedule #1575)

Township 10 South, Range 74 West, 6th P.M.
Park County, Colorado

Section 09: SE/4SW/4,
 S/2SE/4

Section 10: W/2

Section 15: ALL

Section 16: E/2,
 E/2W/2,
 SW/4NW/4,
 NW/4SW/4

Section 21: N/2NE/4,
 NE/4NW/4

Section 22: N/2

Containing 2,080 acres, more or less
(Park County Assessor Schedule #1576)

T10S, R74W, Section 9: SE/4, South Park Meadows Sub 3 Lot 17B Amendment
No 1

Containing 28.85 acres, more or less
(Park County Assessor Schedule/Parcel #691)

APPENDIX 2

NATURAL HERITAGE METHODOLOGY

Natural Heritage Status Ranks

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 "watchlisted," 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 7.

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 4, 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 7. Definition of Natural Heritage Imperilment Ranks.

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

Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element 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 8 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Table 8. Federal and State Agency Special Designations for Rare Species.

Federal Status:

1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)

- LE Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
- LT Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
- P Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
- C Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
- PDL Proposed for delisting.
- XN Nonessential experimental population.

2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")

- FS Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:
 - Significant current or predicted downward trends in population numbers or density.
 - Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as "S")

- BLM Sensitive: those species found on public lands designated by a State Director that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.

4. State Status:

The Colorado Division of 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 9.

Table 9. 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 10 for a summary of these B-ranks.

Table 10. Natural Heritage Program Biological Diversity Ranks and their Definitions.

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

Protection Urgency Ranks

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occurs. In most cases, this rank refers to the need for a major change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table 11 summarizes the P-ranks and their definitions.

Table 11. 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 12 summarizes M-ranks and their definitions.

Table 12. 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.

APPENDIX 3

PLANT, LICHEN, AND WILDLIFE SPECIES LISTS

Table 1. PLANTS (rare species are in bold). See Appendix 2 for an explanation of Status. “cf” indicates a reasonable ID, but not able to be confirmed. C-value is the Coefficient of Conservatism (Smith et al. 2020, Rocchio 2007). For more information about the Colorado Noxious Weed List, see: <https://ag.colorado.gov/conservation/noxious-weeds/species-id>.

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Amaranthaceae	Pigweed	<i>Chenopodium</i> sp.	Goosefoot						North, South	Dry Hillside, Spring
Amaryllidaceae	Amaryllis	<i>Allium geyeri</i>	Geyer's Onion			5	Native		North	Riparian
Amaryllidaceae	Amaryllis	<i>Allium</i> sp.	Wild Onion				Native		North	Dry Hillside
Anacardiaceae	Cashew	<i>Rhus trilobata</i>	Skunkbush Sumac			5	Native		North	Dry Hillside
Apiaceae	Carrot	<i>Angelica ampla</i>	Giant Angelica			4	Native		North	Riparian
Apiaceae	Carrot	<i>Conioselinum scopulorum</i>	Hemlock Parsley			7	Native		North	Riparian
Apocynaceae	Dogbane	<i>Asclepias</i> sp.	Milkweed				Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Achillea millefolium</i>	Common Yarrow			4	Native		North, South	Riparian, Non-Irrigated Wet Meadow
Asteraceae	Sunflower	<i>Agoseris glauca</i> var. <i>glauca</i>	Pale Agoseris			7	Native		North, South	Irrigated Wet Meadow, Spring
Asteraceae	Sunflower	<i>Antennaria parviflora</i>	Little-leaf Pussy-toes	x		5	Native		South	Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Antennaria</i> sp.	Pussy-toes				Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Arnica chamissonis</i>	Chamisso Arnica	x		8	Native		North	Riparian
Asteraceae	Sunflower	<i>Artemisia campestris</i> var. <i>pacifica</i>	Field Sagewort			5	Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Artemisia dracunculus</i>	Tarragon			3	Native		North	Dry Hillside, Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Artemisia frigida</i>	Fringed Sagebrush			4	Native		North, South	Dry Hillside, Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Chysothamnus viscidiflorus</i>	Viscid Rabbitbrush			5	Native		North, South	Dry Hillside
Asteraceae	Sunflower	<i>Cirsium americanum</i>	Dinnerplate Thistle			N/A	Native		North, South	Riparian, Pond, Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Cirsium arvense</i>	Canada Thistle			0	Non-native	B	North, South	Ditch, Non-irrigated Wet Meadow, Spring
Asteraceae	Sunflower	<i>Cirsium coloradoense</i>	Colorado thistle			N/A	Native		North	Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Ericameria nauseosa</i>	Rubber Rabbitbrush			3	Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Erigeron vetensis</i>	Early Bluetop Fleabane	x		6	Native		North, South	Dry Hillside
Asteraceae	Sunflower	<i>Heterotheca pumila</i>	Alpine False Goldenaster	x		2	Native		South	Dry Hillside
Asteraceae	Sunflower	<i>Heterotheca villosa</i>	Hairy False Goldenaster			4	Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Hymenoxys richardsonii</i>	Colorado Rubberweed			4	Native		North, South	Dry Hillside

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Asteraceae	Sunflower	<i>Packera debilis</i>	Rocky Mountain Ragwort	x	G4/S1	10	Native		South	Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Packera fendleri</i>	Fendler's Ragwort	x		4	Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Rudbeckia hirta</i> var. <i>pulcherrima</i>	Black-Eyed Susan			6	Native		North	Riparian
Asteraceae	Sunflower	<i>Taraxacum officinale</i>	Dandelion			0	Non-native		North, South	Irrigated Wet Meadow, Non-irrigated Wet Meadow
Asteraceae	Sunflower	<i>Tetraneuris acaulis</i> var. <i>acaulis</i>	Stemless Four-nerve-daisy	x		6	Native		North	Dry Hillside
Asteraceae	Sunflower	<i>Xanthisma coloradense</i>	Colorado Tansy-aster	x	G3/S3	6	Native		North, South	Dry Hillside
Boraginaceae	Borage	<i>Hackelia floribunda</i>	Manyflower Stickseed			3	Native		North, South	Irrigated Wet Meadow, Spring
Boraginaceae	Borage	<i>Lappula occidentalis</i>	Western Stickseed			2	Native		South	Spring
Boraginaceae	Borage	<i>Mertensia lanceolata</i>	Prairie Bluebell	x		6	Native		North	Dry Hillside
Boraginaceae	Borage	<i>Oreocarya</i> sp.	Cryptantha				Native		North	Dry Hillside
Brassicaceae	Mustard	<i>Draba streptocarpa</i>	Pretty Draba	x		8	Native		North	Dry Hillside
Brassicaceae	Mustard	<i>Erysimum cheiranthoides</i>	Wormseed Wallflower	x		0	Non-native		North	Riparian
Brassicaceae	Mustard	<i>Lepidium draba</i>	White Top			0	Non-native	B	North	Irrigated Wet Meadow, Ditch
Brassicaceae	Mustard	<i>Lepidium paysonii</i>	Payson's Pepperweed	x		N/A	Native		North	Dry Hillside
Brassicaceae	Mustard	<i>Physaria montana</i>	Mountain Bladderpod	x		5	Native		North	Dry Hillside
Brassicaceae	Mustard	<i>Thlaspi arvense</i>	Field Penny-Cress			0	Non-native		North, South	Riparian, Spring
Cactaceae	Cactus	<i>Pediocactus simpsonii</i>	Mountain Cactus			6	Native		North	Dry Hillside
Campanulaceae	Bellflower	<i>Campanula uniflora</i>	Arctic Harebell			8	Native		North	Dry Hillside, Irrigated Wet Meadow
Caryophyllaceae	Pink	<i>Cerastium arvense</i> ssp. <i>strictum</i>	Prairie Mouse-ear	x		5	Native		North	Riparian
Caryophyllaceae	Pink	<i>Eremogone fendleri</i>	Fendler's Sandwort	x		6	Native		South	Dry Hillside
Cupressaceae	Cypress	<i>Juniperus communis</i>	Common Juniper			6	Native		North	Dry Hillside
Cyperaceae	Sedge	<i>Carex aquatilis</i>	Water Sedge	x		6	Native		North, South	Riparian, Irrigated Wet Meadow, Pond, Spring, Non-irrigated Wet Meadow
Cyperaceae	Sedge	<i>Carex duriuscula</i>	Needleleaf Sedge	x		7	Native		North, South	Dry Hillside
Cyperaceae	Sedge	<i>Carex hallii</i>	Hall's Sedge	x		9	Native		South	Non-irrigated Wet Meadow
Cyperaceae	Sedge	<i>Carex oreocharis</i>	Grassyslope Sedge	x	G3/S3	8	Native		North, South	Dry Hillside

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Cyperaceae	Sedge	<i>Carex praeegracilis</i>	Clustered Field Sedge	x		5	Native		North, South	Riparian, Irrigated Wet Meadow, Non-irrigated Wet Meadow
Cyperaceae	Sedge	<i>Carex simulata</i>	Analogue Sedge	x		6	Native		North	Irrigated Wet Meadow
Cyperaceae	Sedge	<i>Carex utriculata</i>	Beaked Sedge	x		5	Native		North, South	Riparian, Irrigated Wet Meadow, Pond, Ditch, Spring
Cyperaceae	Sedge	<i>Eleocharis palustris</i>	Common Spikerush	x, cf		3	Native		North	Irrigated Wet Meadow
Cyperaceae	Sedge	<i>Eleocharis quinqueflora</i>	Fewflower Spikerush	x		8	Native		North	Riparian, Irrigated Wet Meadow, Pond, Ditch
Cyperaceae	Sedge	<i>Schoenoplectus tabernaemontani</i>	Softstem Bulrush			3	Native		North	Pond
Cystopteridaceae	Bladder Fern	<i>Cystopteris fragilis</i>	Brittle Bladderfern			9	Native		North	Dry Hillside
Equisetaceae	Horsetail	<i>Equisetum arvense</i>	Field Horsetail			4	Native		North	Riparian
Equisetaceae	Horsetail	<i>Equisetum laevigatum</i>	Smooth Horsetail			4	Native		North	Riparian
Fabaceae	Pea	<i>Astragalus agrestis</i>	Purple Milkvetch			6	Native		North	Riparian
Fabaceae	Pea	<i>Oxytropis deflexa</i> var. <i>sericea</i>	White Nodding Locoweed			8	Native			Riparian
Fabaceae	Pea	<i>Thermopsis montana</i>	Mountain Goldenbean			6	Native		North	Riparian, Irrigated Wet Meadow
Fabaceae	Pea	<i>Trifolium hybridum</i>	Alsike Clover			0	Non-Native		North	Riparian, Irrigated Wet Meadow
Fabaceae	Pea	<i>Trifolium pratense</i>	Red Clover			0	Non-Native		North	Irrigated Wet Meadow
Gentianaceae	Gentian	<i>Gentiana fremontii</i>	Moss Gentian			9	Native		North	Irrigated Wet Meadow
Geraniaceae	Geranium	<i>Geranium caespitosum</i>	Rocky Mountain Geranium	x		6	Native		North	Dry Hillside
Geraniaceae	Geranium	<i>Geranium</i> sp.	Geranium				Native		South	Dry Hillside
Grossulariaceae	Gooseberry	<i>Ribes cereum</i>	Wax Currant			6	Native		North, South	Dry Hillside, Riparian
Haloragaceae	Water Milfoil	<i>Myriophyllum sibiricum</i>	Siberian Water-Milfoil	x		3	Native		North	Pond
Hydrangeaceae	Hydrangea	<i>Jamesia americana</i> var. <i>americana</i>	Fivepetal Cliffbush			7	Native		North	Dry Hillside
Iridaceae	Iris	<i>Iris missouriensis</i>	Rocky Mountain Iris			4	Native		North	Riparian, Non-Irrigated Wet Meadow
Iridaceae	Iris	<i>Sisyrinchium pallidum</i>	Pale Blue-Eyed Grass	x	G3/S3	7	Native		North, South	Riparian, Irrigated Wet Meadow, Non-irrigated Wet Meadow
Juncaceae	Rush	<i>Juncus arcticus</i> var. <i>balticus</i>	Arctic Rush	x		4	Native		North, South	Irrigated Wet Meadow, Non-irrigated Wet Meadow, Spring
Juncaceae	Rush	<i>Juncus bryoides</i>	Moss Rush	x		9	Native		North	Riparian
Juncaceae	Rush	<i>Juncus longistylis</i>	Longstyle Rush	x		6	Native		North	Riparian

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Juncaginaceae	Arrowgrass	<i>Triglochin maritima</i>	Seaside Arrowgrass			6	Native		North	Riparian, Irrigated Wet Meadow, Pond, Non-irrigated Wet Meadow
Juncaginaceae	Arrowgrass	<i>Triglochin palustris</i>	Marsh Arrowgrass			7	Native		North, South	Riparian, Non-irrigated Wet Meadow
Lamiaceae	Mint	<i>Mentha arvensis</i>	Wild Mint			4	Native		North	Riparian, Ditch
Linaceae	Flax	<i>Linum lewisii</i>	Lewis Flax	x		4	Native		North, South	Non-irrigated Wet Meadow
Melanthiaceae	False-Hellebore	<i>Anticlea elegans</i>	Mountain Death Camas			6	Native		North	Riparian
Onagraceae	Evening Primrose	<i>Epilobium sp.</i>	Willowherb				Native		North	Riparian
Onagraceae	Evening Primrose	<i>Oenothera coronopifolia</i>	Crownleaf Evening Primrose			4	Native		South	Dry Hillside
Orchidaceae	Orchid	<i>Platanthera aquilonis</i>	Northern Green Orchid	x		7	Native		North	Riparian, Irrigated Wet Meadow
Orobanchaceae	Broomrape	<i>Castilleja integra</i>	Wholeleaf Indian Paintbrush			6	Native		South	Dry Hillside
Orobanchaceae	Broomrape	<i>Castilleja septentrionalis</i>	Yellow Indian Paintbrush	x		7	Native		North	Riparian, Irrigated Wet Meadow
Orobanchaceae	Broomrape	<i>Pedicularis crenulata</i>	Meadow Lousewort			7	Native		North	Riparian, Irrigated Wet Meadow
Orobanchaceae	Broomrape	<i>Pedicularis groenlandica</i>	Elephant's Head			8	Native		North	Riparian, Irrigated Wet Meadow
Pinaceae	Pine	<i>Pinus aristata</i>	Bristlecone Pine			9	Native		North, South	Dry Hillside
Plantaginaceae	Plantain	<i>Callitriche hermaphroditica</i>	Northern Water-starwort	x		5	Native		North	Pond
Plantaginaceae	Plantain	<i>Callitriche palustris</i>	Vernal Water-starwort	x		5	Native		North	Ditch
Plantaginaceae	Plantain	<i>Callitriche sp.</i>	Water-starwort				Native		South	Spring
Plantaginaceae	Plantain	<i>Hippuris vulgaris</i>	Mare's Tail	x		6	Native		North	Riparian, Ditch
Plantaginaceae	Plantain	<i>Penstemon caespitosus</i>	Mat Penstemon	x		7	Native		North	Dry Hillside
Plantaginaceae	Plantain	<i>Penstemon virgatus</i>	Oneside Penstemon			6	Native		North, South	Dry Hillside
Plantaginaceae	Plantain	<i>Plantago lanceolata</i>	Narrowleaf Plantain			0	Non-native		North	Riparian
Plantaginaceae	Plantain	<i>Plantago major</i>	Common Plantain			0	Non-native		North	Irrigated Wet Meadow
Plantaginaceae	Plantain	<i>Synthesis plantaginea</i>	White River Kittenails	x		8	Native		North	Dry Hillside
Poaceae	Grass	<i>Agrostis gigantea</i>	Redtop			0	Non-native		North	Irrigated Wet Meadow

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Poaceae	Grass	<i>Alopecurus magellanicus</i>	Alpine Foxtail	x		7	Native		North	Irrigated Wet Meadow
Poaceae	Grass	<i>Alopecurus pratensis</i>	Meadow Foxtail	x		0	Non-native		North, South	Riparian, Irrigated Wet Meadow, Pond, Ditch, Non-irrigated Wet Meadow, Spring
Poaceae	Grass	<i>Anthoxanthum nitens</i>	Northern Sweetgrass	x		9	Native		North	Riparian, Irrigated Wet Meadow
Poaceae	Grass	<i>Beckmannia syzigachne</i>	American Sloughgrass			4	Native		North	Pond, Ditch
Poaceae	Grass	<i>Bouteloua gracilis</i>	Blue Grama			4	Native		North, South	Dry Hillside
Poaceae	Grass	<i>Bromus inermis</i>	Smooth Brome			0	Non-native		North	Riparian, Irrigated Wet Meadow
Poaceae	Grass	<i>Danthonia parryi</i>	Parry's Oatgrass			8	Native		North	Dry Hillside
Poaceae	Grass	<i>Deschampsia cespitosa</i>	Tufted Hairgrass			4	Native		North, South	Riparian, Irrigated Wet Meadow, Non-irrigated Wet Meadow, Spring
Poaceae	Grass	<i>Elymus elymoides</i>	Squirreltail			4	Native		North	Dry Hillside, Riparian
Poaceae	Grass	<i>Elymus repens</i>	Quackgrass			0	Non-native	B	North, South	Riparian, Non-Irrigated Wet Meadow
Poaceae	Grass	<i>Elymus trachycaulus</i>	Slender Wheatgrass			4	Native		North, South	Pond, Spring
Poaceae	Grass	<i>Festuca arizonica</i>	Arizona Fescue	x, cf		6	Native		North	Dry Hillside
Poaceae	Grass	<i>Festuca idahoensis</i>	Idaho Fescue			7	Native		South	Dry Hillside
Poaceae	Grass	<i>Festuca rubra</i> ssp. <i>rubra</i>	Red Fescue	x		0	Non-Native		North	Non-irrigated Wet Meadow
Poaceae	Grass	<i>Glyceria grandis</i>	American Mannagrass	x		6	Native		North	Pond, Ditch
Poaceae	Grass	<i>Hesperostipa comata</i>	Needle-and-thread Grass			6	Native		North	Dry Hillside
Poaceae	Grass	<i>Hordeum brachyantherum</i> ssp. <i>brachyantherum</i>	Meadow Barley			4	Native		North, South	Irrigated Wet Meadow, Spring
Poaceae	Grass	<i>Hordeum jubatum</i>	Foxtail Barley			2	Native		North	Irrigated Wet Meadow
Poaceae	Grass	<i>Koeleria macrantha</i>	Junegrass	x		6	Native		North, South	Dry Hillside, Riparian, Irrigated Wet Meadow, Non-irrigated Wet Meadow
Poaceae	Grass	<i>Muhlenbergia filiculmis</i>	Slimstem Muhly	x		4	Native		South	Dry Hillside
Poaceae	Grass	<i>Muhlenbergia montana</i>	Mountain Muhly	x		7	Native		North	Dry Hillside
Poaceae	Grass	<i>Phleum pratense</i>	Timothy			0	Non-Native		North	Irrigated Wet Meadow

