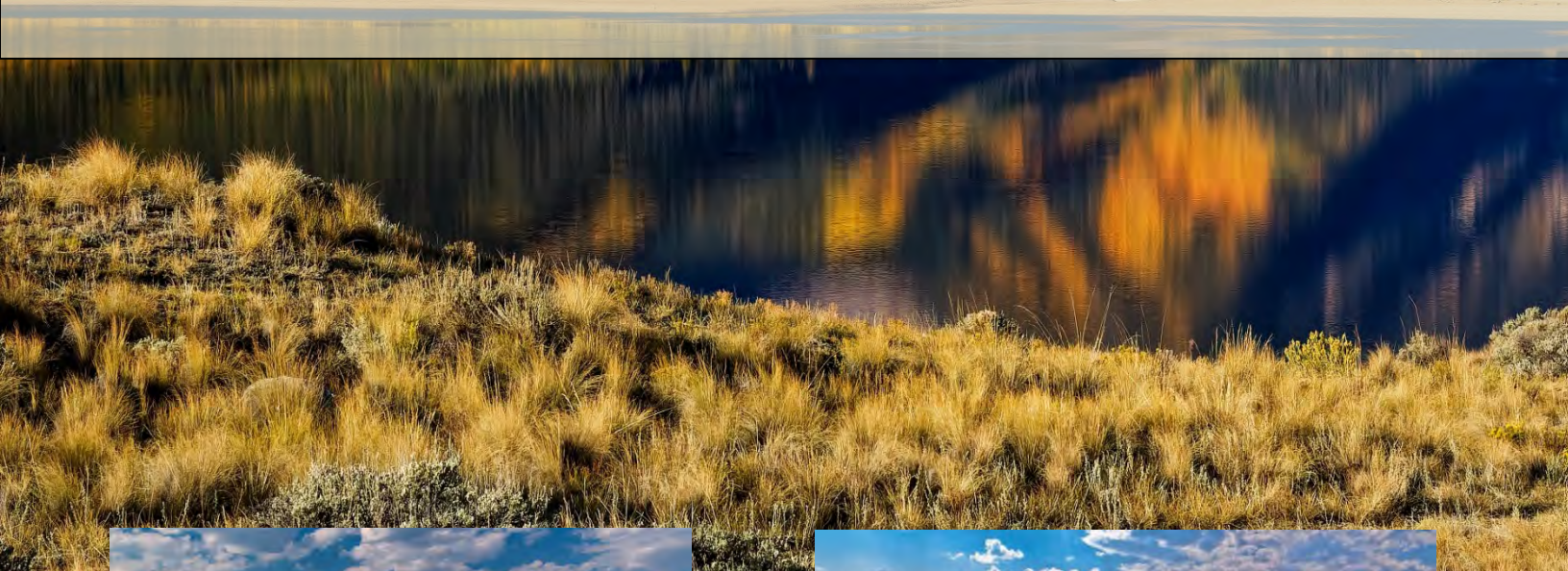


# Survey of Critical Biological Resources in Lake County, CO



**April 2019**



*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**

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# Survey of Critical Biological Resources in Lake County, CO

Denise Culver and Pam Smith

Colorado Natural Heritage Program  
Warner College of Natural Resources

Colorado State University  
Fort Collins, Colorado 80523



April 2019





# EXECUTIVE SUMMARY

In September 2015, the Lake County Commissioners unanimously approved the Colorado Natural Heritage Program's (CNHP) project, ***Survey for Critical Biological Resources in Lake County***. Funding was provided by the U.S. Environmental Protection Agency, Region 8 Wetland Program Development Grant, with matching funds from Colorado Department of Transportation and Colorado State University. In 2017, CNHP was awarded a Great Outdoors Colorado (GOCO) Conservation Excellence Grant to leverage and compliment the wetland project, with matching in-kind funds from Lake County, Central Colorado Conservancy, U.S. Forest Service, Colorado Mountain College, and Lake County Open Space Initiative. The main goal for both projects was to provide a scientific data resource for land managers, county planners, and the citizens of Lake County for conducting proactive landscape planning to preserve the natural biodiversity of significant habitats that support rare, imperiled and/or sensitive plants and animals.

The Lake County Comprehensive Plan (1998) identified a need to recognize sensitive biological elements to inform its overall strategy for conservation of economically important natural resources. Additionally, the plan prioritized the preservation of quality of life for future residents as well as efficient land use planning to identify and protect areas of high value for conservation of biodiversity, habitat, carbon sequestration, and open space. Lake County has been a model for the rest of Colorado due to the unique partnerships formed to address the historic impacts associated with mining and water development projects. Like many areas of Colorado, Lake County is increasingly subjected to intense land and water development pressures and struggles with issues regarding loss of biodiversity, wildlife habitat, impacts to water quality and supply.

The results from this project are critical for decision makers to move forward with an improved understanding of Lake County's opportunities for conservation of its biological resources. Land managers and owners now have accurate data to inform the protection and restoration of natural habitats and to develop adaptation strategies for climate change. As central Colorado faces a changing climate and an increasing demand for its resources from a growing population, it is vital to have a clear and methodical understanding of the location and quality of natural resources to aid long-term protection and stewardship of the county's natural resources.

## Summary of Findings

- ✓ First known extreme rich fen west of the Mosquito Range documented,
- ✓ Three additional rich fen complexes documented,
- ✓ Lake County has a total of 22,292 wetland acres or 9.07% of total land acres, triple the percent of wetlands for the state (<3%) as a whole,
- ✓ Forty-two (42) **new** Lake County plant records and one **new** occurrence of the boreal toad,
- ✓ Fifty (50) rare or imperiled species and 23 plant communities of concern were documented,
- ✓ Forty-one (41) new and 37 known occurrences of animal and plant species documented or updated,

- ✓ Lake County, with only 0.5% of the State land area-contains 40% of the plant species known from the State,
- ✓ Lake County supports 17 plant species known only from Colorado or surrounding region,
- ✓ Twenty-four (24) Potential Conservation Areas in Lake County developed or updated;
  - One (1) is of outstanding biodiversity (B1);
  - Seven (7) are of very high significance (B2),
  - Twelve (12) are of high significance (B3), and
  - Four (4) are of moderate biodiversity (B4).

The Potential Conservation Areas represent the best examples of plant and animal species, plant communities, and their ecological processes observed during the 2017 and 2018 field seasons. Lake County is truly unique with an amazing richness of fauna and flora well worth preserving for future generations. The diversity of species and plant communities, ranging from alpine tundra to montane grassland, substantiate the county's importance to the biodiversity of Colorado and the world; the concentration and quality of imperiled species and habitats attest to the fact that conservation efforts in Lake County will have both statewide and global significance. The final report and PCAs will be provided to the stakeholders, partners, local libraries, and available to the public on the CNHP website ([www.cnhp.colostate.edu](http://www.cnhp.colostate.edu)).



## ACKNOWLEDGEMENTS

The authors would like to acknowledge the U.S. Environmental Protection Agency (EPA) Region 8 and Great Outdoors Colorado for their financial support and encouragement of this project. Special recognition goes to EPA Project Officers Penney Trujillo, Billy Bunch, and Licia Maclear and Grant Specialists Ryan Kloberdanz, as well as Great Outdoors Colorado staff; Michelle Frishman, Open Space Program Manager and Matt Brady, Grants Officer. Matching funds were provided by: Colorado Department of Transportation (CDOT), Colorado Parks and Wildlife (CPW), Central Colorado Conservancy (CCC), Colorado Mountain College (CMC), USFS Pike-San Isabel (USFS), Lake County Open Space Initiative (LCOSI), Lake County, and Colorado State University (CSU).