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
Poaceae	Grass	<i>Poa compressa</i>	Canada Bluegrass	x, cf		0	Non-Native		North	Riparian
Poaceae	Grass	<i>Poa palustris</i>	Fowl Bluegrass	x		6	Native		South	Spring
Poaceae	Grass	<i>Poa pratensis</i>	Kentucky Bluegrass			0	Non-Native		North, South	Irrigated Wet Meadow, Spring
Polemoniaceae	Phlox	<i>Ipomopsis aggregata</i>	Scarlet Gilia			5	Native		North	Dry Hillside
Polygonaceae	Buckwheat	<i>Bistorta bistortoides</i>	Subalpine Bistort	x		7	Native		North	Riparian, Irrigated Wet Meadow
Polygonaceae	Buckwheat	<i>Eriogonum arcuatum</i> var. <i>arcuatum</i>	Baker's Buckwheat	x		6	Native		North, South	Dry Hillside
Polygonaceae	Buckwheat	<i>Rumex occidentalis</i>	Western Dock			5	Native		North	Non-irrigated Wet Meadow
Polygonaceae	Buckwheat	<i>Rumex utahensis</i>	Utah Willow Dock	x		4	Native		North, South	Riparin, Pond, Ditch, Spring
Potamogetonaceae	Pondweed	<i>Potamogeton pusillus</i>	Small Pondweed	x		5	Native		North	Pond
Potamogetonaceae	Pondweed	<i>Potamogeton</i> sp.	Pondweed				Native		South	Pond
Primulaceae	Primrose	<i>Lysimachia maritima</i>	Sea Milkwort	x		7	Native		North	Non-irrigated Wet Meadow
Primulaceae	Primrose	<i>Primula incana</i>	Silvery Primrose			9	Native		South	Non-irrigated Wet Meadow
Primulaceae	Primrose	<i>Primula pauciflora</i> var. <i>pauciflora</i>	Darkthroat Shooting Star			8	Native		North, South	Riparian, Irrigated Wet Meadow, Non-irrigated Wet Meadow
Pteridaceae	Maidenhair Fern	<i>Argyrochosma fendleri</i>	False Cloak Fern		G3/S3	7	Native		North	Dry Hillside
Ranunculaceae	Buttercup	<i>Caltha chionophila</i>	Marsh Marigold			7	Native		North	Irrigated Wet Meadow
Ranunculaceae	Buttercup	<i>Delphinium ramosum</i>	Mountain Larkspur			5	Native		North	Irrigated Wet Meadow
Ranunculaceae	Buttercup	<i>Halerpestes cymbalaria</i>	Marsh Buttercup	x		4	Native		North, South	Riparian, Pond, Spring
Ranunculaceae	Buttercup	<i>Ranunculus aquatilis</i>	Water Crowfoot			3	Native		North	Pond
Ranunculaceae	Buttercup	<i>Ranunculus gmelinii</i>	Gmelin's Buttercup			6	Native		North	Pond
Ranunculaceae	Buttercup	<i>Ranunculus macounii</i>	Macoun's Buttercup	x		7	Native		North	Riparian, Pond
Ranunculaceae	Buttercup	<i>Ranunculus sceleratus</i> var. <i>multifidus</i>	Blister Buttercup	x		1	Native		North, South	Pond, Spring
Rosaceae	Rose	<i>Argentina anserina</i>	Silverweed	x					North	Irrigated Wet Meadow
Rosaceae	Rose	<i>Chamaerhodos erecta</i> var. <i>parviflora</i>	Little Ground Rose	x		7	Native		North, South	Dry Hillside
Rosaceae	Rose	<i>Dasiphora fruticosa</i>	Shrubby Cinquefoil			4	Native		North, South	Dry Hillside, Riparian, Non-irrigated Wet Meadow
Rosaceae	Rose	<i>Geum triflorum</i>	Prairie Smoke			7	Native		North	Dry Hillside
Rosaceae	Rose	<i>Physocarpus monogynus</i>	Mountain Ninebark			7	Native		North	Dry Hillside
Rosaceae	Rose	<i>Potentilla pulcherrima</i> x <i>hippiana</i>	Beautiful Cinquefoil &	x			Native		North	Riparian, Irrigated Wet Meadow

Plant Family Scientific Name	Plant Family Common Name	Plant Scientific Name	Plant Common Name	Verified Specimen	Status	C-Value	Native/Non-native	CO Nox. Weed List	Parcel	Habitat Notes
			Woolly Cinquefoil Hybrid							
Rosaceae	Rose	<i>Potentilla hippiana</i> var. <i>hippiana</i>	Woolly Cinquefoil	x		5	Native		North ,South	Dry Hillside, Riparian, Irrigated Wet Meadow, Pond, Ditch, Non-irrigated Wet Meadow
Rosaceae	Rose	<i>Rosa</i> sp.	Wild Rose				Native		North	Dry Hillside
Salicaceae	Willow	<i>Salix exigua</i>	Coyote Willow			3	Native		North	Riparian
Salicaceae	Willow	<i>Salix irrorata</i>	Bluestem Willow	x		7	Native		North	Riparian
Salicaceae	Willow	<i>Salix melanopsis</i>	Dusky Willow	x		7	Native		North	Irrigated Wet Meadow
Salicaceae	Willow	<i>Salix monticola</i>	Mountain Willow			6	Native		North	Riparian
Salicaceae	Willow	<i>Salix planifolia</i>	Tea-leafed Willow	x		7	Native		North	Riparian
Saxifragaceae	Saxifrage	<i>Heuchera parvifolia</i>	Littleleaf Alumroot	x		7	Native		North	Dry Hillside
Selaginellaceae	Spike-moss	<i>Selaginella densa</i>	Rocky Mountain Spike-moss	x		6	Native		South	Dry Hillside
Selaginellaceae	Spike-moss	<i>Selaginella</i> sp.	Spike-moss				Native		North	Dry Hillside
Typhaceae	Cattail	<i>Sparganium angustifolium</i>	Narrowleaf Bur-Reed			7	Native		South	Pond
Valerianaceae	Valerian	<i>Valeriana edulis</i>	Tobacco Root			7	Native		North	Riparian, Irrigated Wet Meadow

Table 2. LICHEN. See Appendix 2 for an explanation of Status. “cf” indicates a reasonable ID, but not able to be confirmed.

Family	Scientific Name	Common Name	Status	Parcel
Acarosporaceae	<i>Acarospora schleicheri</i>	Schleicher's Cracked Lichen	GNR/SNR	South
Acarosporaceae	<i>Pleopsidium flavum</i>	Gold Cobblestone Lichen	GNR/SNR	North
Candelariaceae	<i>Candelariella vitellina</i>	Common Goldspeck Lichen	G5/SNR	North
Cladoniaceae	<i>Cladonia</i> sp.	a reindeer moss		North
Lecanoraceae	<i>Lecanora</i> sp.	a rim lichen		North
Lecanoraceae	<i>Rhizoplaca chrysoleuca</i>	Orange Rock-posy Lichen	G5/SNR	North
Parmeliaceae	<i>Flavopunctelia flaventior</i>	Speckled Greenshield Lichen	G5/SNR	North
Parmeliaceae	<i>Melanelixia subaurifera</i>	Abraded Camouflage Lichen	G5/SNR	North
Parmeliaceae	<i>Parmelia fraudans</i>	Pea-green Shield Lichen	G5/SNR	North
Parmeliaceae	<i>Punctelia perreticulata</i> (cf.)	Posdered Speckleback Lichen	GNR/SNR	North
Parmeliaceae	<i>Xanthoparmelia</i> spp.	a vagrant lichen		North, South
Pertusariaceae	<i>Ochrolechia upsaliensis</i>	Tundra Saucer Lichen	G4/SNR	North
Stereocaulaceae	<i>Lepraria</i> sp.	a dust lichen		North
Teloschistaceae	<i>Rusavskia elegans</i>	Elegant Sunburst Lichen	G5/SNR	North
Thelotremataceae	<i>Diploschistes diacapsis</i>	Desert Crater Lichen	G4/SNR	North
Thelotremataceae	<i>Diploschistes</i> sp.			South
Umbilicariaceae	<i>Lasallia pustulata</i>	a toadskin lichen	GNR/SNR	North

Table 3. WILDLIFE (rare species are in bold). See Appendix 2 for an explanation of status.

FAMILY	SCIENTIFIC_NAME	COMMON_NAME	Status	NORTH PARCEL	SOUTH PARCEL
AMPHIBIAN					
Ambystomatidae	<i>Ambystoma mavortium</i>	Western Tiger Salamander	G5S3S4	X	X
Hylidae	<i>Pseudacris maculata</i>	Chorus Frog	G5S5	X	X
BIRD					
Accipitridae	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G5S3B,S3N	X	
Alaudidae	<i>Eremophila alpestris</i>	Horned Lark	G5S5B	X	
Anatidae	<i>Anas platyrhynchos</i>	Mallard	G5S5		X
Ardeidae	<i>Ardea herodias</i>	Great Blue Heron	G5S3B	X	
Charadriidae	<i>Charadrius vociferus</i>	Killdeer	G5S5	X	
Corvidae	<i>Corvus corax</i>	Common Raven	G5S5	X	
Corvidae	<i>Pica hudsonia</i>	Black-billed Magpie	G5S5		X
Falconidae	<i>Falco mexicanus</i>	Prairie Falcon	G5S4B,S4N		X
Fringillidae	<i>Spinus pinus</i>	Pine Siskin	G5S5	X	
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	G5S5	X	
Hirundinidae	<i>Petrochelidon pyrrhonota</i>	Cliff swallow	G5S5B	X	
Hirundinidae	<i>Tachycineta bicolor</i>	Tree swallow	G5S5	X	
Icteridae	<i>Agelaius phoeniceus</i>	Red-winged Blackbird	G5S5	X	
Icteridae	<i>Euphagus cyanocephalus</i>	Brewer's Blackbird	G5S5B,S4N	X	
Icteridae	<i>Molothrus ater</i>	Brown-headed Cowbird	G5S5	X	
Icteridae	<i>Sturnella neglecta</i>	Western Meadowlark	G5S5	X	
Mimidae	<i>Oreoscoptes montanus</i>	Sage Thrasher	G4S5	X	
Paridae	<i>Poecile atricapillus</i>	Black-Capped Chickadee	G5S5	X	
Passerellidae	<i>Melospiza melodia</i>	Song Sparrow	G5S5	X	
Passerellidae	<i>Spizella passerina</i>	Chipping Sparrow	G5S5B.S5N	X	
Passerellidae	<i>Chondestes grammacus</i>	Lark Sparrow	G5S4	X	
Passerellidae	<i>Passerculus sandwichensis</i>	Savannah Sparrow	G5S4B	X	
Passerellidae	<i>Pipilo chlorurus</i>	Green-tailed Towhee	G5S5	X	
Passerellidae	<i>Poocetes gramineus</i>	Vesper Sparrow	G5S5	X	X
Passerellidae	<i>Spizella breweri</i>	Brewer's Sparrow	G5S4B		
Picidae	<i>Colaptes auratus</i>	Northern Flicker	G5S5	X	
Scolopacidae	<i>Gallinago delicata</i>	Wilson's Snipe	G5S5	X	
Scolopacidae	<i>Actitis macularius</i>	Spotted Sandpiper	G5S5	X	
Troglodytidae	<i>Salpinctes obsoletus</i>	Rock Wren	G5S4	X	
Troglodytidae	<i>Troglodytes aedon</i>	House Wren	G5S5	X	
Turdidae	<i>Catharus guttatus</i>	Hermit Thrush	G5S5B	X	

FAMILY	SCIENTIFIC_NAME	COMMON_NAME	Status	NORTH PARCEL	SOUTH PARCEL
Turdidae	<i>Catharus fuscescens</i>	Veery	G5S3B	X	
Turdidae	<i>Myadestes townsendi</i>	Townsend's Solitaire	G5S5		X
Tyrannidae	<i>Contopus cooperi</i>	Olive-sided Flycatcher	G4S3S4B	X	
FISH					
Esocidae	<i>Esox lucius</i>	Northern Pike	G5SNA	X	
Salmonidae	<i>Oncorhynchus mykiss</i>	Rainbow Trout	G5SNA	X	
Salmonidae	<i>Salvelinus fontinalis</i>	Brook Trout	G5SNA	X	
INSECT					
Libellulidae	<i>Libellula pulchella</i>	Twelve-spotted Skimmer	G5S5		X
Acrididae	<i>Arphia conspersa</i>	Speckled Rangeland Grasshopper	G5SNR		X
Acrididae	<i>Camnula pellucida</i>	Clear-winged Grasshopper	G5SNR		X
Acrididae	<i>Melanoplus occidentalis</i>	Flabellate Grasshopper	G5SNR		X
Apidae	<i>Bombus nevadensis</i>	Nevada Bumble Bee	G4S4	X	
Apidae	<i>Bombus</i> sp.	Bumble Bee		X	
Asilidae	<i>Crptogon</i> sp.	Robber Fly			X
Asilidae		Robber Fly			X
Baetidae		Small Minnow Mayfly larvae		X	
Bombyliidae		Beefly		X	
Coccinellidae	<i>Coccinella septempunctata</i>	Seven-Spotted Lady Beetle	GNRSNR	X	X
Coenagrionidae		Pond Damselfly		X	X
Dytiscidae	<i>Dystiscus</i> sp.	Predaceous Diving Beetle		X	
Formicidae	<i>Pogonomyrmex occidentalis</i>	Western Harvester Ant	GNRSNR	X	X
Gyrinidae	<i>Gyrinus</i> sp.	Whirligig Beetle		X	X
Hesperiidae	<i>Hesperia nevada</i>	Nevada Skipper	G5S5		X
Hesperiidae	<i>Oarisma garita</i>	Garita Skipperling	G5S5		X
Lycaenidae	<i>caricia lupini</i>	Lupine Blue	G5S5	X	
Lycaenidae	<i>Icaricia saepiolus</i>	Greenish Blue	G5S5	X	X
Lycaenidae	<i>Plebejus melissa</i>	Melissa Blue	G5S5	X	X
Lycaenidae	<i>Tharsalea rubidus</i>	Ruddy Copper	G5S5	X	
Meloidae	<i>Lytta cyanipennis</i>	Green Blister Beetle	GNRSNR	X	
Noctuidae	<i>Anagrapha falcifera</i>	Celery Looper Moth	G5SNR	X	
Notonectidae	<i>Notonecta kirbyi</i>	Kirby's Backswimmer	GNRSNR	X	X
Nymphalidae	<i>Cercyonis pegala</i>	Common Wood-Nymph	G5S5	X	
Nymphalidae	<i>Coenonympha californica</i>	Common Ringlet	G5S5	X	X
Nymphalidae	<i>Phyciodes pulchella</i>	Field Crescent	G5S5		X
Nymphalidae	<i>Cercyonis oetus</i>	Small Wood Nymph	G5S5		X
Nymphalidae	<i>Erebia epipsodea</i>	Common Alpine	G5S5	X	
Nymphalidae	<i>Euphydryas editha</i>	Edith's Checkerspot	G5S4	X	X

FAMILY	SCIENTIFIC_NAME	COMMON_NAME	Status	NORTH PARCEL	SOUTH PARCEL
Nymphalidae	<i>Euptoieta claudia</i>	Variegated Fritillary	G5SNR		X
Nymphalidae	<i>Nymphalis antiopa</i>	Mourning Cloak	G5S5	X	
Nymphalidae	<i>Phyciodes mylitta</i>	Mylitta Crescent	G5S5	X	
		Alpine butterfly		X	
Pieridae	<i>Colias eurytheme</i>	Orange Sulphur	G5S5	X	
Pieridae	<i>Pontia protodice</i>	Checkered White	G5S4	X	X
Psychidae	<i>Phyche casta</i>	Common Bagworm Moth	GNRSNR	X	
Syrphidae		Hover Fly			X
Tenebrionidae	<i>Eleodes carbonaria</i>	Carbonized Darkling Beetle	GNRSNR		X
Tenebrionidae	<i>Eleodes fusiformis</i>	A Darkling Beetle	GNRSNR	X	X
		Amphipod		X	
		Caddisfly		X	
MAMMAL					
Antilocapridae	<i>Antilocapra americana</i>	Pronghorn	G5S4		X
Canidae	<i>Canis latrans</i>	Coyote	G5S5	X	X
Cervidae	<i>Cervus elaphus</i>	American Elk	G5S5	X	X
Cricetidae	<i>Ondatra zibethicus</i>	Common Muskrat	G5S5	X	
Geomyidae	<i>Thomomys talpoides</i>	Northern Pocket Gopher	G5S5	X	X
Leporidae	<i>Sylvilagus nuttallii</i>	Mountain Cottontail	G5S5		X
Sciuridae	<i>Uroditellus elegans</i>	Wyoming Ground Squirrel	G5S5	X	X
Taxidiinae	<i>Taxidea taxus</i>	American Badger	G5S4	X	X
MOLLUSK					
Lymnaeidae	<i>Ladislavella elodes</i>	Marsh Pondsail	G5S5		X
Physidae	<i>Physa acuta</i>	Acute Bladder Snail	G5S2	X	
Sphaeriidae	<i>Pisidium sp.</i>	Peaclam species		X	

APPENDIX 4

WETLAND ECOLOGICAL INTEGRITY ASSESSMENTS

2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – SITE INFORMATION

LOCATION AND GENERAL INFORMATION	
Site ID: _____ Site Name Eagle Rock Ranch, North Parcel _____ LEVEL 2.5 ASSESSMENT Date: 12 July 2023 _____ Surveyors: Jessica Smith, Trista Crook _____	
General Location: _14 mi SE of Jefferson, CO____ County: Park _____ General Ownership: Private _____ Specific Ownership: David Gottenborg _____	
Directions to Point: <u>From Jefferson, CO, head SE on County Road 77 (Tarryall Rd.) for about 14.4 mi (23.2 km). Turn right (SW) onto a paved entryway under an archway for Eagle Rock Ranch. You will need the gate code to enter the ranch. From the cattle guard at the entryway, follow the road SW for about 454' (139 m). Turn left (E/SE), and park by the large building. The AA is only about 94' (29 m) E of the building. To access the west side of the AA, travel SW down a dirt road for about 575 ft (175 m). Then turn right (W) and drive about 113 ft (134 m). Follow the dirt road heading W/SW for 997 ft (304 m). AA is immediately S of this road and extends to the property boundary with Colorado Parks and Wildlife to the west and across the road that crosses Tarryall Creek to the east.</u>	
Access Comments (note permit requirements or difficulties accessing the site): Private working cattle ranch. Must obtain permission and gate code from land owner to access.	
GPS COORDINATES OF TARGET POINT AND ASSESSMENT AREA	
Dimensions of AA: <input type="checkbox"/> 40-m radius circle <input type="checkbox"/> Freeform polygon, limited to 0.5 ha <input checked="" type="checkbox"/> Wetland boundary, other (note in comments)	Elevation (m): _____ Slope (deg): _____ Aspect (deg): _____
AA-Center WP #: _____ UTM E: <u>4 4 3 8 6 9</u> _ _ _ _ _ UTM N: <u>4 3 4 6 0 2</u> _ _ _ _ _ Error (+/-): _____ (Circle AAs Only) (Note: This is for another one of the corners rather than the center.)	
AA-1 WP #: _____ UTM E: <u>4 4 3 8 7 3</u> _ _ _ _ _ UTM N: <u>4 3 4 3 8 5 3</u> _ _ _ _ _ Error (+/-): _____	
AA-2 WP #: _____ UTM E: <u>4 4 5 0 5 4</u> _ _ _ _ _ UTM N: <u>4 3 4 4 0 7 7</u> _ _ _ _ _ Error (+/-): _____	
AA-3 WP #: _____ UTM E: <u>4 4 5 7 7 6</u> _ _ _ _ _ UTM N: <u>4 3 4 3 4 3 6</u> _ _ _ _ _ Error (+/-): _____	
AA-4 WP #: _____ UTM E: <u>4 4 5 7 3 3</u> _ _ _ _ _ UTM N: <u>4 3 4 3 0 8 9</u> _ _ _ _ _ Error (+/-): _____	
AA-Track Track Name: _____ Area: _____	
AA Placement and Dimensions Comments: Drawn in ArcGIS Pro after field visit; coordinates are from ArcGIS Pro.	

ENVIRONMENTAL DESCRIPTION AND CLASSIFICATION OF ASSESSMENT AREA

<p><u>Wetland / riparian / upland inclusions:</u> (should = 100%)</p> <p>95 _____ % AA with true wetland and/or water</p> <p>5 _____ % AA with non-wetland riparian area</p> <p>_____ % AA with upland inclusions</p>	<p><u>Wetland origin:</u> (if known)</p> <p>_____ Natural feature with minimal alteration</p> <p>X _____ Natural feature, but altered or augmented by modification</p> <p>_____ Non-natural feature created by passive or active management</p> <p>_____ Unknown</p>
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Ecological System: (see manual for key and pick the *best match*) Fidelity: **High** Med Low

Irrigated Wet Meadow

<p><u>Cowardin Classification</u> Fidelity: High Med Low</p> <p>(see manual and pick <i>one each</i> of System, Class, Water Regime, and optional Modifier for dominant type)</p> <p>System: Palustrine</p> <p>Class: Emergent</p> <p>Water Regime: Seasonally Flooded</p> <p>Modifier: Farmed</p>	<p><u>HGM Class:</u> (pick <i>only one</i>) Fidelity: High Med Low</p> <p>X _____ Riverine* _____ Lacustrine Fringe</p> <p>_____ Depressional _____ Slope</p> <p>_____ Flats _____ Novel (Irrigation-Fed) Riverine / Slope</p> <p><i>*Specific classification and metrics apply to the Riverine HGM Class</i></p>
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RIVERINE SPECIFIC CLASSIFICATION OF THE ASSESSMENT AREA

<p><u>Confined vs. Unconfined Valley Setting</u></p> <p>_____ Confined Valley Setting (valley width < 2x bankfull width)</p> <p>X _____ Unconfined Valley Setting (valley width ≥ 2x bankfull width)</p> <p><u>Stream Flow Duration</u></p> <p>X _____ Perennial</p> <p>_____ Intermittent</p> <p>_____ Ephemeral</p>	<p><u>Proximity to Channel</u></p> <p>X _____ AA includes the channel and both banks</p> <p>_____ AA is adjacent to or near the channel (< 50 m) and evaluation includes one or both banks</p> <p>_____ AA is > 50 m from the channel and banks were not evaluated</p> <p><u>Stream Depth at Time of Survey (if evaluated)</u></p> <p>_____ Wadeable</p> <p>X _____ Non-wadeable</p>
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MAJOR ZONES WITHIN THE ASSESSMENT AREA (See manual for rules and definitions. Mark each zone on the site sketch.)

Zone 1 Description _____	Dom spp: _____	% of AA: _____
Zone 2 Description _____	Dom spp: _____	% of AA: _____
Zone 3 Description _____	Dom spp: _____	% of AA: _____
Zone 4 Description _____	Dom spp: _____	% of AA: _____
Zone 5 Description _____	Dom spp: _____	% of AA: _____

ENVIRONMENTAL AND CLASSIFICATION COMMENTS

Classification Issues (important for sites with medium or low fidelity to one or more classification systems):

AA REPRESENTATIVENESS

Is AA the entire wetland/riparian area? X Yes No

If no, is AA representative of larger wetland/riparian area? Yes No NA (if AA is the entire wetland)

Comments:

2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – METRICS

LANDSCAPE METRICS

L1. CONTIGUOUS NATURAL LAND COVER		L2. LAND USE INDEX	
Select the statement that best describes the contiguous natural land cover within the 500 m envelope surrounding the AA. See list of natural land covers in the field manual.		Select the statement that best describes the intensity of surrounding land use. Use the Land Use Index Worksheet (last page) to calculate the Land Use Index score.	
Intact: AA embedded in 90–100% contiguous natural land cover.	A	Land Use Index = 9.5–10.0	A
Variegated: AA embedded in 60–90% contiguous natural land cover.	B	Land Use Index = 8.0–9.4	B
Fragmented: AA embedded in 20–60% contiguous natural land cover.	C	Land Use Index = 4.0–7.9	C
Relictual: AA embedded within <20% contiguous natural land cover.	D	Land Use Index = <4.0	D
Landscape comments:			

BUFFER METRICS

B1. PERIMETER WITH NATURAL BUFFER		B2. WIDTH OF NATURAL BUFFER	
Select the statement that best describes the perimeter of the AA with natural buffer . Buffer land covers must be ≥ 5 m wide and extend along ≥ 10 m of the AA perimeter. See list of buffer land covers in the field manual.		Select the statement that best describes the width of the natural buffer . Estimate the width of buffer land covers along eight lines radiating out from the AA at the cardinal and ordinal directions (N, NE, E, SE, S, SW, W, NW) and average their width. Estimate up to 100 m.	
Natural buffer surrounds 100% of the AA perimeter.	A	Average buffer width is 100 m	A
Natural buffer surrounds 75–99% of the AA perimeter.	B	Average buffer width is 75–99 m	B
Natural buffer surrounds 25–74% of the AA perimeter.	C	Average buffer width is 25–74 m	C
Natural buffer surrounds <25% of the AA perimeter.	D	Average buffer width is <25 m	D
B3. CONDITION OF NATURAL BUFFER			
Select the statement that best describes the natural buffer condition . Select one statement per column. Only consider <u>the actual natural buffer</u> measured in metrics above. <i>Remember to look for non-native hay grasses when evaluating native / non-native vegetation in the buffer.</i>			
Abundant (≥95%) relative cover native vegetation and little or no (<5%) cover of non-native plants.	A	Intact soils, no water quality concerns, little or no trash, AND little or no evidence of human visitation.	A
Substantial (75–95%) relative cover of native vegetation and low (5–25%) cover of non-native plants.	B	Intact or minor soil disruption, minor water quality concerns, moderate or lesser amounts of trash, AND/OR minor intensity of human visitation or recreation.	B
Low (25–75%) relative cover of native vegetation and moderate to substantial (25–75%) cover of non-native plants.	C	Moderate or extensive soil disruption, moderate to strong water quality concerns, moderate or greater amounts of trash, AND/OR moderate intensity of human use.	C
Very low (<25%) relative cover of native vegetation and dominant (>75% cover) of non-native plants OR no buffer exists.	D	Barren ground and highly compacted or otherwise disrupted soils, significant water quality concerns, substantial amounts of trash, extensive human use, OR no buffer exists.	D
Buffer comments:			

VEGETATION COMPOSITION METRICS

V1. NATIVE PLANT SPECIES COVER (RELATIVE)		V2. INVASIVE NONNATIVE PLANT SPECIES COVER (ABSOLUTE)	
Select the statement that best describes the <u>relative cover</u> of native plant species within the AA.		Select the statement that best describes the <u>absolute cover</u> of invasive nonnative plant species within the AA. Use list provided in the manual.	
AA contains >99% relative cover of native plant species.	A	Invasive nonnative species are absent from all strata.	A
AA contains 95–99% relative cover of native plant species.	B	Invasive species present, but sporadic (<4% absolute cover).	B
AA contains 85–95% relative cover of native plant species.	C	Noxious weeds somewhat abundant (4–10% cover).	C
AA contains 60–85% relative cover of native plant species.	C-	Noxious weeds abundant (10–30% cover).	C-
AA contains <60% relative cover of native plant species.	D	Noxious weed very abundant (>30% cover).	D

V3. NATIVE PLANT SPECIES COMPOSITION

Select the statement that best describes the native plant species composition (species abundance and diversity) within the AA. Look for native species diagnostic of the system vs. native increasers that may thrive in human disturbance.	
Native plant species composition with expected natural conditions: i) Typical range of native diagnostic species present, AND ii) Native species sensitive to anthropogenic degradation are present, AND iii) Native species indicative of anthropogenic disturbance (i.e., increasers, weedy or ruderal species) absent to minor.	A
Native plant species composition with minor disturbed conditions: i) Some native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with low cover.	B
Native plant species composition with moderately disturbed conditions: i) Many native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with moderate cover.	C
Native plant species composition with severely disturbed conditions: i) Most or all native diagnostic species absent, a few remain in low cover, OR ii) Native species indicative of anthropogenic disturbance are present with high cover.	D
Vegetation composition comments: Meadow Foxtail is a large component of this irrigated wet meadow (likely over 40% cover). Other dominant species, Water Sedge, Beaked Sedge, Spikerush and Arctic Rush are native. The native species expected for the Rocky Mountain Montae Wet Meadow ecosystem are present but somewhat reduced due to dominance of Meadow Foxtail and native species indicative of anthropogenic disturbance (increaser species such as Arctic Rush) are present.	

VEGETATION STRUCTURE METRICS

V4. VEGETATION STRUCTURE (VERTICAL AND HORIZONTAL)	
Select the statement below that best describes the overall vertical and horizontal structure within the AA. Vertical structure relates to the number of vertical vegetation strata. Horizontal structure relates to the number and complexity of biotic and abiotic patches within the wetland/riparian area. See reference card for potential structural patches. Assess each site based on the expected conditions within its Ecological System type. For woody systems, rate regeneration and woody debris individually on next page, then consider those ratings in the overall assessment of structure.	
Herbaceous systems: Marsh, Meadow, Playa	Woody systems: Riparian and Floodplain
<i>General: Vegetation structure is at or near minimally disturbed natural conditions. Little to no structural indicators of degradation evident.</i>	

<p>Structural patches/zones are appropriate in number and type for the system (can be few in playas, fens, meadows). There is diversity in vertical strata within the herbaceous vegetation (some tall and some short layers and/or low cover of shrubs or trees, where appropriate). Litter and other organic inputs are typical of the system (i.e., playas should have low litter while meadows and marshes should have moderate amounts of litter).</p>	<p>AA is characterized by a complex array of nested or interspersed patches. Canopy (if present) contains a mosaic of different ages or sizes, including large old trees and obvious regeneration. Number of live stems is well within expected range. Shrub and herbaceous layers are complex, providing a diversity of vertical strata. Woody species are of sufficient size and density to provide future woody debris to stream or floodplain. Litter layer is neither lacking nor extensive.</p>	<p>A</p>
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General: Vegetation structure shows minor alterations from natural conditions.

<p>Marshes: cattail and bulrush density may prevent animal movement in some areas of the wetland, but not throughout. Meadows: grazing and mowing have minor effects. Playas: natural areas of bare ground are still prevalent, though non-native or weedy species may be encroaching.</p>	<p>AA is characterized by a moderate array of nested or interspersed zones with no single dominant zone, though some structural patches (especially open zones) may be missing. Canopy still heterogeneous in age or size, but may be missing some age classes. Vertical strata may be somewhat less complex than natural conditions. Woody debris or litter may be somewhat lacking.</p>	<p>B</p>
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General: Vegetation structure is moderately altered from natural conditions.

<p>Marshes: cattail and bulrush density may prevent animal movement in half or more of the wetland. Meadows: grazing and mowing have moderate effects. Playas: natural areas of bare ground are present, but non-native or weedy species have filled in many area.</p>	<p>AA is characterized by a simple array of nested or interspersed zones. One zone may dominate others. Vertical strata may be moderately less complex than natural conditions. Site may be denser than natural conditions (due to non-native woody species) or may be more open and decadent. Woody debris or litter may be moderately lacking.</p>	<p>C</p>
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General: Vegetation structure is greatly altered from natural conditions.

<p>Marshes: cattail and bulrush density prevent animal movement throughout the wetland. Meadows: grazing and mowing greatly affect the structure of the vegetation and prevalence of litter. Playas: natural areas of bare ground are absent due to an abundance of non-native or weedy species.</p>	<p>AA is characterized by one dominant zone and several expected structural patches or vertical strata are missing. Site is either extremely dense with non-native woody species or open with predominantly decadent or dead trees. Woody debris and/or litter may be absent entirely or may be excessive due to decadent trees.</p>	<p>D</p>
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V5. REGENERATION OF NATIVE WOODY SPECIES	V6. COARSE AND FINE WOODY DEBRIS
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<p>Select the statement that best describes the regeneration of native woody species within the AA.</p>		<p>Select the statement that best describes coarse and fine woody debris within the AA.</p>	
<p>Woody species are naturally uncommon or absent.</p>	<p>NA</p>	<p>There are no obvious inputs of woody debris or woody species are naturally uncommon.</p>	<p>NA</p>
<p>All age classes of <i>native</i> woody species present. Native tree saplings /seedlings and shrubs common to the type present in expected amounts and diversity. Regeneration is obvious.</p>	<p>A</p>	<p>AA characterized by moderate amount of coarse and fine woody debris, relative to expected conditions. There is wide size-class diversity of standing snags and downed logs in various stages of decay. For riverine wetlands, debris is sufficient to trap sediment, but does not inhibit stream flow. For non-riverine wetlands, woody debris provides structural complexity, but does not overwhelm the site.</p>	<p>A/B</p>
<p>Age classes of <i>native</i> woody species restricted to mature individuals and young sprouts. Middle age groups appear to be absent or there is some other indication that regeneration is moderately impacted.</p>	<p>B</p>		
<p><i>Native</i> woody species comprised of mainly mature individuals OR mainly evenly aged young sprouts that choke out other vegetation. Regeneration is obviously impacted. Site may contain Russian Olive and/or Salt Cedar.</p>	<p>C</p>	<p>AA characterized by small amounts of woody debris OR debris is somewhat excessive. For riverine wetlands, lack of debris may affect stream temperatures and reduce available habitat.</p>	<p>C</p>
<p><i>Native</i> woody species predominantly consist of decadent or dying individuals OR are absent from an area that should be wooded. Site may be dominated by Russian Olive / Salt Cedar.</p>	<p>D</p>	<p>AA lacks woody debris, even though inputs are available.</p>	<p>D</p>

Vegetation structure comments (including regeneration and woody debris):

HYDROLOGY METRICS

H1. WATER SOURCE

Check off all *major* water sources in the table to the right. Select the statement below that best describes the **water sources** feeding the AA during the growing season.

- | | |
|---|---|
| <input checked="" type="checkbox"/> Overbank flooding | <input checked="" type="checkbox"/> Irrigation via direct application |
| <input type="checkbox"/> Alluvial aquifer | <input type="checkbox"/> Irrigation via seepage |
| <input type="checkbox"/> Groundwater discharge | <input type="checkbox"/> Irrigation via tail water run-off |
| <input type="checkbox"/> Natural surface flow | <input type="checkbox"/> Urban run-off / culverts |
| <input type="checkbox"/> Precipitation | <input type="checkbox"/> Pipes (directly feeding wetland) |
| <input type="checkbox"/> Snowmelt | <input type="checkbox"/> Other |

Water sources are natural. Site hydrology is fed by precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body. The system may naturally lack water at times, even for several years. There is no indication of direct artificial water sources, either point sources or non-point sources. Land use in the local watershed is primarily open space or low density, passive use with little irrigation.

A

Water sources are mostly natural, but also include occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic sources include developed land or irrigated agriculture that comprises < 20% of the immediate drainage area, some road runoff, small storm drains or other minor point source discharges. No large point sources control the overall hydrology.

B

Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Indications of moderate contribution from anthropogenic sources include developed land or irrigated agriculture that comprises 20–60% of the immediate drainage area or moderate point source discharges into the wetland, such as many small storm drains or a few large ones or many sources of irrigation runoff. The key factors to consider are whether the wetland is located in a landscape position that supported wetlands before irrigation / development *AND* whether the wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers or natural stream channels that now receive substantial irrigation return flows).

C

Water sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises > 60% of the immediate drainage basin of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA. The key factors to consider are whether the wetland is located in a landscape position that likely never supported a wetland prior to human development *OR* did support a wetland, but is now disconnected from its natural water source. The reason the wetland exists is because of direct irrigation, irrigation seepage, irrigation return flows, urban storm water runoff, or direct pumping.

D

Water source comments:

H2. HYDROPERIOD

Select the statement below that best describes the **hydroperiod** within the AA (extent and duration of inundation and/or saturation). Search the AA and 500 m envelope for hydrologic stressors (see list on following pages). Use best professional judgment to determine the overall condition of the hydroperiod. For some wetlands, this may mean that water is being channelized or diverted away from the wetland. For others, water may be concentrated or increased. Please add comments on next page.

Hydroperiod is characterized by natural patterns of inundation/saturation and drawdown and/or flood frequency, duration, level and timing. There are no major hydrologic stressors that impact the natural hydroperiod. Riparian channels are characterized by equilibrium conditions with no evidence of severe aggradation or degradation indicative of altered hydrology.	A
Hydroperiod inundation and drying patterns deviate slightly from natural conditions due to presence of stressors such as: flood control/water storage dams upstream; berms or roads at/near grade; minor pugging by livestock; small ditches or diversions removing water; or minor flow additions from irrigation return flow or storm water runoff. Outlets may be slightly constricted, but not to significantly slow outflow. Riparian channels may have some sign of aggradation or degradation, but approach equilibrium conditions. Playas are not significantly impacted pitted or dissected. <i>If wetland is artificially controlled</i> , the management regime closely mimics a natural analogue (it is very unusual for a purely artificial wetland to be rated in this category).	B
Hydroperiod inundation and drying patterns deviate moderately from natural conditions due to presence of stressors such as: flood control/water storage dams upstream or downstream that moderately effect hydroperiod; two lane roads; culverts adequate for base stream flow but not flood flow; moderate pugging by livestock that could channelize or divert water; shallow pits within playas; ditches or diversions 1–3 ft. deep; or moderate flow additions. Outlets may be moderately constricted, but flow is still possible. Riparian channels may show distinct signs of aggradation or degradation. <i>If wetland is artificially controlled</i> , the management regime approaches a natural analogue. Site may be passively managed, meaning that the hydroperiod is still connected to and influenced by natural high flows timed with seasonal water levels.	C

Hydroperiod inundation and drawdown patterns deviate substantially from natural conditions from high intensity alterations such as: significant flood control / water storage das upstream or downstream; a 4-lane highway; large dikes impounding water; diversions > 3ft. deep that withdraw a significant portion of flow, deep pits in playas; large amounts of fill; significant artificial groundwater pumping; or heavy flow additions. Outlets may be significantly constricted, blocking most flow. Riparian channels may be concrete or artificially hardened. <i>If wetland is artificially controlled</i> , the site is actively managed and not connected to any natural season fluctuations.	D
Hydroperiod comments: Mostly natural, but there are some densely-vegetated islands, suggesting a lack of regular flooding. Floodplain seems obvious. Not a lot of active undercutting observed?	

H3. HYDROLOGIC CONNECTIVITY

Select the statement below that best describes the degree to which **hydrology within the AA is connected to the larger landscape** throughout the year, but particularly at times of high water. Consider the effect of impoundments, entrenchment, or other obstructions to connectivity that occur within the surrounding landscape, if those impoundments clearly impact the AA.

<i>Marsh / Meadow variant</i>	<i>Playa variant</i>	<i>Riverine / Riparian variant</i>	
No unnatural obstructions to lateral or vertical movement of surface or ground water. Rising water in the site has unrestricted access to adjacent upland, without levees, excessively high banks, artificial barriers, or other obstructions to the lateral movement of flood flows.	Surrounding land cover / vegetation does not interrupt surface flow. No artificial channels feed water to playa.	Completely connected to floodplain (backwater sloughs and channels). No geomorphic modifications made to contemporary floodplain. Channel is not entrenched.	A
Minor restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Up to 25% of the site may be restricted by barriers to drainage. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.	Surrounding land cover / vegetation may interrupt a minor amount of surface flow. Artificial channels may feed minor amounts of excess water to playa.	Minimally disconnected from floodplain. Up to 25% of stream banks may be affected by dikes, rip rap, and/or elevated culverts. Channel may be somewhat entrenched, but overbank flow occurs during most floods.	B

<p>Moderate restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Between 25–75% of the site may be restricted by barriers to drainage. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.</p>	<p>Surrounding land cover / vegetation may interrupt a moderate amount of surface flow. Artificial channels may feed moderate amounts of excess water to playa.</p>	<p>Moderately disconnected from floodplain due to multiple geomorphic modifications. Between 25-75% of stream banks may be affected by bakes, rip rap, concrete, and/or elevated culverts. Channel may be moderately entrenched and disconnected from the floodplain except in large floods.</p>	<p>C</p>
<p>Essentially no hydrologic connection to adjacent landscape. Most or all stages may be contained within artificial banks, levees, or comparable features. Greater than 75% of the site is restricted by barriers to drainage.</p>	<p>Surrounding land cover / vegetation may dramatically restrict surface flow. Artificial channels may feed significant amounts of excess water to playa.</p>	<p>Channel is severely entrenched and entirely disconnected from the floodplain. More than 75% of stream banks may be affected by dikes, rip rap, concrete and/or elevated culverts. Overbank flow never occurs or only in severe floods.</p>	<p>D</p>
<p>Hydrologic connectivity comments: There were ditches throughout, but I don't think they would impede floodwaters. A banked 33road running along the north side of the AA may impede floodwaters to a degree.</p>			

PHYSIOCHEMICAL METRICS

S1. SUBSTRATE / SOIL DISTURBANCE

Select the statement below that best describes disturbance to the substrate or soil within the AA. For playas, the most significant substrate disturbance is sedimentation or unnaturally filling, which prevents the system’s ability to pond after heavy rains. For other wetland types, disturbances may lead to bare or exposed soil and may increase ponding or channelization where it is not normally. For any wetland type, consider the disturbance relative to what is expected for the system.