We would also like to thank the following people who were instrumental in the success of this project: Mike Conlin (LCOSI), Andrew Mackie and Buffy Lenth (CCC), Dave Gilbert (BLM), Jeni Windowski (USFS), and Katy Warner (CMC).

We extend much gratitude to CNHP staff: Joanna Lemly, Sarah Marshall, Amy Greenwell, Gabrielle Smith, Michael Menefee, Jill Handwerk, Georgia Doyle, Brad Lambert, John Sovell, Jeremy Siemers, Sierra Crumbaker, and work studies Illana Vargas and Renee Lile.

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# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	I
ACKNOWLEDGEMENTS .....	III
TABLE OF CONTENTS.....	V
LIST OF FIGURES.....	VIII
LIST OF TABLES .....	IX
LIST OF MAPS.....	IX
1.0 INTRODUCTION.....	1
1.1 PROJECT OVERVIEW.....	1
2.0 PROJECT BACKGROUND .....	4
2.1 HISTORY OF LAKE COUNTY (ADAPTED FROM LAKE COUNTY COMPREHENSIVE PLAN 1998) .....	4
2.2 PHYSIOGRAPHY AND ECOREGIONS .....	5
2.3 HYDROLOGY .....	6
2.4 GEOLOGY (ADAPTED FROM KARNUTA 1995 AND CHRONIC AND WILLIAMS 2002) .....	9
2.5 SOILS .....	11
2.6 CLIMATE .....	11
2.7 POPULATION .....	13
2.8 LAND OWNERSHIP .....	13
2.9 LAND USE (ADAPTED FROM LAKE COUNTY COMPREHENSIVE PLAN 1988).....	14
2.10 ECOREGIONS .....	15
2.11 ECOLOGICAL SYSTEMS .....	18
2.11a. Rocky Mountain Lodgepole Pine Forest.....	20
2.11b. Rocky Mountain Subalpine Mesic Meadow .....	20
2.11c. Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland.....	21
2.11d. Southern Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland .....	21
2.11e. Rocky Mountain Alpine Turf.....	22
2.11f. Southern Rocky Mountain Montane Grassland.....	23
2.11g. Rocky Mountain Alpine Dwarf – Shrubland .....	23
2.11h. Rocky Mountain Alpine Bedrock and Scree.....	24
2.11i. Rocky Mountain Subalpine-Montane Riparian Woodland and Shrubland .....	24
2.11j. Rocky Mountain Cliff, Canyon and Massive Bedrock .....	25
2.11k. Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland .....	26
2.11l. Rocky Mountain Aspen Forest and Woodland .....	26
2.2 FLORA .....	27
2.2a. Non-native Plant Species.....	29
2.3 FAUNA .....	30
3.0 WETLANDS OF LAKE COUNTY.....	36
3.1 WETLAND DEFINITIONS .....	36
3.2 WETLAND PLANTS .....	36

3.3 WETLAND TYPES IN LAKE COUNTY (ADAPTED FROM CULVER AND LEMLY 2013)	37
3.3a Marshes	37
3.3b Riparian Wetlands	38
3.3c Wet Meadows	38
3.3d Fens	39
3.4 WETLAND SOILS	40
3.5 WETLAND ECOLOGICAL FUNCTIONS AND SERVICES	41
3.5a Wetland Condition Assessment	41
3.6 WETLAND MAPPING IN COLORADO	42
3.6a National Wetland Inventory Maps	42
3.7 WETLAND RESTORATION	42
3.8 WETLAND REGULATION IN COLORADO	43
<b>4.0 POTENTIAL IMPACTS TO BIOLOGICAL DIVERSITY IN LAKE COUNTY</b>	<b>44</b>
4.0a Climate Change	44
4.0b Drought	44
4.0c Hydrological Impacts (adapted from Winchester 2001)	45
4.0d Mining Impacts	48
4.0e Livestock Grazing	48
4.0f Recreation	49
<b>5.0 METHODS</b>	<b>50</b>
5.1 SURVEY METHODS	50
5.1a Collect Available Information	50
5.1b Identify rare or imperiled species and significant plant associations with potential to occur in Lake County	50
5.1c Identify Targeted Inventory Areas	50
5.1d Contact Landowners	51
5.1e Conduct Field Site Surveys and Gather Data	51
5.1f Natural Heritage Methodology	52
5.1g Fen Mapping	59
<b>6.0 RESULTS</b>	<b>61</b>
6.1 FLORISTIC RESULTS	66
6.1a Globally Rare Plant Species (G1-G2)	66
6.1b Endemic Species - Flora	73
6.2 FAUNA RESULTS	77
6.3 FEN MAPPING RESULTS	82
6.4 NATIONAL WETLAND MAPPING SUMMARY	86
6.5 POTENTIAL CONSERVATION AREAS	89
<b>7.0 DISCUSSION</b>	<b>93</b>
7.1 CONSERVATION RECOMMENDATIONS	95
<b>8.0 SITES OF BIODIVERSITY SIGNIFICANCE</b>	<b>98</b>



<b>B1 Outstanding Biodiversity</b>	
Mosquito Pass PCA .....	100
<b>B2 Very High Biodiversity</b>	
Hayden Fen PCA.....	113
Homestake Peak Fen Complex PCA .....	118
Mount Elbert PCA .....	121
North Fork Lake Creek PCA .....	124
Sawatch Range Fen Complex PCA.....	127
Twining Peak PCA.....	131
Upper Lake Fork Fen Complex PCA.....	135
<b>B3 High Biodiversity</b>	
Arkansas River between Hayden and Balltown PCA.....	139
Big Union Creek PCA .....	143
Buckeye Gulch PCA .....	146
Corske Creek PCA.....	149
East Fork Arkansas River PCA.....	152
Empire Gulch PCA .....	156
Longs Gulch PCA.....	160
Lower Lake Fork PCA.....	162
Mount Massive PCA .....	166
Mountain Boy Park PCA .....	169
Tennessee Creek at East Fork Arkansas River PCA .....	172
Twin Lakes PCA .....	176
<b>B4 Moderate Biodiversity</b>	
Birdseye Gulch PCA.....	180
Dyer Amphitheatre at Iowa Gulch PCA.....	183
Halfmoon Creek PCA.....	187
Upper Chalk Creek PCA.....	191
<b>9.0 REFERENCES .....</b>	<b>194</b>

# LIST OF FIGURES

Figure 1. Location of Lake County, CO. ....	1
Figure 2. Status map for CNHP Survey of Biological Resources (as of 12/2018). ....	2
Figure 4. Lake County’s Mining Districts (CGS 2018). ....	4
Figure 3. Original Colorado counties established 1861 (Stanwyck 2003). ....	4
Figure 5. Lake County Location within Colorado’s Ecoregions. ....	5
Figure 6. Physiography of Lake County. ....	6
Figure 7. Hydrology of Lake County. ....	7
Figure 8. Location of the Upper Arkansas River Aquifer Lake County. ....	8
Figure 9. Leadville Limestone aquifer location in central Colorado and Lake County (Hearne et al. 1986). ....	8
Figure 10. Simplified Geology of Lake County. ....	9
Figure 11. Extent of Glaciers in Lake County. ....	10
Figure 12. Turquoise Lake. ....	10
Figure 13. Soils of Lake County (USDA NRCS 2008). ....	11
Figure 14. Average for temperature and precipitation for Leadville 1981-2010 (WRCC 2018). ....	12
Figure 15. Annual Average Precipitation for Lake County. ....	12
Figure 16. Forty year average for snowfall for Leadville 1976-2016 (WRCC 2018). ....	13
Figure 17. Land Ownership in Lake County. ....	14
Figure 18. Omernik Level 4 Ecoregions in Lake County. ....	17
Figure 19. Major Ecological Systems in Lake County. ....	19
Figure 20. Distribution of Leadville milkvetch ( <i>Astragalus molybdenus</i> ) in Colorado. ....	28
Figure 21. Wetland Focus Area Prioritized Restoration Projects. ....	43
Figure 22. Ditches and Wells with Water Diversion Tunnels. ....	46
Figure 23. Target Inventory Areas Results. ....	61
Figure 24. Distribution of Brown-capped Rosy Finch. ....	78
Figure 25. Locations of CNHP Boreal Toad Surveys in Lake County 2017-2018. ....	81
Figure 26. Fen mapping results for Lake County. ....	83
Figure 27. Example of Fen Mapping at Timberline Lake displayed on true color digital photos. ....	84
Figure 28. Example of Fen Mapping at Timberline Lake displayed on USGS 7.5’ topographic map. ....	85
Figure 29. NWI Mapping Results for Lake County. ....	87
Figure 30. Example of NWI mapping Tennessee Park. ....	88
Figure 31. Fen Complexes in Lake County. ....	93
Figure 32. Likely boundaries for extreme rich fen before anglo settlement. ....	94