No soil disturbance within AA. Little bare soil OR bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails OR soil is naturally bare (e.g., playas). No pugging, soil compaction, or sedimentation.	A
Minimal soil disturbance within AA. Some amount of bare soil, pugging, compaction, or sedimentation present due to human causes, but the extent and impact are minimal. The depth of disturbance is limited to only a few inches and does not show evidence of altering hydrology. Any disturbance is likely to recover within a few years after the disturbance is removed.	B
Moderate soil disturbance within AA. Bare soil areas due to human causes are common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Sedimentation may be filling the wetland. Damage is obvious, but not excessive. The site could recover to potential with the removal of degrading human influences and moderate recovery times.	C
Substantial soil disturbance within AA. Bare soil areas substantially degrade the site and have led to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Sedimentation may have severely impacted the hydrology. The site will not recover without active restoration and/or long recovery times.	D

Substrate / soil comments and photo #'s:

S2. SURFACE WATER TURBIDITY / POLLUTANTS

S3. ALGAL GROWTH

Select the statement that best describes the turbidity or evidence or pollutants in surface water within the AA.		Select the statement that best describes algal growth within surface water in the AA. Exclude <i>Chara</i> (multicellular algae) in cover estimate.	
No open water in AA	NA	No open water in AA or evidence of open water.	NA
No visual evidence of turbidity or other pollutants.	A	Water is clear with minimal algal growth.	A
Some turbidity in water (such as turbidity caused by high flows or naturally occurring in playas) OR presence of other pollutants, but limited to small and localized areas within the wetland. Water may be slightly cloudy.	B	Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	B
Water is cloudy or has unnatural oil sheen, but the bottom is still visible. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	C	Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen.	C
Water is milky and/or muddy or has unnatural oil sheen. The bottom is difficult to see. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	D	Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see.	D

Water quality comments and photo #'s:

Turbidity and algal growth may be natural depending on recent weather patterns and flow timing (i.e., higher flows are often more turbid). Please rank the system as you see it, regardless of whether the conditions are natural. Include good notes and take photos.

SIZE METRICS

Z1. COMPARATIVE SIZE

Select the statement below that best describes the **absolute size** of the wetland, as compared with others of its type.

<i>Meadows and Marshes</i>	<i>Playas and Fens</i>	<i>Riparian Areas</i>	
>10 hectares (>25 acres)	>2 hectares (>5 acres)	>5 km (>3 miles)	A
2–10 hectares (25 acres)	0.5–2 hectares (5 acres)	1–5 km (3 miles)	B
0.5–2hectares (5 acres)	0.1–0.5 hectares (1 acre)	0.1–1 km (0.6 mile)	C
<0.5 hectare (<1 acre)	<0.1 hectare (<0.25 acre)	<0.1 km (<0.06 mile)	D

Comparative size comments:

Z2. CHANGE IN SIZE

Select the statement below that best describes the **change in size** of the wetland.

Occurrence is at, or only minimally reduced (<15%) from its original, natural extent, and has not been artificially reduced in size.	A
Occurrence is only somewhat reduced (15-10%) from its original natural extent.	B
Occurrence is modestly reduced (10-30%) from its original, natural extent.	C
Occurrence is substantially reduced (>30%) from its original, natural extent.	D

Change in size comments: Unless there have been significant changes to the creek since European settlement, the size has likely not changed much, if at all.

Land Use Index Worksheet

Land Use Categories ¹ _s	Coefficient	500 m Envelope	
		% Area	Score
Paved roads, parking lots, domestic, commercial, and industrial buildings	0	0.154	0
Gravel pit operation, open pit mining, strip mining, abandoned mines	0	0	0
Unpaved roads (e.g., driveway, tractor trail, 4-wheel drive roads)	1	0.015	0.015
Resource extraction (oil and gas)	1	0	0
Tilled agricultural crop production (corn, wheat, soy, etc.)	2	0	0
Intensively managed golf courses, sports fields, lawns	2	0	0
Vegetation conversion (chaining, cabling, rotochopping, clearcut)	3	0	0
Heavy grazing by livestock	3	0	0
Logging or tree removal with 50-75% of large trees removed	4	0	0
Intense recreation (ATV use / camping / popular fishing spot, etc.)	4	0	0
Permanent crop agriculture (hay pasture, vineyard, orchard)	4	0	0
Dam sites and disturbed shorelines around water storage reservoirs. Include open water of reservoir if there is intensive recreation, such as boating.	5	0	0
Old fields and other disturbed fallow lands dominated by non-native species	5	0	0
Moderate grazing on rangeland	6	33.8	2.028
Moderate recreation (high-use trail)	7	0	0
Selective logging or tree removal with <50% of large trees	8	0	0
Light grazing on rangeland	9	0	0
Light recreation (low-use trail)	9	0	0
Natural area / land managed for native vegetation	10	66.035	6.6035
Total Land Use Score			8.6465

Buffer Width Worksheet

1: 0 _____	5: 100
2: 0	6: 100 _____
3: 0 _____	7: 0 _____
4: 0 _____	8: 100
Average width: 37.5 _____	

COLORADO ECOLOGICAL INTEGRITY ASSESSMENT (EIA) SCORECARD

Made by: Colorado Natural Heritage Program, Version: August 31, 2015



Site ID: Eagle Rock, North Parcel

Site Name: Irrigated Wet Meadow (Hay Meadow)

Project: _____

Date 6/8/2023; 7/12/2023

Ecol System: Rocky Mountain Montane Wet Meadow

HGM: Riverine

Cowardin: Palustrine, Emergent, Seasonally Flooded

	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				2.29	C+
Overall Ecological Integrity + Size Score and Rank				NULL	NULL
Rank Factor: LANDSCAPE CONTEXT	0.30			2.63	B-
LANDSCAPE METRICS	0.33			3.00	B+
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	B	3		
BUFFER METRICS	0.67			2.45	C+
B1. Perimeter with Natural Buffer	n/a	C	2		
B2. Width of Natural Buffer	n/a	C	2		
B3.1. Condition of Natural Buffer - Veg	n/a	B	3		
B3.2. Condition of Natural Buffer - Soils	n/a	B	3		
Rank Factor: CONDITION	0.70			2.15	C+
VEGETATION METRICS	0.55			2.00	C+
V1. Native Plant Species Cover	1	D	1		
V2. Invasive Nonnative Plant Species Cover	1	B	3		
V3. Native Plant Species Composition	1	C	2		
V4. Vegetation Structure	1	C	2		
V5. Regen. of Native Woody Species (opt.)	1		NULL		
V65. Coarse and Fine Woody Debris (opt.)	1		NULL		
HYDROLOGY METRICS	0.35			2.00	C+
H1. Water Source	1	C	2		
H2. Hydroperiod	1	C	2		
H3. Hydrologic Connectivity	1	C	2		
PHYSIOCHEMISTRY METRICS	0.10			3.50	A-
S1. Soil Condition	1	B	3		
S2. Surface Water Turbidity / Pollutants (opt.)	0.5	A	4		
S3. Algal Growth (opt.)	0.5	A	4		
Rank Factor: SIZE	n/a			NULL	NULL
SIZE METRICS	1			NULL	NULL
Z1. Comparative Size (opt.)	1		NULL		
Z2. Change in Size (opt.)	1	A	4		

Input field metric ratings into empty boxes to calculate Rank Factor and Final EIA Scores. Fill in all metrics that are not marked as optional. Optional metrics depend on method used and wetland type.

2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – SITE INFORMATION

LOCATION AND GENERAL INFORMATION	
Site ID: _____ Site Name Eagle Rock Ranch South Parcel _____	LEVEL 2.5 ASSESSMENT
Date: 13 July 2023 _____ Surveyors: Jessica Smith, Trista Crook _____	
General Location: 14 mi SE of Jefferson, CO _____ County: Park _____	
General Ownership: Private _____ Specific Ownership: Dave Gottenborg _____	
<p>Directions to Point: From Jefferson, CO, head SE on County Road 77 (Tarryall Rd.) for about 14.4 mi (23.2 km). Turn right (SW) onto a paved entryway under an archway for Eagle Rock Ranch. You will need the gate code to enter the ranch. From the cattle guard at the entryway, travel SW along a dirt road for about 2 miles (3.3 km), past the main ranch buildings and under an archway, crossing Tarryall Creek at about 1015' (309 m). You will need the combination lock code for one (?) of the gates, but the rest do not have locks. At this point, the road splits; continue SW onto County Road(?) 36/NF-147 for about 4767' (1.5 km), past a building with a corral. Head E, crossing Ruby Gulch to pick up a faint two-track. After approximately 400' (122 m), follow the road SE for 3435' (1.1 km). Then follow the road for 1.1 mi (1.7 km) SW/SE/S until it intersects with a dirt road near some corrals and a pond. Follow this road S/SE past the corrals and around the pond. The road then heads NW. Stop after following the road for about 1950' (594.5 m). The AA is about 1025' (312.6 m) NW of the road.</p>	
Access Comments (note permit requirements or difficulties accessing the site): Private working cattle ranch. Must obtain permission, gate codes, and use of an ORV from land owner to access.	
GPS COORDINATES OF TARGET POINT AND ASSESSMENT AREA	
<p><u>Dimensions of AA:</u></p> <p>____ 40-m radius circle</p> <p>____ Freeform polygon, limited to 0.5 ha</p> <p>__x__ Wetland boundary, other (note in comments)</p>	<p>Elevation (m): _____</p> <p>Slope (deg): _____</p> <p>Aspect (deg): _____</p>
<p>AA-Center WP #: _____ UTM E: 442375_ _ _ _ _ UTM N: <u>4 3 3 8 0 9 6</u> _ _ _ _ _ Error (+/-): _____ (Circle AAs Only)</p> <p>AA-1 WP #: _____ UTM E: <u>4 4 2 3 6 1</u> _ _ _ _ _ UTM N: 4337999_ _ _ _ _ Error (+/-): _____</p> <p>AA-2 WP #: _____ UTM E: <u>4 4 2 2 3 2 1</u> _ _ _ _ _ UTM N: <u>4 3 3 8 1 6 1</u> _ _ _ _ _ Error (+/-): _____</p> <p>AA-3 WP #: _____ UTM E: <u>4 4 2 3 2 2</u> _ _ _ _ _ UTM N: <u>4 3 3 8 0 3 2</u> _ _ _ _ _ Error (+/-): _____</p> <p>AA-4 WP #: _____ UTM E: <u>4 4 2 4 8 8</u> _ _ _ _ _ UTM N: <u>4 3 3 8 1 3 6</u> _ _ _ _ _ Error (+/-): _____</p>	
AA-Track Track Name: _____ Area: _____	
AA Placement and Dimensions Comments: Drawn in ArcGIS Pro after field visit; coordinates are from ArcGIS Pro.	

ENVIRONMENTAL DESCRIPTION AND CLASSIFICATION OF ASSESSMENT AREA

<p><u>Wetland / riparian / upland inclusions:</u> (should = 100%)</p> <p><u>100</u> % AA with true wetland and/or water</p> <p>_____ % AA with non-wetland riparian area</p> <p>_____ % AA with upland inclusions</p>	<p><u>Wetland origin:</u> (if known)</p> <p><input checked="" type="checkbox"/> Natural feature with minimal alteration</p> <p>_____ Natural feature, but altered or augmented by modification</p> <p>_____ Non-natural feature created by passive or active management</p> <p>_____ Unknown</p>
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Ecological System: (see manual for key and pick the *best match*) Fidelity: High Med **Low**

Rocky Mountain Alpine-Montane Wet Meadow

<p><u>Cowardin Classification</u> Fidelity: High Med Low</p> <p>(see manual and pick <i>one each</i> of System, Class, Water Regime, and optional Modifier for dominant type)</p> <p>System: Palustrine</p> <p>Class: Emergent</p> <p>Water Regime: Temporarily Flooded</p>	<p><u>HGM Class:</u> (pick <i>only one</i>) Fidelity: High Med Low</p> <p>_____ Riverine* _____ Lacustrine Fringe</p> <p>_____ Depressional <input checked="" type="checkbox"/> Slope</p> <p>_____ Flats _____ Novel (Irrigation-Fed) Riverine / Slope</p> <p><i>*Specific classification and metrics apply to the Riverine HGM Class</i></p>
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RIVERINE SPECIFIC CLASSIFICATION OF THE ASSESSMENT AREA

<p><u>Confined vs. Unconfined Valley Setting</u></p> <p>_____ Confined Valley Setting (valley width < 2x bankfull width)</p> <p>_____ Unconfined Valley Setting (valley width ≥ 2x bankfull width)</p> <p><u>Stream Flow Duration</u></p> <p>_____ Perennial</p> <p>_____ Intermittent</p> <p>_____ Ephemeral</p>	<p><u>Proximity to Channel</u></p> <p>_____ AA includes the channel and both banks</p> <p>_____ AA is adjacent to or near the channel (< 50 m) and evaluation includes one or both banks</p> <p>_____ AA is > 50 m from the channel and banks were not evaluated</p> <p><u>Stream Depth at Time of Survey (if evaluated)</u></p> <p>_____ Wadeable</p> <p>_____ Non-wadeable</p>
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MAJOR ZONES WITHIN THE ASSESSMENT AREA (See manual for rules and definitions. Mark each zone on the site sketch.)

Zone 1 Description _____	Dom spp: _____	% of AA: _____
Zone 2 Description _____	Dom spp: _____	% of AA: _____
Zone 3 Description _____	Dom spp: _____	% of AA: _____
Zone 4 Description _____	Dom spp: _____	% of AA: _____
Zone 5 Description _____	Dom spp: _____	% of AA: _____

ENVIRONMENTAL AND CLASSIFICATION COMMENTS

Classification Issues (important for sites with medium or low fidelity to one or more classification systems):

AA REPRESENTATIVENESS

Is AA the entire wetland/riparian area? Yes No

If no, is AA representative of larger wetland/riparian area? Yes No NA (if AA is the entire wetland)

Comments:

2015 COLORADO WETLAND ECOLOGICAL INTEGRITY ASSESSMENT (EIA) – METRICS

LANDSCAPE METRICS

L1. CONTIGUOUS NATURAL LAND COVER		L2. LAND USE INDEX	
Select the statement that best describes the contiguous natural land cover within the 500 m envelope surrounding the AA. See list of natural land covers in the field manual.		Select the statement that best describes the intensity of surrounding land use. Use the Land Use Index Worksheet (last page) to calculate the Land Use Index score.	
Intact: AA embedded in 90–100% contiguous natural land cover.	A	Land Use Index = 9.5–10.0	A
Variagated: AA embedded in 60–90% contiguous natural land cover.	B	Land Use Index = 8.0–9.4	B
Fragmented: AA embedded in 20–60% contiguous natural land cover.	C	Land Use Index = 4.0–7.9	C
Relictual: AA embedded within <20% contiguous natural land cover.	D	Land Use Index = <4.0	D
Landscape comments: Established road N of AA decreases the contiguous natural land cover to about 78%.			

BUFFER METRICS

B1. PERIMETER WITH NATURAL BUFFER		B2. WIDTH OF NATURAL BUFFER	
Select the statement that best describes the perimeter of the AA with natural buffer . Buffer land covers must be ≥ 5 m wide and extend along ≥ 10 m of the AA perimeter. See list of buffer land covers in the field manual.		Select the statement that best describes the width of the natural buffer . Estimate the width of buffer land covers along eight lines radiating out from the AA at the cardinal and ordinal directions (N, NE, E, SE, S, SW, W, NW) and average their width. Estimate up to 100 m.	
Natural buffer surrounds 100% of the AA perimeter.	A	Average buffer width is 100 m	A
Natural buffer surrounds 75–99% of the AA perimeter.	B	Average buffer width is 75–99 m	B
Natural buffer surrounds 25–74% of the AA perimeter.	C	Average buffer width is 25–74 m	C
Natural buffer surrounds <25% of the AA perimeter.	D	Average buffer width is <25 m	D

B3. CONDITION OF NATURAL BUFFER

Select the statement that best describes the natural buffer condition . Select one statement per column. Only consider <u>the actual natural buffer</u> measured in metrics above. <i>Remember to look for non-native hay grasses when evaluating native / non-native vegetation in the buffer.</i>			
Abundant (≥95%) relative cover native vegetation and little or no (<5%) cover of non-native plants.	A	Intact soils, no water quality concerns, little or no trash, AND little or no evidence of human visitation.	A
Substantial (75–95%) relative cover of native vegetation and low (5–25%) cover of non-native plants.	B	Intact or minor soil disruption, minor water quality concerns, moderate or lesser amounts of trash, AND/OR minor intensity of human visitation or recreation.	B
Low (25–75%) relative cover of native vegetation and moderate to substantial (25–75%) cover of non-native plants.	C	Moderate or extensive soil disruption, moderate to strong water quality concerns, moderate or greater amounts of trash, AND/OR moderate intensity of human use.	C
Very low (<25%) relative cover of native vegetation and dominant (>75% cover) of non-native plants OR no buffer exists.	D	Barren ground and highly compacted or otherwise disrupted soils, significant water quality concerns, substantial amounts of trash, extensive human use, OR no buffer exists.	D

Buffer comments: Hummock formation in wetland from cattle grazing and possibly in part to native ungulates (elk)

VEGETATION COMPOSITION METRICS

V1. NATIVE PLANT SPECIES COVER (RELATIVE)		V2. INVASIVE NONNATIVE PLANT SPECIES COVER (ABSOLUTE)	
Select the statement that best describes the <u>relative cover</u> of native plant species within the AA.		Select the statement that best describes the <u>absolute cover</u> of invasive nonnative plant species within the AA. Use list provided in the manual.	
AA contains >99% relative cover of native plant species.	A	Invasive nonnative species are absent from all strata.	A
AA contains 95–99% relative cover of native plant species.	B	Invasive species present, but sporadic (<4% absolute cover).	B
AA contains 85–95% relative cover of native plant species.	C	Noxious weeds somewhat abundant (4–10% cover).	C
AA contains 60–85% relative cover of native plant species.	C-	Noxious weeds abundant (10–30% cover).	C-
AA contains <60% relative cover of native plant species.	D	Noxious weed very abundant (>30% cover).	D

V3. NATIVE PLANT SPECIES COMPOSITION	
Select the statement that best describes the native plant species composition (species abundance and diversity) within the AA. Look for native species diagnostic of the system vs. native increasers that may thrive in human disturbance.	
Native plant species composition with expected natural conditions: i) Typical range of native diagnostic species present, AND ii) Native species sensitive to anthropogenic degradation are present, AND iii) Native species indicative of anthropogenic disturbance (i.e., increasers, weedy or ruderal species) absent to minor.	A
Native plant species composition with minor disturbed conditions: i) Some native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with low cover.	B
Native plant species composition with moderately disturbed conditions: i) Many native diagnostic species absent or substantially reduced in abundance, OR ii) Native species indicative of anthropogenic disturbance are present with moderate cover.	C
Native plant species composition with severely disturbed conditions: i) Most or all native diagnostic species absent, a few remain in low cover, OR ii) Native species indicative of anthropogenic disturbance are present with high cover.	D
Vegetation composition comments: Sedges and Tufted Hairgrass are dominant in this wetland, with a moderate component of shrubby cinquefoil. Some species indicative of drier conditions are present (yarrow, arctic rush, Canada thistle). This wetland has some remnant, high quality plant species with high C-values, but is also impacted by cattle pugging and a noxious weed, Canada thistle and arctic rush is an increaser species, avoided by cattle grazing.	