## LIST OF TABLES

Table 1. Descriptions of Level 4 Ecoregions within Lake County.....	15
Table 2. Ecological Systems of Lake County (Comer et al. 2003).....	18
Table 3. List B noxious weeds documented in Lake County (CWMA 2018). ....	29
Table 4. Major Storage Projects within Lake County.....	45
Table 5. Definition of Natural Heritage Imperilment Ranks. ....	53
Table 6. Federal and State Agency Special Designations for Rare Species.....	54
Table 7. Element Occurrence Ranks and their Definitions. ....	56
Table 8. Natural Heritage Program Biological Diversity Ranks and their Definitions. ....	57
Table 9. Natural Heritage Program Protection Urgency Ranks and their Definitions ....	58
Table 10. Natural Heritage Program Management Urgency Ranks and their Definitions.....	59
Table 11. Description of potential fen confidence levels. ....	60
Table 12. List of Significant Animal and Plant Species and Plant Communities for Lake County. ....	62
Table 13. List of Plant Species Endemic to the State of Colorado or the Region, Lake County, CO. ....	75
Table 14. Species historically known from Lake County.....	75
Table 15. County Plant Species List of County Records for the CNHP 2017-2018 Survey*.....	76
Table 16. Fen Mapping Results. ....	82
Table 17. National Wetland Mapping Compilation and Results.....	86
Table 18. Potential Conservation Areas.....	89

## LIST OF MAPS

Map 1 Potential Conservation Areas in Lake County before 2017 Survey .....	90
Map 2 Potential Conservation Areas in Lake County .....	91
Map 3 Mosquito Pass PCA .....	112
Map 4 Hayden Fen PCA.....	117
Map 5 Homestake Peak Fen Complex PCA.....	120
Map 6 Mount Elbert PCA .....	123
Map 7 North Fork Lake Creek PCA.....	126
Map 8 Sawatch Range Fen Complex PCA .....	130
Map 9 Twining Peak PCA .....	134
Map 10 Upper Lake Fork Fen Complex PCA.....	138
Map 11 Arkansas River between Hayden and Balltown PCA .....	142
Map 12 Big Union Creek PCA.....	145
Map 13 Buckeye Gulch PCA.....	148
Map 14 Corske Creek PCA.....	151
Map 15 East Fork Arkansas River PCA .....	155
Map 16 Empire Gulch PCA.....	158
Map 17 Longs Gulch PCA .....	161



Map 18 Lower Lake Fork PCA .....	165
Map 19 Mount Massive PCA.....	168
Map 20 Mountain Boy Park PCA.....	171
Map 21 Tennessee Creek at East Fork Arkansas River PCA.....	175
Map 22 Twin Lakes PCA .....	179
Map 23 Birdseye Gulch PCA.....	182
Map 23 Dyer Amphitheatre at Iowa Gulch PCA.....	186
Map 25 Halfmoon Creek PCA.....	190
Map 26 Upper Chalk Creek PCA.....	193