VEGETATION STRUCTURE METRICS

V4. VEGETATION STRUCTURE (VERTICAL AND HORIZONTAL)	
Select the statement below that best describes the overall vertical and horizontal structure within the AA. Vertical structure relates to the number of vertical vegetation strata. Horizontal structure relates to the number and complexity of biotic and abiotic patches within the wetland/riparian area. See reference card for potential structural patches. Assess each site based on the expected conditions within its Ecological System type. For woody systems, rate regeneration and woody debris individually on next page, then consider those ratings in the overall assessment of structure.	
<i>Herbaceous systems: Marsh, Meadow, Playa</i>	<i>Woody systems: Riparian and Floodplain</i>
<u>General:</u> Vegetation structure is at or near minimally disturbed natural conditions. Little to no structural indicators of degradation evident.	
Structural patches/zones are appropriate in number and type for the system (can be few in playas, fens, meadows). There is diversity in vertical strata within the herbaceous vegetation (some tall and some short layers and/or low cover of shrubs or trees, where appropriate). Litter and other organic inputs are typical of the system (i.e., playas should have low litter while meadows and marshes should have moderate amounts of litter).	AA is characterized by a complex array of nested or interspersed patches. Canopy (if present) contains a mosaic of different ages or sizes, including large old trees and obvious regeneration. Number of live stems is well within expected range. Shrub and herbaceous layers are complex, providing a diversity of vertical strata. Woody species are of sufficient size and density to provide future woody debris to stream or floodplain. Litter layer is neither lacking nor extensive.
A	

<i>General: Vegetation structure shows minor alterations from natural conditions.</i>		AA is characterized by a moderate array of nested or interspersed zones with no single dominant zone, though some structural patches (especially open zones) may be missing. Canopy still heterogeneous in age or size, but may be missing some age classes. Vertical strata may be somewhat less complex than natural conditions. Woody debris or litter may be somewhat lacking.	B
<p>Marshes: cattail and bulrush density may prevent animal movement in some areas of the wetland, but not throughout.</p> <p>Meadows: grazing and mowing have minor effects.</p> <p>Playas: natural areas of bare ground are still prevalent, though non-native or weedy species may be encroaching.</p>			
<i>General: Vegetation structure is moderately altered from natural conditions.</i>		AA is characterized by a simple array of nested or interspersed zones. One zone may dominate others. Vertical strata may be moderately less complex than natural conditions. Site may be denser than natural conditions (due to non-native woody species) or may be more open and decadent. Woody debris or litter may be moderately lacking.	C
<p>Marshes: cattail and bulrush density may prevent animal movement in half or more of the wetland.</p> <p>Meadows: grazing and mowing have moderate effects.</p> <p>Playas: natural areas of bare ground are present, but non-native or weedy species have filled in many area.</p>			
<i>General: Vegetation structure is greatly altered from natural conditions.</i>		AA is characterized by one dominant zone and several expected structural patches or vertical strata are missing. Site is either extremely dense with non-native woody species or open with predominantly decadent or dead trees. Woody debris and/or litter may be absent entirely or may be excessive due to decadent trees.	D
<p>Marshes: cattail and bulrush density prevent animal movement throughout the wetland.</p> <p>Meadows: grazing and mowing greatly affect the structure of the vegetation and prevalence of litter.</p> <p>Playas: natural areas of bare ground are absent due to an abundance of non-native or weedy species.</p>			
V5. REGENERATION OF NATIVE WOODY SPECIES		V6. COARSE AND FINE WOODY DEBRIS	
Select the statement that best describes the regeneration of native woody species within the AA.		Select the statement that best describes coarse and fine woody debris within the AA.	
Woody species are naturally uncommon or absent.	NA	There are no obvious inputs of woody debris or woody species are naturally uncommon.	NA
All age classes of <i>native</i> woody species present. Native tree saplings /seedlings and shrubs common to the type present in expected amounts and diversity. Regeneration is obvious.	A	AA characterized by moderate amount of coarse and fine woody debris, relative to expected conditions. There is wide size-class diversity of standing snags and downed logs in various stages of decay. For riverine wetlands, debris is sufficient to trap sediment, but does not inhibit stream flow. For non-riverine wetlands, woody debris provides structural complexity, but does not overwhelm the site.	A/B
Age classes of <i>native</i> woody species restricted to mature individuals and young sprouts. Middle age groups appear to be absent or there is some other indication that regeneration is moderately impacted.	B		
<i>Native</i> woody species comprised of mainly mature individuals OR mainly evenly aged young sprouts that choke out other vegetation. Regeneration is obviously impacted. Site may contain Russian Olive and/or Salt Cedar.	C	AA characterized by small amounts of woody debris OR debris is somewhat excessive. For riverine wetlands, lack of debris may affect stream temperatures and reduce available habitat.	C
<i>Native</i> woody species predominantly consist of decadent or dying individuals OR are absent from an area that should be wooded. Site may be dominated by Russian Olive / Salt Cedar.	D	AA lacks woody debris, even though inputs are available.	D
Vegetation structure comments (including regeneration and woody debris): This was not assessed in the field, so assessment outside of the field may be inaccurate. Regeneration may be impacted because of the grazing, resulting in mostly mature Dasiphora shrubs.			

HYDROLOGY METRICS

H1. WATER SOURCE

Check off all *major* water sources in the table to the right. Select the statement below that best describes the **water sources** feeding the AA during the growing season.

- | | |
|---|--|
| <input type="checkbox"/> Overbank flooding | <input type="checkbox"/> Irrigation via direct application |
| <input type="checkbox"/> Alluvial aquifer | <input type="checkbox"/> Irrigation via seepage |
| <input checked="" type="checkbox"/> Groundwater discharge | <input type="checkbox"/> Irrigation via tail water run-off |
| <input checked="" type="checkbox"/> Natural surface flow | <input type="checkbox"/> Urban run-off / culverts |
| <input type="checkbox"/> Precipitation | <input type="checkbox"/> Pipes (directly feeding wetland) |
| <input type="checkbox"/> Snowmelt | <input type="checkbox"/> Other: |

Water sources are natural. Site hydrology is fed by precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body. The system may naturally lack water at times, even for several years. There is no indication of direct artificial water sources, either point sources or non-point sources. Land use in the local watershed is primarily open space or low density, passive use with little irrigation.

A

Water sources are mostly natural, but also include occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic sources include developed land or irrigated agriculture that comprises < 20% of the immediate drainage area, some road runoff, small storm drains or other minor point source discharges. No large point sources control the overall hydrology.

B

Water sources are moderately impacted by anthropogenic sources, but are still a mix of natural and non-natural sources. Indications of moderate contribution from anthropogenic sources include developed land or irrigated agriculture that comprises 20–60% of the immediate drainage area or moderate point source discharges into the wetland, such as many small storm drains or a few large ones or many sources of irrigation runoff. The key factors to consider are whether the wetland is located in a landscape position that supported wetlands before irrigation / development *AND* whether the wetland is still connected to its natural water source (e.g., modified ponds on a floodplain that are still connected to alluvial aquifers or natural stream channels that now receive substantial irrigation return flows).

C

Water sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises > 60% of the immediate drainage basin of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA. The key factors to consider are whether the wetland is located in a landscape position that likely never supported a wetland prior to human development *OR* did support a wetland, but is now disconnected from its natural water source. The reason the wetland exists is because of direct irrigation, irrigation seepage, irrigation return flows, urban storm water runoff, or direct pumping.

D

Water source comments:

H2. HYDROPERIOD

Select the statement below that best describes the **hydroperiod** within the AA (extent and duration of inundation and/or saturation). Search the AA and 500 m envelope for hydrologic stressors (see list on following pages). Use best professional judgment to determine the overall condition of the hydroperiod. For some wetlands, this may mean that water is being channelized or diverted away from the wetland. For others, water may be concentrated or increased. Please add comments on next page.

Hydroperiod is characterized by natural patterns of inundation/saturation and drawdown and/or flood frequency, duration, level and timing. There are no major hydrologic stressors that impact the natural hydroperiod. Riparian channels are characterized by equilibrium conditions with no evidence of severe aggradation or degradation indicative of altered hydrology.

A

Hydroperiod inundation and drying patterns deviate slightly from natural conditions due to presence of stressors such as: flood control/water storage dams upstream; berms or roads at/near grade; minor pugging by livestock; small ditches or diversions removing water; or minor flow additions from irrigation return flow or storm water runoff. Outlets may be slightly constricted, but not to significantly slow outflow. Riparian channels may have some sign of aggradation or degradation, but approach equilibrium conditions. Playas are not significantly impacted pitted or dissected. *If wetland is artificially controlled*, the management regime closely mimics a natural analogue (it is very unusual for a purely artificial wetland to be rated in this category).

B

Hydroperiod inundation and drying patterns deviate moderately from natural conditions due to presence of stressors such as: flood control/water storage dams upstream or downstream that moderately effect hydroperiod; two lane roads; culverts adequate for base stream flow but not flood flow; moderate pugging by livestock that could channelize or divert water; shallow pits within playas; ditches or diversions 1–3 ft. deep; or moderate flow additions. Outlets may be moderately constricted, but flow is still possible. Riparian channels may show distinct signs of aggradation or degradation. *If wetland is artificially controlled*, the management regime approaches a natural analogue. Site may be passively managed, meaning that the hydroperiod is still connected to and influenced by natural high flows timed with seasonal water levels.

C

Hydroperiod inundation and drawdown patterns deviate substantially from natural conditions from high intensity alterations such as: significant flood control / water storage das upstream or downstream; a 4-lane highway; large dikes impounding water; diversions > 3ft. deep that withdraw a significant portion of flow, deep pits in playas; large amounts of fill; significant artificial groundwater pumping; or heavy flow additions. Outlets may be significantly constricted, blocking most flow. Riparian channels may be concrete or artificially hardened. *If wetland is artificially controlled*, the site is actively managed and not connected to any natural season fluctuations.

D

Hydroperiod comments: High amount of pugging by livestock.

H3. HYDROLOGIC CONNECTIVITY

Select the statement below that best describes the degree to which **hydrology within the AA is connected to the larger landscape** throughout the year, but particularly at times of high water. Consider the effect of impoundments, entrenchment, or other obstructions to connectivity that occur within the surrounding landscape, if those impoundments clearly impact the AA.

<i>Marsh / Meadow variant</i>	<i>Playa variant</i>	<i>Riverine / Riparian variant</i>	
No unnatural obstructions to lateral or vertical movement of surface or ground water. Rising water in the site has unrestricted access to adjacent upland, without levees, excessively high banks, artificial barriers, or other obstructions to the lateral movement of flood flows.	Surrounding land cover / vegetation does not interrupt surface flow. No artificial channels feed water to playa.	Completely connected to floodplain (backwater sloughs and channels). No geomorphic modifications made to contemporary floodplain. Channel is not entrenched.	A
Minor restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Up to 25% of the site may be restricted by barriers to drainage. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.	Surrounding land cover / vegetation may interrupt a minor amount of surface flow. Artificial channels may feed minor amounts of excess water to playa.	Minimally disconnected from floodplain. Up to 25% of stream banks may be affected by dikes, rip rap, and/or elevated culverts. Channel may be somewhat entrenched, but overbank flow occurs during most floods.	B
Moderate restrictions to the lateral or vertical movement of surface and ground water by unnatural features such as levees, road grades or excessively high banks. Between 25–75% of the site may be restricted by barriers to drainage. Flood flows may exceed the impoundments, but drainage back into the wetland may be incomplete due to the impoundments.	Surrounding land cover / vegetation may interrupt a moderate amount of surface flow. Artificial channels may feed moderate amounts of excess water to playa.	Moderately disconnected from floodplain due to multiple geomorphic modifications. Between 25-75% of stream banks may be affected by bikes, rip rap, concrete, and/or elevated culverts.	C
Essentially no hydrologic connection to adjacent landscape. Most or all stages may be contained within artificial banks, levees, or comparable features. Greater than 75% of the site is restricted by barriers to drainage.	Surrounding land cover / vegetation may dramatically restrict surface flow. Artificial channels may feed significant amounts of excess water to playa.	Channel is severely entrenched and entirely disconnected from the floodplain. More than 75% of stream banks may be affected by dikes, rip rap, concrete and/or elevated culverts. Overbank flow never occurs or only in severs floods.	D

Hydrologic connectivity comments:

PHYSIOCHEMICAL METRICS

S1. SUBSTRATE / SOIL DISTURBANCE

Select the statement below that best describes disturbance to the substrate or soil within the AA. For playas, the most significant substrate disturbance is sedimentation or unnaturally filling, which prevents the system’s ability to pond after heavy rains. For other wetland types, disturbances may lead to bare or exposed soil and may increase ponding or channelization where it is not normally. For any wetland type, consider the disturbance relative to what is expected for the system.

No soil disturbance within AA. Little bare soil OR bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails OR soil is naturally bare (e.g., playas). No pugging, soil compaction, or sedimentation.	A
Minimal soil disturbance within AA. Some amount of bare soil, pugging, compaction, or sedimentation present due to human causes, but the extent and impact are minimal. The depth of disturbance is limited to only a few inches and does not show evidence of altering hydrology. Any disturbance is likely to recover within a few years after the disturbance is removed.	B
Moderate soil disturbance within AA. Bare soil areas due to human causes are common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Sedimentation may be filling the wetland. Damage is obvious, but not excessive. The site could recover to potential with the removal of degrading human influences and moderate recovery times.	C
Substantial soil disturbance within AA. Bare soil areas substantially degrade the site and have led to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Sedimentation may have severely impacted the hydrology. The site will not recover without active restoration and/or long recovery times.	D

Substrate / soil comments and photo #'s:

S2. SURFACE WATER TURBIDITY / POLLUTANTS

S3. ALGAL GROWTH

Select the statement that best describes the turbidity or evidence or pollutants in surface water within the AA.		Select the statement that best describes algal growth within surface water in the AA. Exclude <i>Chara</i> (multicellular algae) in cover estimate.	
No open water in AA	NA	No open water in AA or evidence of open water.	NA
No visual evidence of turbidity or other pollutants.	A	Water is clear with minimal algal growth.	A
Some turbidity in water (such as turbidity caused by high flows or naturally occurring in playas) OR presence of other pollutants, but limited to small and localized areas within the wetland. Water may be slightly cloudy.	B	Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	B
Water is cloudy or has unnatural oil sheen, but the bottom is still visible. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	C	Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen.	C
Water is milky and/or muddy or has unnatural oil sheen. The bottom is difficult to see. <i>Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.</i>	D	Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see.	D

Water quality comments and photo #'s:

Turbidity and algal growth may be natural depending on recent weather patterns and flow timing (i.e., higher flows are often more turbid). Please rank the system as you see it, regardless of whether the conditions are natural. Include good notes and take photos.

SIZE METRICS

Z1. COMPARATIVE SIZE

Select the statement below that best describes the **absolute size** of the wetland, as compared with others of its type.

<i>Meadows and Marshes</i>	<i>Playas and Fens</i>	<i>Riparian Areas</i>	
>10 hectares (>25 acres)	>2 hectares (>5 acres)	>5 km (>3 miles)	A
2–10 hectares (25 acres)	0.5–2 hectares (5 acres)	1–5 km (3 miles)	B
0.5–2hectares (5 acres)	0.1–0.5 hectares (1 acre)	0.1–1 km (0.6 mile)	C
<0.5 hectare (<1 acre)	<0.1 hectare (<0.25 acre)	<0.1 km (<0.06 mile)	D

Comparative size comments:

Z2. CHANGE IN SIZE

Select the statement below that best describes the **change in size** of the wetland.

Occurrence is at, or only minimally reduced (<15%) from its original, natural extent, and has not been artificially reduced in size.	A
Occurrence is only somewhat reduced (15-10%) from its original natural extent.	B
Occurrence is modestly reduced (10-30%) from its original, natural extent.	C
Occurrence is substantially reduced (>30%) from its original, natural extent.	D

Change in size comments:

Land Use Index Worksheet

Land Use Categories ¹ _s	Coefficient	500 m Envelope	
		% Area	Score
Paved roads, parking lots, domestic, commercial, and industrial buildings	0	0	
Gravel pit operation, open pit mining, strip mining, abandoned mines	0	0	
Unpaved roads (e.g., driveway, tractor trail, 4-wheel drive roads)	1	0.0582	0.0582
Resource extraction (oil and gas)	1	0	
Tilled agricultural crop production (corn, wheat, soy, etc.)	2	0	
Intensively managed golf courses, sports fields, lawns	2	0	
Vegetation conversion (chaining, cabling, rotochopping, clearcut)	3	0	
Heavy grazing by livestock	3	0	
Logging or tree removal with 50-75% of large trees removed	4	0	
Intense recreation (ATV use / camping / popular fishing spot, etc.)	4	0	
Permanent crop agriculture (hay pasture, vineyard, orchard)	4	0	
Dam sites and disturbed shorelines around water storage reservoirs. Include open water of reservoir is there is intensive recreation, such as boating.	5	0	
Old fields and other disturbed fallow lands dominated by non-native species	5	0	
Moderate grazing on rangeland	6	0.78	4.68
Moderate recreation (high-use trail)	7	0	
Selective logging or tree removal with <50% of large trees	8	0	
Light grazing on rangeland	9	0	
Light recreation (low-use trail)	9	0	
Natural area / land managed for native vegetation	10	0.2194	2.194
Total Land Use Score			6.9322-

Buffer Width Worksheet

1: 100 _____	5: 100
2: 100 _____	6: <u>100</u>
3: <u>100</u>	7: 100
4: <u>100</u>	8: 100
Average width: 100 _____	

COLORADO ECOLOGICAL INTEGRITY ASSESSMENT (EIA) SCORECARD

Made by: Colorado Natural Heritage Program, Version: August 31, 2015



Site ID: Eagle Rock Ranch, South Parcel
 Site Name: South Assessment Area
 Project: _____

Date: 7/13/2023

Ecol System: Rocky Mountain Montane Wet Meadow
 HGM: Slope
 Cowardin: Palustrine, Emergent, Temporarily Flooded

	Wt	Field Rating	Field Points	Calc Points	Calc Rating
Overall Ecological Integrity Score and Rank				2.97	B-
Overall Ecological Integrity + Size Score and Rank				NULL	NULL
Rank Factor: LANDSCAPE CONTEXT	0.30			3.50	A-
LANDSCAPE METRICS	0.33			2.50	B-
L1. Contiguous Natural Land Cover	1	B	3		
L2. Land Use Index	1	C	2		
BUFFER METRICS	0.67			4.00	A+
B1. Perimeter with Natural Buffer	n/a	A	4		
B2. Width of Natural Buffer	n/a	A	4		
B3.1. Condition of Natural Buffer - Veg	n/a	A	4		
B3.2. Condition of Natural Buffer - Soils	n/a	A	4		
Rank Factor: CONDITION	0.70			2.74	B-
VEGETATION METRICS	0.55			2.50	B-
V1. Native Plant Species Cover	1	B	3		
V2. Invasive Nonnative Plant Species Cover	1	B	3		
V3. Native Plant Species Composition	1	C	2		
V4. Vegetation Structure	1	C	2		
V5. Regen. of Native Woody Species (opt.)	1		NULL		
V65. Coarse and Fine Woody Debris (opt.)	1		NULL		
HYDROLOGY METRICS	0.35			3.33	B+
H1. Water Source	1	A	4		
H2. Hydroperiod	1	C	2		
H3. Hydrologic Connectivity	1	A	4		
PHYSIOCHEMISTRY METRICS	0.10			2.00	C+
S1. Soil Condition	1	C	2		
S2. Surface Water Turbidity / Pollutants (opt.)	0.5		NULL		
S3. Algal Growth (opt.)	0.5		NULL		
Rank Factor: SIZE	n/a			NULL	NULL
SIZE METRICS	1			NULL	NULL
Z1. Comparative Size (opt.)	1		NULL		
Z2. Change in Size (opt.)	1	A	4		

Input field metric ratings into empty boxes to calculate Rank Factor and Final EIA Scores. Fill in all metrics that are not marked as optional. Optional metrics depend on method used and wetland type.

Site Visit Details

[Site Visit ID: Plot 2-42_20050815]

Site Data

Project Code: 2004_VIBI

Project Name: VIBI and EIA Development

Site Code: Plot 2-42

Reference Network Site: No

Location:

County: PARK

Location General: Tarryall Reservoir SWA

Quad Code: 3910525

Quad Name: FARNUM PEAK

Huc 6 Code: 101900

Huc 6 Name: South Platte

Huc 8 Code: 10190001

Huc 8 Name: South Platte Headwater

Huc 12 Code:

Huc 12 Name: Tarryall Reservoir-Tarryall Creek

Level 3 Ecoregion: 21: Southern Rockies

Level 4 Ecoregion: 21j: Grassland Parks

Wetland Indicator Region: Western Mountains

Land Status (Ownership and Management):

General Land Ownership: CPW

Specific Land Ownership: Colorado Parks & Wildlife

General Land Manager: CPW

Specific Land Manager: Colorado Parks & Wildlife

Site Visit

Visit Date: 2005/08/15

Visit Number: 1

Site Selection: Targeted assessment

Visit Project Code: 2004_VIBI

Visit Project Name: VIBI and EIA Development

Classification:

Ecological System: Rocky Mountain Subalpine-Montane Riparian Shrubland

Ecological System Confidence:

HGM Class: Riverine

Confidence:

Cowardin:

Confidence:

Wetland Origin:

Elevation (m): 2700

Elevation (ft): 8865

Slope (deg): 0

Aspect (dir): Flat

Site Visit Details

[Site Visit ID: Plot 2-42_20050815]

Wetland vs. Status:

% Wetland:

% Mesic Riparian:

% Upland:

Plot Description:

Valley Setting:

Stream Duration:

Channel Proximity:

Stream Depth:

Plot Shape: Freeform

Plot Size (m2): 20068

Is the Plot the Entire Wetland?

Is the Plot Representative of the Wetland?

Plot Description:

Site Visit Details

[Site Visit ID: Plot 2-42_20050815]

Vegetation

Plot Species Richness: 30

Percent Native Species: 89%

Mean C: 4.32

Percent Hydrophytic (OBL & FACW): 50%

Species	Cover	Native Status	Noxious Weed
<i>Carex utriculata</i>	85.0	Native	
<i>Mentha arvensis</i>	2.5	Native	
<i>Rorippa sphaerocarpa</i>	2.3	Native	
<i>Glyceria grandis</i>	1.9	Native	
<i>Calamagrostis stricta</i>	0.9	Native	
<i>Eleocharis macrostachya</i>	0.9	Native	
<i>Epilobium ciliatum</i>	0.6	Native	
<i>Alopecurus pratensis</i>	0.5	Non-native	
<i>Hippuris vulgaris</i>	0.5	Native	
<i>Salix monticola</i>	0.5	Native	
<i>Senecio eremophilus</i> var. <i>kingii</i>	0.5	Native	
<i>Beckmannia syzigachne</i>	0.4	Native	
<i>Galium trifidum</i> spp. <i>subbiflorum</i>	0.4	Native	
<i>Rumex aquaticus</i> var. <i>fenestratus</i>	0.4	Native	
<i>Argentina anserina</i>	0.3	Native	
<i>Carex aquatilis</i>	0.3	Native	
<i>Polygonum amphibium</i> var. <i>emersum</i>	0.3	Native	
<i>Alopecurus aequalis</i>	0.1	Native	
<i>Cirsium arvense</i>	0.1	Non-native	List B
<i>Cirsium scariosum</i>	0.1	Native	
<i>Deschampsia cespitosa</i>	0.1	Native	
<i>Epilobium halleianum</i>	0.1	Native	
<i>Hordeum brachyantheru</i> m spp. <i>brachyantherum</i>	0.1	Native	
<i>Hordeum jubatum</i> spp. <i>jubatum</i>	0.1	Native	
<i>Poa palustris</i>	0.1	Native	
<i>Symphyotrichum campestre</i> var. <i>campestre</i>	0.1	Native	
<i>Thlaspi arvense</i>	0.1	Non-native	

Site Visit Details

[Site Visit ID: Plot 2-42_20050815]

Soil Pits

Soil Pit: 1	Soil Type:	Representative Pit:
Depth to saturated soil(cm):	Depth to free water(cm):	
Settling Time(min):	If not observed:	

No soil horizon data available for this Soil Pit.

Hydric Soil Indicators:

<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Histic Epipedon (A2/A3)
<input type="checkbox"/> Gleyed Matrix (S4/F2)	<input type="checkbox"/> Depleted Matrix (A11/A12/F3)
<input type="checkbox"/> Mucky Mineral (S1/F1)	<input type="checkbox"/> Redox Concentrations (S5/F6/F8)
<input type="checkbox"/> Hydrogen Sulfide Order (A4)	<input type="checkbox"/> No Indicator

Comments:

Hydrology and Water Chemistry

No hydrology and water chemistry data available for this site visit.

Ecological Condition

Overall condition rank: *

**Overall condition rank was assigned at the site visit using a qualitative Natural Heritage ranking system and was not assigned using the formal EIA methodology.*

Stressors

Current Landscape Disturbance (model date Dec 2016):

Landscape Disturbance Rank: 285 Landscape Disturbance Score: Moderate

No stressor data for this site visit.

APPENDIX 5

THE BRYOPHYTES OF EAGLE ROCK RANCH BY STACEY ANDERSON

The Bryophytes of Eagle Rock Ranch

By Stacey Anderson

Prepared for the Gottenborg Family, Eagle Rock Ranch

February 2024

This report is organized into four general habitat sections with photos of individual mosses and information specific to those species in each section following the habitat summaries. The genus and species name along with the sample's packet number (yymmdd-sample#) is noted at the head of each specie's page. Unless indicated otherwise, all photographs and identifications were provided by the author. Attached to this report is a spreadsheet for the bryophytes collected along with their collection information and a map of their locations. All photos (787) taken at the ranch and during identification are available upon request.

Introduction

David Gottenborg correctly identified and reported finding moss in his hay field the previous winter and was curious to know what mosses might be living on his ranch property. On June 8, 2023, a day-long survey for bryophytes (mosses, liverworts, and hornworts) was conducted with the Colorado Natural Heritage Program by Stacey Anderson along with Jessica Smith, Elias Castaneda, Grant Musgrave, and River Blessing.

Four different habitat locations were sampled. Each location had its own unique characteristics that influence the micro-niches mosses inhabit. These locations included the north wet meadow at flood time and the hay field east that was not flooded, a disturbed (irrigated) slope next to the ranch house, a rocky outcrop bordering the hay field/wetlands, and a stock pond to the south (see attached map).

Sixteen unique species of bryophytes in nine families were found (Appendix 1). To determine the distribution of each species within Park County and the State, a search was conducted using the Consortium of Bryophyte Herbaria database for Park County and for the state of Colorado (Consortium of Bryophyte Herbaria, 2024). Four species from the ranch are new Park County occurrences, one from each of the four sampled areas. They include *Leptobryum pyriforme*, *Plagiomnium cuspidatum*, *Ptychostomum cyclophyllum*, and *Tortula acaulon*. *Ptychostomum cyclophyllum* has only six other occurrences in Colorado.

Twelve species found at the ranch have been reported from three or fewer places in Park County. *Tortula cernua*, although found once before in Park County, has also only been reported from six other places in the State with the earliest collection in 1895. The earliest collected bryophyte in Park County, the ubiquitous *Ceratodon purpureus*, was first collected over 150 years ago in 1873. One might expect there to have been more reported occurrences in Park County of the species found on the ranch during that span of time. A dearth of knowledge exists about bryophyte occurrence and distribution in Colorado. Surveys like this contribute greatly to understanding their ecology and unique characteristics that impact the landscape.

Irrigated Hay Meadow (flooded condition) and East Hay Meadow (saturated soils)

The Tarryall Creek riparian area is a movement corridor for riparian and aquatic bryophytes. Mosses dislodged during high stream flow, animal and human disturbance, wind and snow events are carried downstream to new habitats. Because of runoff and siltation buildup of agricultural areas and pasturelands, bryophytes in streams and streambanks are found in fewer numbers and diversity if at all, depending on the condition of the stream's substrate stability, substrate size, flow, alkalinity, and human interference with the surrounding landscape (Glime, 2017). Four wetland bryophytes, *Drepanocladis aduncas*, *Hygrohypnum luridum*, *Hygroamblystegium varium*, and *Ptychostomum cyclophyllum* were found in these two areas. They are typical of wetland/riparian/fen areas and good indicators of the favorable conditions for their occurrence.

Mosses were not searched for within Tarryall Creek in the flooded part of the hay meadow but a typical streambank species, *Hygrohypnum luridum*, was found away from the stream successfully growing on soil in an area that dries out much more than the creekbank would. The overflow of Tarryall Creek probably brought *H. luridum* to a more unusual location for that species. *Tortula acaulon*, a new record for Park County is, "...hardly ever encounter[ed] except in early spring or late fall when the ground is moist...After a few weeks the soil is baked dry, and the mosses go into a summer dormancy and disappear from view. Its habitat is primarily...open grassland or grassy slopes." (Weber & Wittmann, 2007). Although it is not known as a wetland species, it seems to take advantage of the time of year when a habitat meets its life history requirements.

In the eastern section of the hay field, a short stretch of the streambank itself was investigated but no mosses were found. However, an interesting species, *Ptychostomum cyclophyllum*, was found growing on the saturated soil approximately 100 ft. west of the creek. It is, “A rare species of subalpine peatlands that is characterized by slender stems; dull, bluish-green, oval leaves, rounded-obtuse at the apex, remotely scattered on the stem, and greatly contorted when dry; a costa that does not quite reach the leaf apex.” (Weber & Wittmann, 2007). It occurs as a colonist on wet soils that are subject to inundation. CNHP ranks this moss as critically imperiled in the state (G4G5 S1S3) (Smith, 2023, pp. 49-50). This is a new county record and has only been reported from nine other places in the state, one of those occurrences, at Left Hand Creek has been destroyed by peat mining. This moss, usually found at higher altitudes, is an example of the movement corridor that Tarryall Creek provides carrying mosses dislodged at higher elevations and depositing them, especially during flooding, at lower elevations.

The persistence and sometimes unexpected occurrence of the wetland mosses found in a grazed and harvested hay meadow reflects the careful stewardship given to the area.

Irrigated Slope, north side of House

The slope next to the house under the Ponderosa Pine tree is an example of a “wild” moss garden. Areas near buildings usually have some disturbances from foot-traffic, erosion, and irrigation. Mosses that can inhabit these places will invariably grow there if the micro-niche is right. The ability of moss to reproduce new plants from mere fragments that are dispersed by wind and water enables along with a species ability to adapt to many kinds of habitats, enable some to have a worldwide distribution. A little protection, some shade and some water may be all that is needed for them to thrive.

Two hardy and widespread species, *Ceratodon purpureus*, first found in Park County in 1877, and *Syntrichia ruralis*, first found in Park County only five years earlier in 1873, were found there. *Sanionia uncinata*, a common species in Antarctica, was also growing there.

Syntrichia ruralis grows in habitats of dry to moist soil and rock and is considered a dry-land moss. It doesn't do as well in disturbed areas as the former but is hardy enough that it is a component of biocrusts on Colorado's western slope as well as many other areas.

All three species are mosses that can withstand a wide range of temperature and moisture. There could likely be other species found in the area around the house and buildings.

Rocky Outcrop with North-facing Slope

This area had the most diversity with seven distinct species of mosses found. It is likely this area receives little disturbance, adequate moisture, and shade due to its north facing aspect and proximity to the riparian area. It is a boundary area between the wetlands of Tarryall Creek and the upland hills. Boundary areas, with their quickly changing gradients of light, slope, moisture, soil, and ground cover, among many other parameters provide a substantial number of micro-niches for various kinds of mosses.

All seven species can grow in habitats of rock or rocky soil. *Plagiomnium cuspidatum*, a new County record, *Roaldia revoluta* and *Syntrichia ruralis* were collected multiple times indicating a suitable habitat for their growth. More time exploring this area and areas like it on the ranch would probably reveal even more species.

Agricultural Ponds-Ruby Gulch

Areas where cattle congregate are areas of high disturbance. A group of mosses adapted to disturbance, lime-rich surfaces, frequent drying-out and higher atmospheric nitrogen levels, among other challenging conditions are considered ruderal mosses. Besides extreme disturbances like burned areas, they can be found occupying unusual places that hold more moisture than the surrounding ground such as hoof-prints, or tractor ruts. Ruderal mosses are often the first plants to grow on packed, bare earth, limiting erosion and contributing to soil creation, often paving the way for other plants. Rhizoids instead of roots allow for quick attachment and fast growth often producing reproductive sporophytes in a brief time that allows them to take advantage of fast-changing habitats. (Bell, 2023)

Three mosses that grow well in ruderal places were found in one of the stock ponds in Ruby Gulch on top of a hummock near the perimeter. Grasses, forbes, and mosses were growing together, some in initial stages of growth. One of the mosses, *Leptobryum pyriforme*, though found many times in other parts of the state, has never been documented for Park County before. *Tortula cernua* has been found once before in Park County, and only six other times in the State. A third moss, *Ptychostomum sp.* could not be identified to species. That genus is known for its variable morphology and difficult identification, especially without sporophytes.

North Parcel-Hay Meadow, flooded conditions



Redwing Blackbird nest in flooded wet meadow

Drepanocladis aduncus

230608-01A & -01B



D. aduncus in flooded hay meadow (left)



Macro-photo of sampled *D. aduncus*. Note the hooked stems, uniform green color, and leaves that curve at the tip (falcate) (above and right)



D. aduncus leaf

This is likely the moss found in the hay meadow during the winter. It is a carpet forming moss probably occurring in patches. It is commonly found in mineral and nutrient-rich wetlands in Colorado and has been found at three other localities in Park County. There are two different samples in the collection, one that I found, and one that Dave found, both in the wet meadow but quite a distance apart. Patches of *D. aduncus* may occur over a large area of the wet meadow.

Its morphology is quite variable depending on environmental conditions. It can grow fully submerged but also can do well on low-lying, wet ground. The mineral and nutrient-rich, wet hay meadow fits the habitat requirements for *Drepanocladis aduncus* well.

Tortula acaulon 230608-02

T. acaulon growing on bare soil; hay-meadow



Easily overlooked, this very small moss is ephemeral and grows on disturbed, bare, often calcareous soil. It has interesting capsules that are spherical and nested down in the leaves hidden from view until examined closely. Immature capsules were found in the collected sample.



The mid-rib (costa) extends beyond the tip of the leaf and can be a short or long hair-point. Usually one or both margins of the leaf are recurved (folded toward the back) making the edges look thicker. The cells have projections on the surface called papillae. In the photo above, the papillae are what look like light-green dots on the cell. There is often red coloring in the leaf and costa. It belongs to the Pottiaceae family which contains members adapted to harsh conditions.



Leaf of *T. acaulon* with recurved margins and red coloration



T. acaulon leaf cells showing papillae appearing as spots on the quadrate-shaped cells

Hygrohypnum luridum 230608-03



H. luridum at collection site



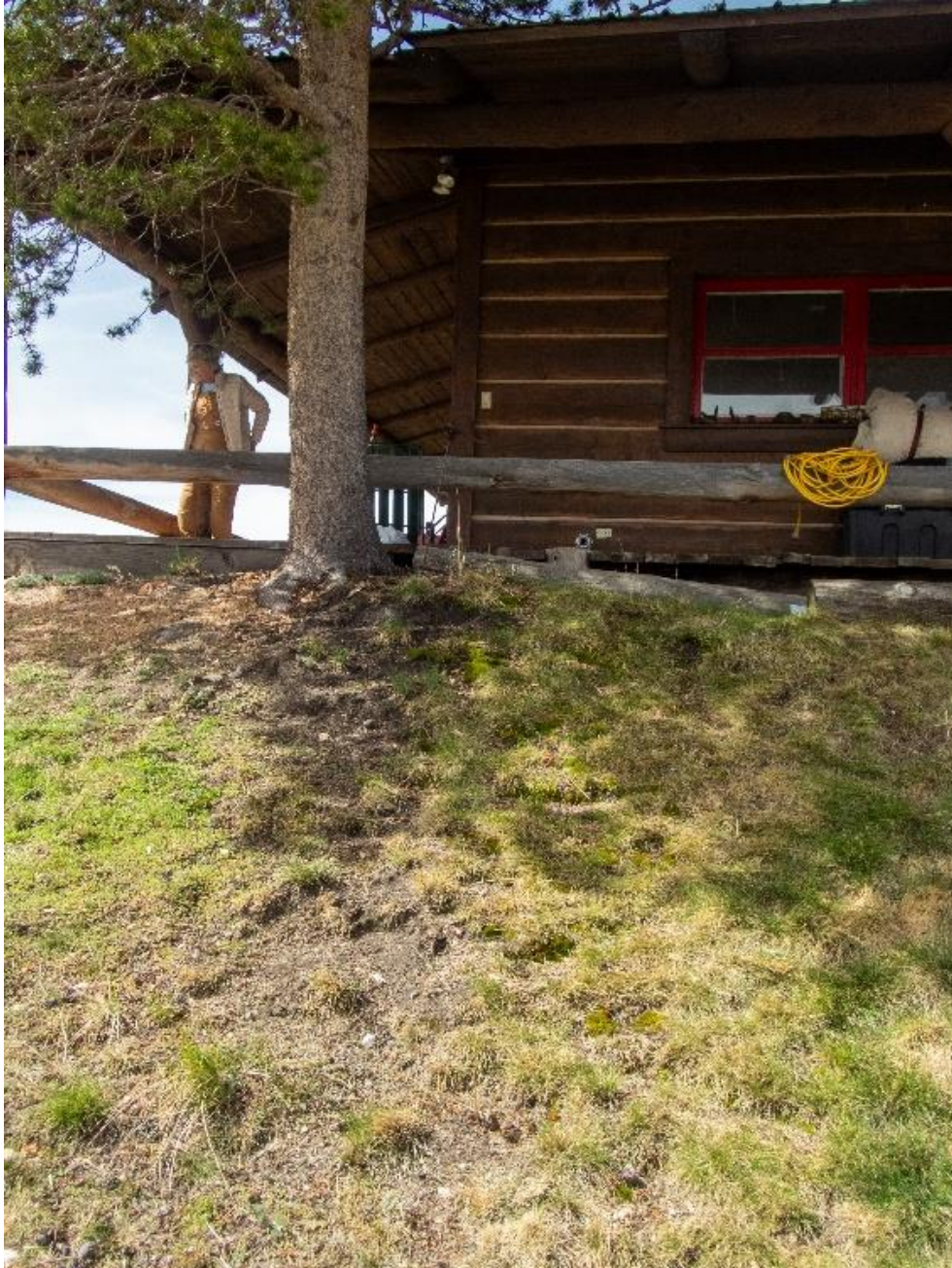
H. luridum sample



Leaves of *H. luridum*

This moss was a puzzle. It was found on soil beneath grasses but is usually found on rocks in flowing water. John Brinda, research scientist with the Missouri Botanical Garden, identified this “mystery” moss. He suggested that its unusual location was likely due to being carried into the meadow by the flooding Tarryall Creek. With enough water flowing and wet conditions enough times of the year it likely survived and probably occurs in scattered patches. It is a highly variable moss and can have straight or falcate (curved) leaves with the costa (mid-rib) being short and double, to short or long and single. This sample had straight leaves with costas to $\frac{3}{4}$ the length of the leaf. It is also a calcicole, usually occurring on calcareous rock or other substrates irrigated with calcareous water. Both *H. luridum* and *T. acaulon* have calcareous habitat requirements.

Irrigated Slope; north side of house under Ponderosa pine



North slope of ranch house

Sanionia uncinata 230608-04



S. uncinata at collection site

“*Sanionia uncinata* (Amblystegiaceae) is one of the most abundant mosses colonizing maritime Antarctica; in this region, plants can experience very harsh environmental conditions such as sub-zero temperatures, poor soils, strong winds, fluctuations in UVB and PAR radiation and water deficit.” (Pizarro, Contreras, Köhler, & Zúñiga, 2019). *S. uncinata* produces considerable amounts of carotenoids in the presence of high levels of UVB radiation. It has been suggested that *Sanionia* could be an important natural source of antioxidants for applications in medicine and cosmetics (Bhattarai, Paudel, Lee, & Yim, 2008).

With its long, often shiny, curved stem leaves, this is a handsome moss. The curved leaves clustered at the tops of stems and branches give it a hooked appearance. The plications (folds) of the leaves can be seen with a hand lens, especially when the plant is dry. It grows in a wide range of habitats including relatively dry, grassy, or rocky areas.



S. uncinata stems



S. uncinata leaf with hooked leaf tip

Syntrichia ruralis 230608-05



Syntrichia ruralis has been given the common name of “Star Moss” by William Weber, an easy to remember name that fits this moss very well. It is a robust moss and one of the most frequently seen mosses in Colorado. The outstanding characteristic of this moss is its ability to rehydrate, turn green and start photosynthesizing from a dehydrated state in a matter of minutes. Because of this ability to respond rapidly to available moisture, it is well suited to dry, inhospitable environments

<https://3dmoss.berkeley.edu/community-outreach/media/>. It typically has long, silvery, toothed



S. ruralis leaf

hair points, leaves that curve away from the stem when wet, and recurved margins. Often there is red coloring in the leaves and costa. Rhizoids, reddish attachment filaments, are abundant on the stem and aid in moving water along their outside to the leaves via capillary action. The open “empty” cells at the base of the leaves hold water. The translucent, barbed hairpoint at the top of the leaf has just the right configuration to condense moisture from the air into droplets that run to the leaf even when upside down! The leaf cells are covered with small bumps called papillae that are believed to function as “snorkels” when the leaf is covered with a film of water enabling carbon-dioxide into the cell.

Hay Meadow (east)



Mosses collected here were about 100 ft. from Tarryall Creek on saturated soil. Most mosses are adapted to low levels of light but if the cover is thick enough, growth slows. The grasses and sedges in this hay meadow location have a low enough density that adequate light gets through to the mosses below. It would be interesting to see what their growth is like as the season progresses and the cover increases.

Ptychostomum cyclophyllum 230608-07

This moss occurs as a colonist on wet sandy or organic soils that are subject to inundation. *P. cyclophyllum* has blunt orbicular to ovate leaves that, when dry, are quite shrunk. That, along with its small size, makes it difficult to find in the field.