# 1.0 INTRODUCTION

## 1.1 Project Overview

Lake County is located in the Upper Arkansas River Valley in central Colorado (Figure 1). It is the fourth smallest county by area in the state. Nonetheless, Lake County, has many distinctive claims:

- ✓ Highest point in Colorado and the Rocky Mountains;
- ✓ One of the oldest and highest incorporated cities in the United States;
- ✓ Second longest tributary in the Mississippi River Headwaters and the sixth longest river in United States, and most importantly,
- ✓ Highest elevation golf course in the U.S. at 10,152 feet!

Lake County is a popular destination for fishing, hiking (especially summiting fourteen peaks), hunting, backpacking, boating, and wildlife viewing. Contiguous habitats, especially wetland and riparian areas, span the diverse elevation zones, providing essential water, habitat, and food sources for wildlife, birds, and plants, not to mention the incredible benefits for the people of the county. Proactive and informed land planning decisions are necessary to preserve these unique natural resources, as well as the rural and agricultural characteristics of Lake County. It is necessary to retain the intrinsic values of the landscape which provide economic assets and environmental qualities for both county residents and visitors. The Colorado Natural Heritage Program (CNHP) approached this project with the intent of addressing this need. CNHP is a research unit within the Warner College of Natural Resources at Colorado State University. CNHP is a multi-disciplinary team of scientists, information managers, and conservation planners that gathers and analyzes comprehensive information on rare, threatened, and endangered species and significant plant communities of Colorado. CNHP is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. CNHP is a member of NatureServe, an international network of conservation data centers that use the Biological and Conservation Data System developed by The Nature Conservancy. There are 85 conservation data centers, including one in each state. Information collected by the Heritage Programs throughout the globe provides a means to protect species before the need for legal endangerment status arises. Methods used to conduct the *Survey of Critical Biological Resources in Lake County* were those employed worldwide throughout Natural Heritage Programs and

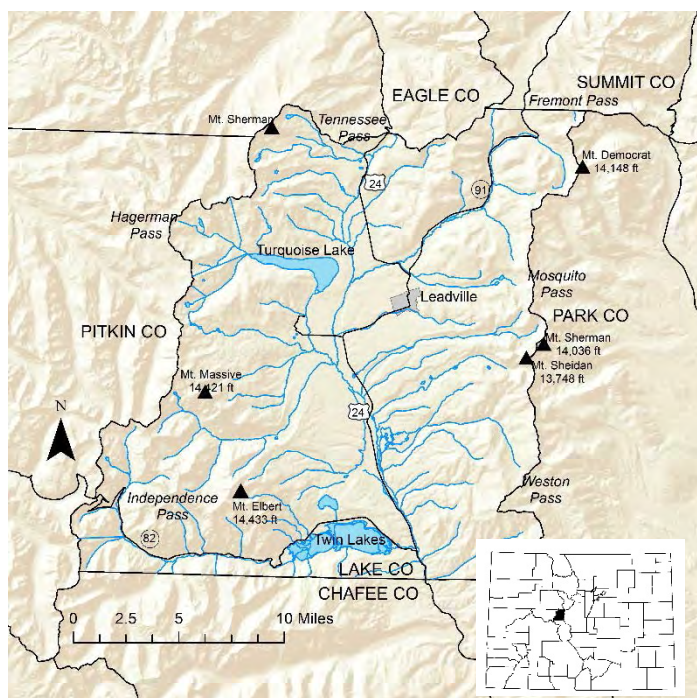
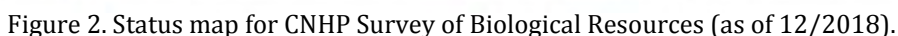


Figure 1. Location of Lake County, CO.