Ptychostomum on saturated soil and decaying vegetation



New growth at tips of stems is lighter green.

The Flora of North America notes, “The occurrence of *P. cyclophyllum* has probably declined in the United States, as the plants grow in wetlands and along streams in mid elevation regions, areas where human development is often concentrated.” (Flora of North America Editorial Committee, 2024).



Fig: A part of filament bearing Heterocysts and Akinetes.

Anabaena

Photosynthetic cyanobacteria, like this *Anabaena*, found with *P. cyclophyllum*, are responsible for most of the Earth’s atmospheric oxygen. *Anabaena* can also change atmospheric Nitrogen into a form usable to other organisms, like plants. Their nitrogen-fixing heterocysts create a mutually beneficial relationship with many mosses. The moss helps maintain a wet

environment and substrate, and its nitrogen production benefits the moss and other plants including grasses and forbes. In the boreal forests of Canada, “Half of ecosystem N input may derive from moss–cyanobacteria associations in pristine ecosystems...Different moss hosts influence bacteria in distinct ways, which suggests that threats to mosses also threaten unique microbial communities with important ecological and biogeochemical consequences.” (Glime, 2017).

Hygroamblystegium varium* var. *varium 230608-08



H. varium on wet, organic soil at base of grasses



Leaf and stem arrangement



Stems of *H. varium* showing leaf/stem relationship



Hygroamblystegium varium leaf

Hygroamblystegium varium grows in and on a variety of moist or wet habitats where there is some disturbance including marshes, fens, ponds, and mountain fast flowing streams. In the field it looks like a small, dark, and non-descript moss (Allen 2014). It is clearly a very adaptable wetland species. At this time, it has been found only in one other place in the County.

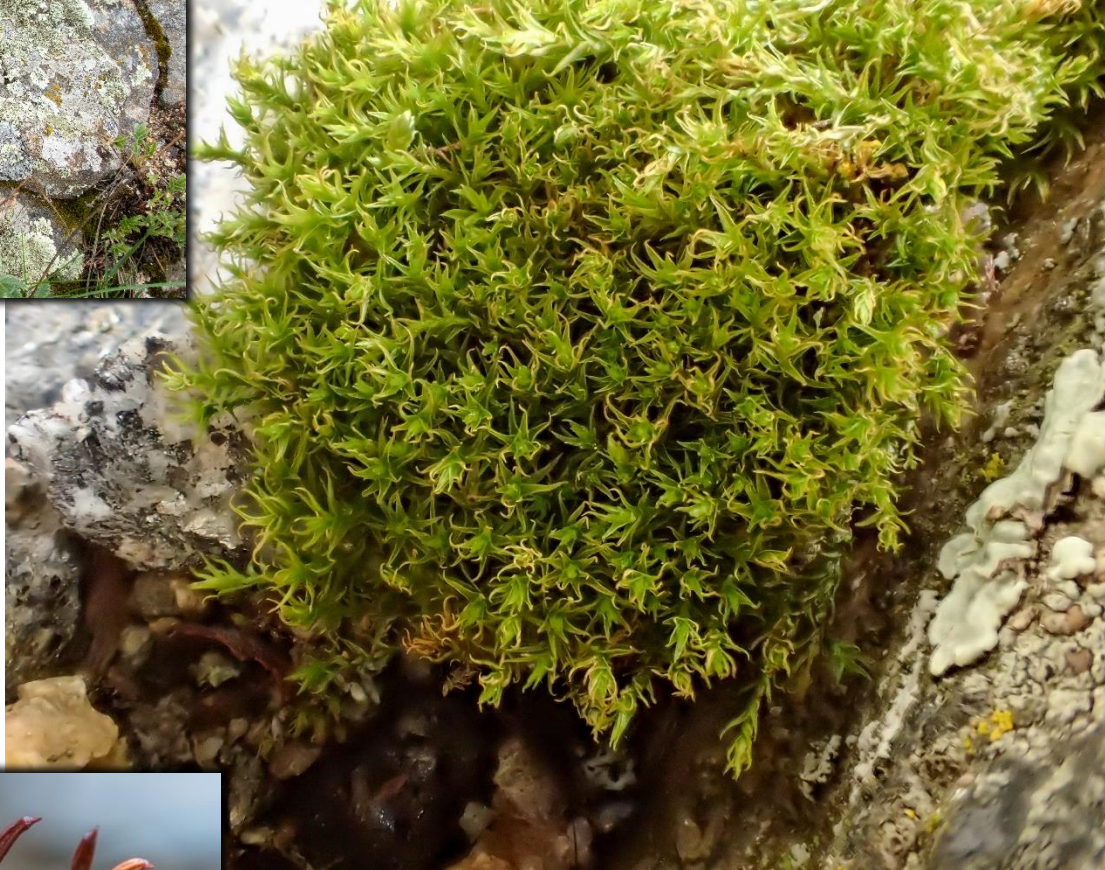
This diverse moss can appear differently from one place to another based on the availability of water. It is usually found in wet or marshy ground and often looks quite scraggly. It has befuddled many bryologists so often that Bruce Allen in *Maine Mosses* wishes the reader “Good luck!”. The Latin word “varium” in this species’ name means “varied”. A suitable name!

Rocky Outcrop and North Facing Slope



Mosses were found and collected at the base of this outcrop and upslope among boulders, shrubs, and grasses. This habitat is home to those mosses that are best adapted to drier conditions compared to those on the floodplain of Tarryall Creek.

Ceratodon purpureus 230608-06



C. purpureus capsules

Photo by Štěpán Koval

C. purpureus leaves starting to dry and curl

Ceratodon is a ubiquitous species with worldwide distribution including Antarctica. It is a “weedy” or ruderal moss because of its ability to grow almost anywhere. It is “...most common on open soil, also rock ledges, tree bases, roof tops, old wood, a common colonizer of soil following fires.” (Flora of North America Editorial Committee, 2024). Without capsules it can be hard to identify being known as a “trickster” moss. It is often mistaken for something else and therefore collected partly due to its attractive, plush cushions that can cover extensive areas of packed earth with a lush green. It usually has many capsules that are purple-brown, deeply furrowed, and attached to the stem (setae) horizontally or at an inclined angle as pictured to the left.

Plagiomnium cuspidatum 230608-10



P. cuspidatum starting to dry out



P. cuspidatum leaf (above); leaf apex (left)

Dried *P. cuspidatum*



This is a beautiful moss that is found in a variety of wetter areas. It is commonly found growing along rocks in base-rich habitats such as wet meadows. It has small teeth on the edges that continue half-way down to the bottom of the leaf.

P. cuspidatum can produce bactericides and fungicides and has shown resistance to methicillin-resistant *Staphylococcus aureus*. Flavonoids, rich in antioxidant properties, have been extracted from *P. cuspidatum*. The moss is used in India to stop nosebleeds (Glime, 2017).



Pinnate (feather) branching of R. revoluta

Leaves of R. revoluta with falcate leaf tips

This lovely pleurocarp with its shiny green to golden leaves that hook at the tip (falcate) is described by Dr. Weber as, “Probably the most abundant and conspicuous pleurocarpous moss throughout the forested area, from the lower foothills up to the alpine.” It can vary greatly in size and appearance and tolerates drought surviving on snow-melt and intermittent wetting from rain.

Mnium arizonicum

230608-13



Twisted, dried leaves of *M. arizonicum*



Hydrated plant



Leaf apex and whole leaf of *M. arizonicum*

This moss resembles *Plagiomnium cuspidatum* and is in the same family, Mniaceae. *M. arizonicum* has marginal teeth, which can be single or double (see above right) and that are usually restricted to the upper 1/3 of the leaf. This plant had some leaves with teeth extending farther down the leaf illustrating, as with *Hygroamblystegium varium*, how variable mosses can be in their morphology. The genus *Mnium* is known to have highly unsaturated lipids and to have been used in poultices to reduce pain and bruises, wounds, and burns (Glime, 2017).

Encalypta raptocarpa

230608-15



The Flora of North America observes, for the genus *Encalypta*, “The large, straw-colored calyptra* of *Encalypta* are generally present in mature colonies, growing on shallow soil over rock in exposed or moderately sheltered recesses.” (Magil 2022). Because of this feature, it is easy to identify in the field. Dr. Weber describes this moss as looking like “a partly inflated sausage balloon”. It has been called “extinguisher” moss possibly from the calyptra’s resemblance to a candle snuffer (Weber & Wittmann, 2007). The small niches formed by rocks on the slope are good places to look for *Encalypta*.

* A calyptra is a cap or hood covering the capsule and falls off before spores are dispersed.



"Candlesnuffer" moss with large capsule hoods (calyptra)

Agricultural Ponds



The three mosses found growing together in a stock pond are (diagonally from top right to bottom left): *Leptobryum pyriforme*, *Ptychostomum sp.*, and *Tortula cernua*.

Notice the difference between the leaf shapes and the way they grow on the stem. Ruderal mosses grow quickly then often seem to disappear when conditions worsen but will become apparent again when conditions are right.

Leptobryum pyriforme

230608-17

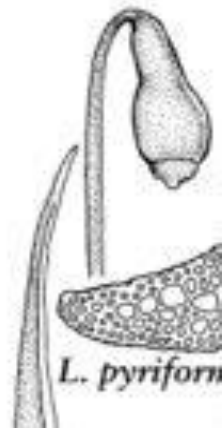


Stem of *L. pyriforme*



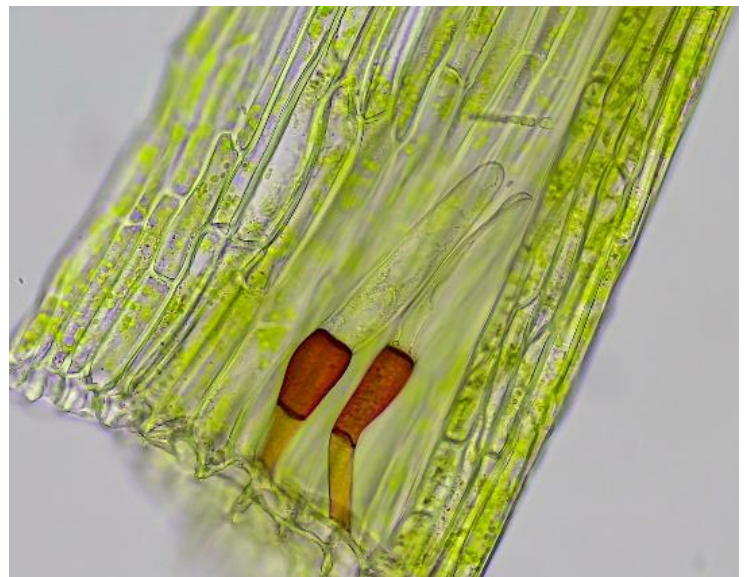
Leaf of *L. pyriforme*

Disturbed places, burned areas, and greenhouses are where this moss prefers to grow. It occurs in all but four states in North America. It has long, slender leaves with a wide costa (mid-rib) filling about half of the leaf base. It usually has nodding, pear-shaped capsules although this sample did not.

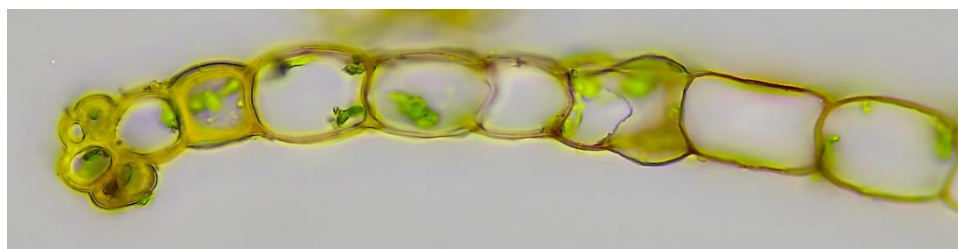


Capsule
(Flora of North America)

Obvious in this sample are the club-shaped axillary hairs (between the leaf base and the stem) with lower cells that are red. While the upper, transparent (hyaline) cell will fall off, the two lower, pigmented cells will persist.



Axillary hairs with red basal cells



Cross-section of leaf showing row of single cells with multi-celled margin

This cross-section of *T. cernua* shows the single row of leaf cells with a tri-stratose (three-layer) margin at the edge. As shown here, most mosses have leaves that are one-cell thick. Looking at the photo of the whole leaf to the right, you can see the thicker, darker margin created by the thick-walled and tri-stratose cells. (Note: Usually the margins of *L. pyriforme* are two-stratose but variations within a leaf can occur.



Leaf of L. pyriforme. Note axillary hair at base.

This is a small moss, 3-10mm high, often overlooked and mostly collected when it has capsules and can be seen more easily (Weber & Wittmann, 2007). It too, like *Leptobryum*, is considered a “weed” moss. Besides the ranch, the other place *T. cernua* has been collected in Park County is at High Creek Fen. It seems to prefer calcium rich soils. Capsules mature in the summer which probably explains, with the rain and cooler temperatures of early June 2023, why there were no visible capsules when this sample was collected.

***Ptychostomum* sp.** 230608-19



Ptychostomum sp. plants and leaf (left)

This *Ptychostomum* species identity will remain a mystery for the time being. The *Ptychostomum* genus can be exceedingly difficult to impossible to identify without capsules. It could possibly be *Ptychostomum creberrimum* or *P. pallescens* which is very similar differing mostly in its capsule and spores. This sample had neither. Many bryophyte identifications are less than 100% certain. The genus usually occurs on wet mud, soil, or peat. These plants were intermixed with *L. pyriforme* and *T. cernua*.



Leaves of *Ptychostomum* sp.

Summary

Eagle Rock Ranch is home to sixteen identified species of bryophytes in nine families. Four new Park County species were found including *Ptychostomum cyclophyllum* which has only been found in six other places in Colorado. Mosses were sampled from four different habitats. They were the hay field/wetlands, the house irrigated slope, the rocky outcrop, and the agricultural ponds.

The ranch is a wetlands corridor bringing wetland and aquatic mosses that grow at higher elevations onto the property. It is possible there is a shifting number and kind of moss genera over time in the wetland area because of this corridor. In addition, weather, climate conditions, and landuse practices all impact the diversity and density of bryophytes.

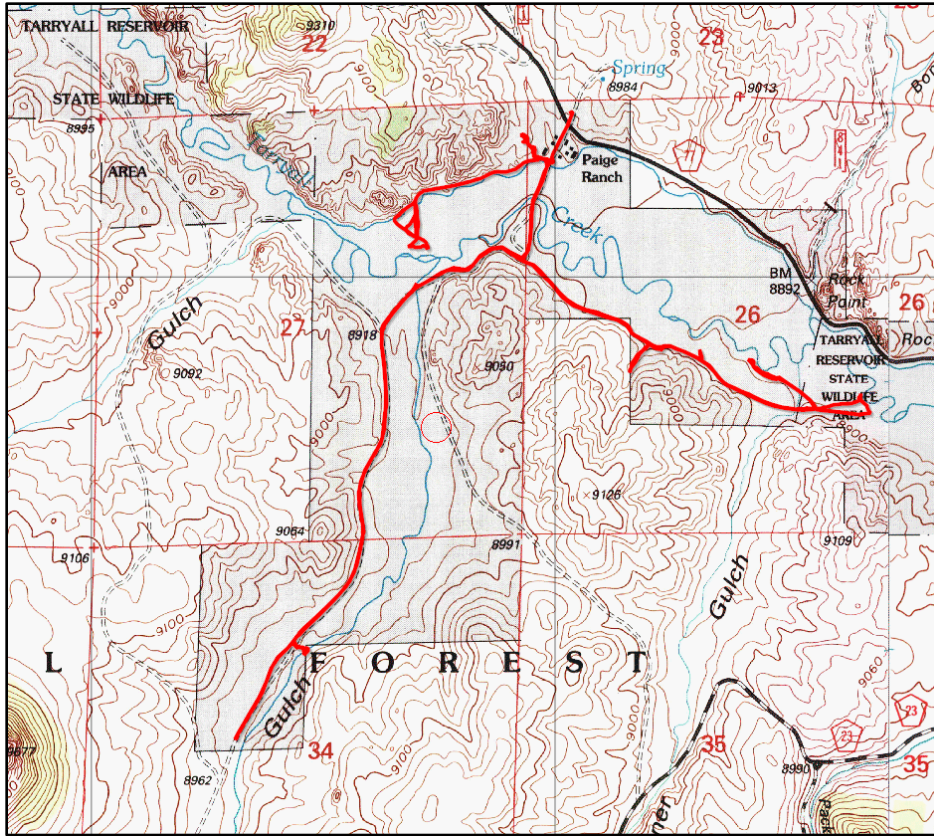
Bryophytes are important organisms to a healthy ecosystem and affect components important to ranching. They contribute to soil formation by trapping wind-blown organic and inorganic material and adding to undecomposed organic matter. They are important to soil protection in arid areas by forming soil covers and stable crusts in combination with cyanobacteria, green algae, and fungi. They also play a significant role in mediating soil temperatures, preventing wind and water erosion and absorbing and holding water (Vanderpoorten & Goffinet, 2009). The bryophytes found at Eagle Rock Ranch reflect a diversity of moss habitats with minimal human impact in the wetland and rocky outcrop areas. They are and will continue to be an important if almost unseen part of the ecological health of Eagle Rock Ranch.

References

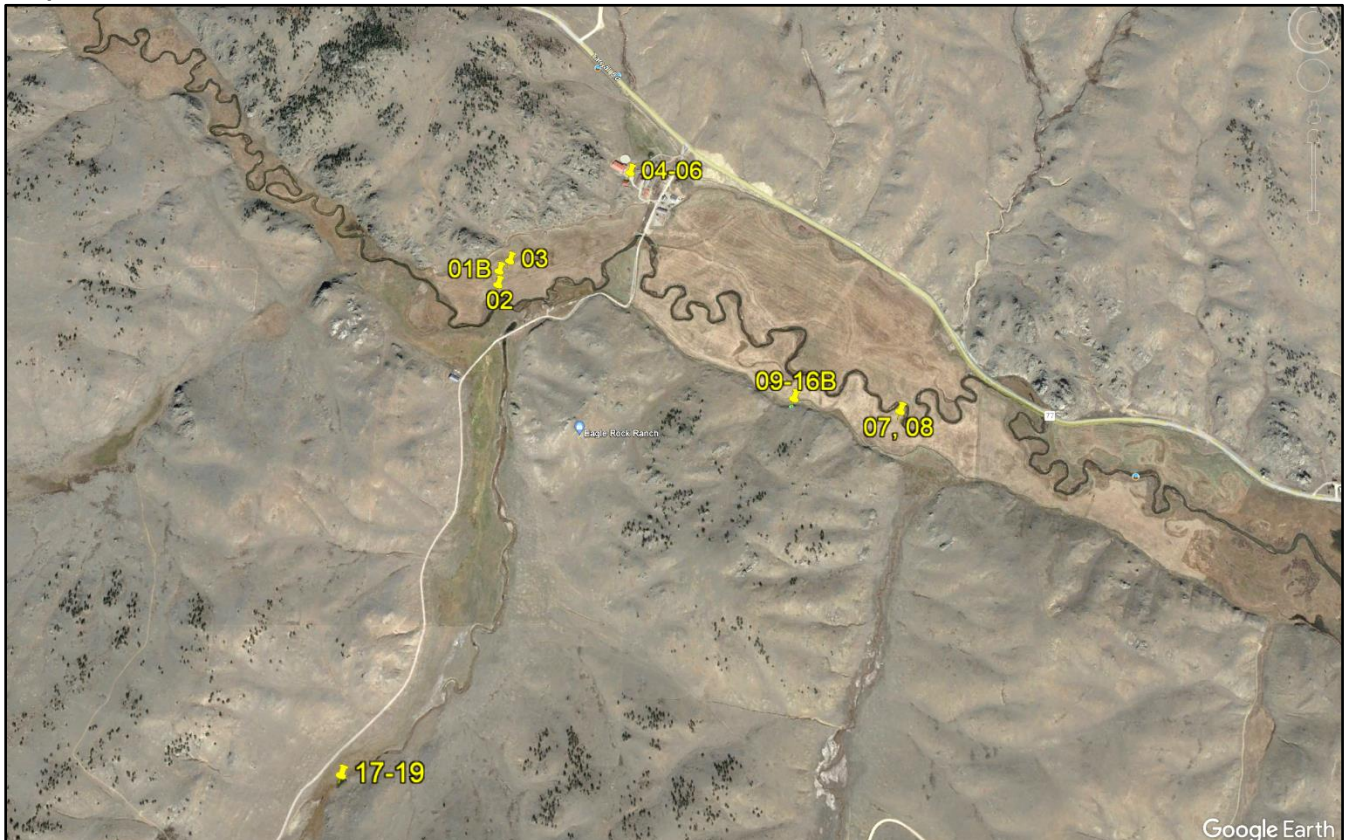
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APPENDIX Maps

Collection Track

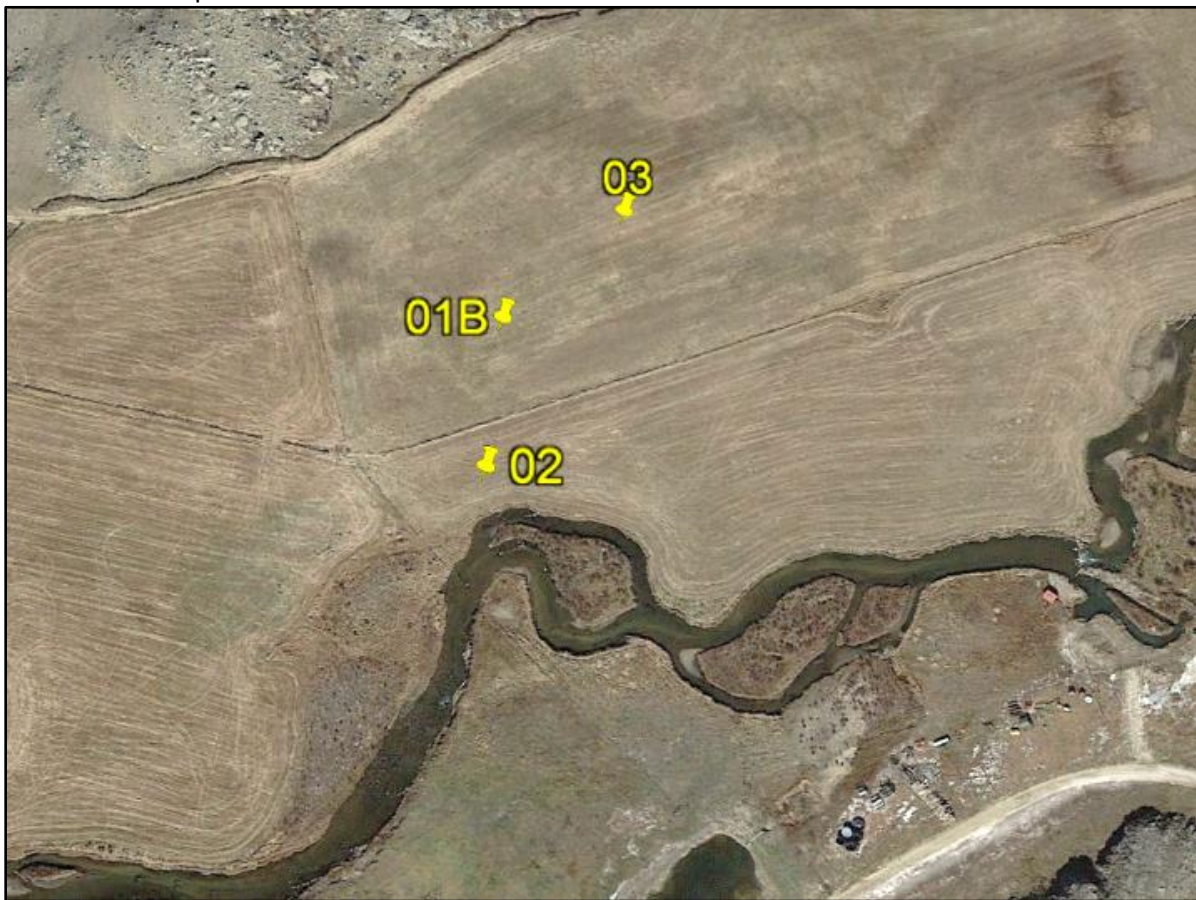


All Sample Locations



Irrigated Hay Meadow

Locations of collected samples 01B-03



East Hay Meadow

Locations of collected samples 07, 08



Irrigated Slope, north side of House
Locations of collected samples 04-06



Rocky Outcrop with North-facing Slope
Locations of collected samples 09-16B



Agricultural Ponds

Locations of collected samples 17-19



Collection number	Genus	Species	Authority	Family	Synonym or Other name	Collection Date	Time	ID date	Lab Bk. 2 page number	Number of previous occurrences in county
230608 Eagle Rock Ranch (ERR) for the Gottenborg Family and CNHP by Stacey Anderson; Collected June 6, 2023										
230608-01A	<i>Drepanocladis</i>	<i>aduncas</i>	(Hedw.) Warnst.	AMB		June 6, 2023	s.n.	2023-06-09	65	3; many occurrences in the State
230608-01B	<i>Drepanocladis</i>	<i>aduncas</i>	(Hedw.) Warnst.	AMB		June 6, 2023	8:48 & 8:53	2023-06-09	65	
230608-02	<i>Tortula</i>	<i>acaulon</i>	(Withering) R. H. Zander	AMB		June 6, 2023	9:18	2023-06-09	65, 67	New county record; many in State
230608-03	<i>Hygrohypnum</i>	<i>luridum</i>	(Hedw.) Jenn.	AMB		June 6, 2023	9:26	2023-06-24	67	2; many in State
230608-04	<i>Sanionia</i>	<i>uncinata</i>	(Hedwig) Loeske	AMB	<i>Pseudocalliergon angustifolium</i> Hedenäs	June 6, 2023	9:53	2024-02-09	107	3; many in State
230608-05	<i>Syntrichia</i>	<i>ruralis</i>	(Hedw.) F. Weber & D. Mohr	POT		June 6, 2023	9:59	2023-11-20	107	6 (1877 Mt. Lincoln by Mary Parry Haines) many in State
230608-06	<i>Ceratodon</i>	<i>purpureus</i>	(Hedw.) Brid.,	DTR		June 6, 2023	10:01	2023-10-16	69	8 (1873 John Wolf & J.T. Rothrock)
230608-07	<i>Ptychostomum</i>	<i>cyclophyllum</i>	(Schwägr.) J.R. Spence	BRY	<i>Mnium cyclophyllum</i> Schwägr	June 6, 2023	11:06	2023-06-10	66	New county record; 6 in State
230608-08	<i>Hygroamblystegium</i>	<i>varium</i> var. <i>varium</i>	(Hedw.) Mönk. var. <i>varium</i>	AMB	<i>Amblystegium riparium</i> (Hedw.) Schimp.	June 6, 2023	11:12	2024-02-10	66	1 (2012); many in State
230608-09	<i>Ceratodon</i>	<i>purpureus</i>	(Hedw.) Warnst.	DTR		June 6, 2023	11:58 (12:01)	2023-07-09	68	

Collection number	Genus	Species	Authority	Family	Synonym or Other name	Collection Date	Time	ID date	Lab Bk. 2 page number	Number of previous occurrences in county
230608-10	<i>Plagiomnium</i>	<i>cuspidatum</i>	(Hedw.) T.J. Kop.	MNI	<i>Orthomnion cuspidatum</i> (Hedw.) T.J. Kop. & Yu Sun	June 6, 2023	12:01	2023-07-10	68	New county record; many in State
230608-11	<i>Roaldia</i>	<i>revoluta</i>	(Mitt.) P.E.A.S. Câmara & Carv.-Silva	HYP	<i>Hypnum revolutum</i> (Mitt.) Lindb.	June 6, 2023	12:05	2023-11-20	65	13; many in State
230608-PO2	<i>Bryum</i>	<i>argenteum</i>	Hedw.	BRY		June 6, 2023	12:06	2023-06-08	1	2 (1910 & 1954); many in State
230608-PO1	<i>Syntrichia</i>	<i>ruralis</i>	(Hedw.) F. Weber & D. Mohr	POT		June 6, 2023	12:09	2023-06-09	2	
230608-12#1	<i>Plagiomnium</i>	<i>cuspidatum</i>	(Hedw.) T.J. Kop.	MNI		June 6, 2023	12:12	2023-11-20	67	
230608-12#2	<i>Roaldia</i>	<i>revoluta</i>	(Mitt.) P.E.A.S. Câmara & Carv.-Silva	HYP	<i>Hypnum revolutum</i> (Mitt.) Lindb.	June 6, 2023	12:12	2023-11-20	67	
230608-12#3	<i>Syntrichia</i>	<i>ruralis</i>	(Hedw.) F. Weber & D. Mohr	POT		June 6, 2023	12:12	2023-11-20	67	
230608-13	<i>Mnium</i>	<i>arizonicum</i>	J.J. Amann	MNI		June 6, 2023	12:13	2023-10-20	101	2 (1960 & 2009); many in State
230608-14	<i>Roaldia</i>	<i>revoluta</i>	(Mitt.) P.E.A.S. Câmara & Carv.-Silva	HYP	<i>Hypnum revolutum</i> (Mitt.) Lindb.	June 6, 2023	12:17	2023-10-24	101	
230608-15	<i>Encalypta</i>	<i>rhaptocarpa</i>	Schwägr	ENC		June 6, 2023	12:26-27	2023-06-10	66	2 (1967, 2007); many in State

Collection number	Genus	Species	Area Designation	Nearest Town	County	State	Country	Quad	General Location	Specific Location	General Habitat
230608 Eagle Rock Ranch (ERR) for the Gottenborg Family and CNHP											
230608-01A	<i>Drepanocladis</i>	<i>aduncas</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	Wet meadow north of Tarryall Creek	Emergent wetlands; Wet hay meadow, flooded condition
230608-01B	<i>Drepanocladis</i>	<i>aduncas</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	Center of wet meadow north of Tarryall Creek	Emergent wetlands; Wet hay meadow, flooded condition
230608-02	<i>Tortula</i>	<i>acaulon</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	Wet meadow, 100' north of Tarryall Creek	Emergent wetlands; Wet hay meadow, flooded condition
230608-03	<i>Hygrohypnum</i>	<i>luridum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	Wet meadow, 400' north of Tarryall Creek	Emergent wetlands; Wet hay meadow, flooded condition
230608-04	<i>Sanionia</i>	<i>uncinata</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	North side of house	North slope next to house
230608-05	<i>Syntrichia</i>	<i>ruralis</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	North side of house	North slope next to house
230608-06	<i>Ceratodon</i>	<i>purpureus</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	North side of house	North slope next to house
230608-07	<i>Ptychostomum</i>	<i>cyclophyllum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	800' east of Tarryall Reservoir SWA west boundry, 100' west of Tarryall Creek	Emergent wetlands; Hay meadow, east; saturated to wet soils
230608-08	<i>Hygroamblystegium</i>	<i>varium var. varium</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	800' east of Tarryall Reservoir SWA west boundry, 100' west of Tarryall Creek	Emergent wetlands; Hay meadow, east; saturated to wet soils
230608-09	<i>Ceratodon</i>	<i>purpureus</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope

Collection number	Genus	Species	Area Designation	Nearest Town	County	State	Country	Quad	General Location	Specific Location	General Habitat
230608-10	<i>Plagiomnium</i>	<i>cuspidatum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-11	<i>Roaldia</i>	<i>revoluta</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-PO2	<i>Bryum</i>	<i>argenteum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-PO1	<i>Syntrichia</i>	<i>ruralis</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-12#1	<i>Plagiomnium</i>	<i>cuspidatum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-12#2	<i>Roaldia</i>	<i>revoluta</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-12#3	<i>Syntrichia</i>	<i>ruralis</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-13	<i>Mnium</i>	<i>arizonicum</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek and at base of cliff	Rocky outcrop with north-facing slope
230608-14	<i>Roaldia</i>	<i>revoluta</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek on steep, rocky slope	Rocky outcrop with north-facing slope
230608-15	<i>Encalypta</i>	<i>rhaptocarpa</i>	Eagle Rock Ranch	Jefferson	Park	CO	United States	Eagle Rock	Eagle Rock Ranch, 14709 CoRd 77, Jefferson, CO 80827	450' south of Tarryall Creek on steep, rocky slope	Rocky outcrop with north-facing slope

Collection number	Genus	Species	GPS (N or E)	GPS (W or N)	Geodetic system	Elevation	Micro habitat-specific loc, light, water	Substrate	Collector 0009-0009-0226-410X	Associate Collectors
230608 Eagle Rock Ranch (ERR) for the Gottenborg Family and CNHP										
230608-01A	<i>Drepanocladis</i>	<i>aduncas</i>	s.n.	s.n.	WGS84	8900	Wet hay-meadow at base of grasses	on soil	David Gottenborg	Stacey Anderson, Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-01B	<i>Drepanocladis</i>	<i>aduncas</i>	39°14'29.1683" N	105°38'46.6967" W	WGS84	8900	Wet hay-meadow at base of grasses	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-02	<i>Tortula</i>	<i>acaulon</i>	39°14'27.6341" N	105°38'46.782" W	WGS84	8500'	Wet hay-meadow at base of grasses	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-03	<i>Hygrohypnum</i>	<i>luridum</i>	39°14'30.3543" N	105°38'45.3145" W	WGS84	8500'	Wet hay-meadow at base of grasses	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-04	<i>Sanionia</i>	<i>uncinata</i>	39°14'40.3848" N	105°38'29.0605" W	WGS84	9000'	Irrigated slope beneath Ponderosa Pine	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-05	<i>Syntrichia</i>	<i>ruralis</i>	39°14'40.3848" N	105°38'29.0605" W	WGS84	9000'	Irrigated slope beneath Ponderosa Pine	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-06	<i>Ceratodon</i>	<i>purpureus</i>	39°14'40.3848" N	105°38'29.0605" W	WGS85	9000'	Irrigated slope beneath Ponderosa Pine	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-07	<i>Ptychostomum</i>	<i>cyclophyllum</i>	39°14'13.8585" N	105°37'53.3991" W	WGS84	8840'	At base of wet pasture grasses	on wet, organic soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-08	<i>Hygroamblystegium</i>	<i>varium var. varium</i>	39°14'13.8585" N	105°37'53.3991" W	WGS84	8840'	At base of wet pasture grasses	on wet, organic soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-09	<i>Ceratodon</i>	<i>purpureus</i>	39°14'15.1628" N	105°38'7.2914" W	WGS84	8840'	In crack of sloped boulders	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave

Collection number	Genus	Species	GPS (N or E)	GPS (W or N)	Geodetic system	Elevation	Micro habitat-specific loc, light, water	Substrate	Collector 0009-0009-0226-410X	Associate Collectors
230608-10	<i>Plagiomnium</i>	<i>cuspidatum</i>	39°14'15.1868" N	105°38'7.2849" W	WGS84	8840'	At base of sloped boulders with forbes	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-11	<i>Roaldia</i>	<i>revoluta</i>	39°14'15.1569" N	105°38'7.223" W	WGS84	8840'	Beneath underhang of boulder outcrop	on rock	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-PO2	<i>Bryum</i>	<i>argenteum</i>	39°14'15.0824" N	105°38'7.2094" W	WGS84	8894'	with other mosses	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-PO1	<i>Syntrichia</i>	<i>ruralis</i>	39°14'14.984" N	105°38'7.2451" W	WGS84	8894'	Soil over rocks with other mosses	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-12#1	<i>Plagiomnium</i>	<i>cuspidatum</i>	39°14'15.2595" N	105°38'7.3604" W	WGS84	8840'	Base of a rock with grasses with <i>Roaldia</i> and <i>Syntrichia</i>	on moist soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-12#2	<i>Roaldia</i>	<i>revoluta</i>	39°14'15.2595" N	105°38'7.3604" W	WGS84	8840'	Base of a rock with grasses with <i>Plagiomnium</i> and <i>Syntrichia</i>	on moist soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-12#3	<i>Syntrichia</i>	<i>ruralis</i>	39°14'15.2595" N	105°38'7.3604" W	WGS84	8840'	Base of a rock with grasses with <i>Roaldia</i> and <i>Plagiomnium</i>	on moist soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-13	<i>Mnium</i>	<i>arizonicum</i>	39°14'15.2595" N	105°38'7.3604" W	WGS84	8840'	Under rock outcrop	on moist soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-14	<i>Roaldia</i>	<i>revoluta</i>	39°14'15.3084" N	105°38'7.5221" W	WGS84	8840'	Beneath shrube with grasses growing on slope	on soil	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave
230608-15	<i>Encalypta</i>	<i>rhaptocarpa</i>	39°14'15.0785" N	105°38'7.7445" W	WGS84	8840'	North-west facing rocky slope	on soil over rock	Stacey Anderson 0009-0009-0226-410X	Jessica Smith, Elias Castaneda, River Blessing, Grant Musgrave

Collection number	Genus	Species	Det. By	Confirmed By	Confirm Date	Number of Photos	Photo Folder Name	Location Photographer	Lab Photographer
230608 Eagle Rock Ranch (ERR) for the Gottenborg Family and CNHP									
230608-01A	<i>Drepanocladis</i>	<i>aduncas</i>	Stacey Anderson				230608 ERR	Stacey Anderson	Stacey Anderson
230608-01B	<i>Drepanocladis</i>	<i>aduncas</i>	Stacey Anderson			36	230608 ERR	Stacey Anderson	Stacey Anderson
230608-02	<i>Tortula</i>	<i>acaulon</i>	Stacey Anderson	John Brinda	6/24/23	56	230608 ERR	Stacey Anderson	Stacey Anderson
230608-03	<i>Hygrohypnum</i>	<i>luridum</i>	Stacey Anderson	John Brinda	6/24/23	40	230608 ERR	Stacey Anderson	Stacey Anderson
230608-04	<i>Sanionia</i>	<i>uncinata</i>	Stacey Anderson			8	230608 ERR	Stacey Anderson	Stacey Anderson
230608-05	<i>Syntrichia</i>	<i>ruralis</i>	Stacey Anderson			13	230608 ERR	Stacey Anderson	Stacey Anderson
230608-06	<i>Ceratodon</i>	<i>purpureus</i>	Stacey Anderson			54	230608 ERR	Stacey Anderson	Stacey Anderson
230608-07	<i>Ptychostomum</i>	<i>cyclophyllum</i>	Stacey Anderson			34	230608 ERR	Stacey Anderson	Stacey Anderson
230608-08	<i>Hygroamblystegium</i>	<i>varium var. varium</i>	Stacey Anderson			18	230608 ERR	Stacey Anderson	Stacey Anderson
230608-09	<i>Ceratodon</i>	<i>purpureus</i>	Stacey Anderson			6	230608 ERR	Stacey Anderson	Stacey Anderson

Collection number	Genus	Species	Det. By	Confirmed By	Confirm Date	Number of Photos	Photo Folder Name	Location Photographer	Lab Photographer
230608-10	<i>Plagiomnium</i>	<i>cuspidatum</i>	Stacey Anderson			15	230608 ERR	Stacey Anderson	Stacey Anderson
230608-11	<i>Roaldia</i>	<i>revoluta</i>	Stacey Anderson			15	230608 ERR	Stacey Anderson	Stacey Anderson
230608-PO2	<i>Bryum</i>	<i>argenteum</i>	Stacey Anderson			2	230608 ERR	Stacey Anderson	Stacey Anderson
230608-PO1	<i>Syntrichia</i>	<i>ruralis</i>	Stacey Anderson			3	230608 ERR	Stacey Anderson	Stacey Anderson
230608-12#1	<i>Plagiomnium</i>	<i>cuspidatum</i>	Stacey Anderson			9	230608 ERR	Stacey Anderson	Stacey Anderson
230608-12#2	<i>Roaldia</i>	<i>revoluta</i>	Stacey Anderson			1	230608 ERR	Stacey Anderson	Stacey Anderson
230608-12#3	<i>Syntrichia</i>	<i>ruralis</i>	Stacey Anderson			9	230608 ERR	Stacey Anderson	Stacey Anderson
230608-13	<i>Mnium</i>	<i>arizonicum</i>	Stacey Anderson			60	230608 ERR	Stacey Anderson	Stacey Anderson
230608-14	<i>Roaldia</i>	<i>revoluta</i>	Stacey Anderson			14	230608 ERR	Stacey Anderson	Stacey Anderson
230608-15	<i>Encalypta</i>	<i>rhaptocarpa</i>	Stacey Anderson			11	230608 ERR	Stacey Anderson	Stacey Anderson