The *Survey of Critical Biological Resources in Lake County* is part of the ongoing biological surveys of Colorado counties conducted by CNHP since 1992. To date, similar surveys have been conducted in all or parts of 40 Colorado counties (Figure 2). Identification of sites containing natural heritage resources will allow conservation of these resources for future generations, enabling proactive planning to avoid land use conflicts in the future.



1. Examining existing biological data for rare or imperiled plant and animal species and significant plant communities (collectively called elements);
2. Accumulating additional existing information (e.g., interviews of local experts); and
3. Conducting extensive field surveys.

Colorado Natural Heritage Program 2019



topographic, geomorphic, and hydrologic features, vegetative cover, and current and potential land uses to delineate PCA boundaries.

***PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of all activity.*** It is hypothesized that some activities will prove degrading to the element(s) or the ecological processes on which they depend, while others will not. These PCA boundaries represent the best professional estimate of the primary area supporting the long-term survival of the targeted species or plant communities and are presented for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that planned activities are compatible with protection of natural heritage resources and sensitive species. Please note that these boundaries are based primarily on CNHP's understanding of the ecological systems. A thorough analysis of the human context and potential stresses was not conducted. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning to achieve sustainability.

CNHP uses the Heritage Ranking Methodology (see Method Section for details) to prioritize conservation actions by identifying those areas that have the greatest chance of conservation success for the most imperiled elements. Sites are prioritized according to their biodiversity significance rank, or "B-rank," which ranges from B1 (outstanding significance) to B5 (general or statewide significance). Biodiversity ranks are based on the conservation (imperilment or rarity) ranks for each element and the element occurrence ranks (viability rank) for that particular location. Therefore, the highest quality occurrences (those with the greatest likelihood of long-term survival) of the most imperiled elements are the highest priority (receive the highest B-rank). The B1-B3 sites are the highest priorities for conservation actions. Based on current knowledge, the sites in this report represent areas that CNHP recommends for protection in order to preserve the natural heritage of Lake County.



## 2.0 PROJECT BACKGROUND

### 2.1 History of Lake County (adapted from Lake County Comprehensive Plan 1998)

Lake County was one of the original 17 counties created by the Colorado legislature on November 1, 1861. It contained a large portion of western Colorado to the south and west of its present boundaries (Figure 3). It was named Carbonate County for only two days in 1879, then renamed Lake County for Twin Lakes.

The Ute Indian tribe periodically hunted and fished in what is now Lake County. During the first half of the 19<sup>th</sup> century trappers, and explorers, including John Fremont and James Purcell, explored the upper reaches of the Arkansas

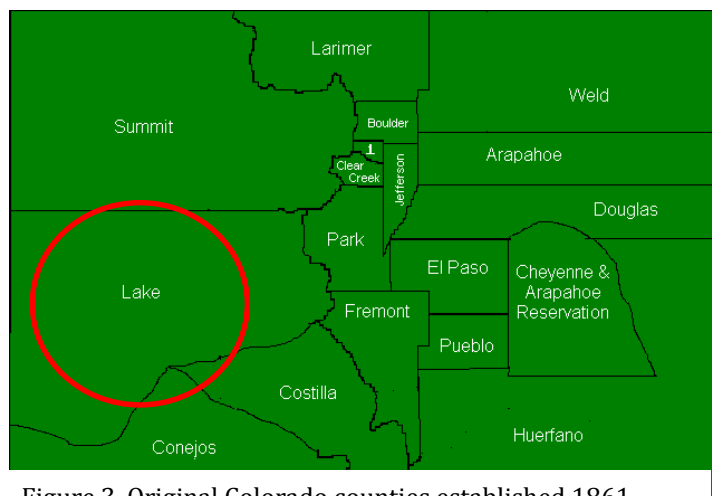


Figure 3. Original Colorado counties established 1861 (Stanwyck 2003).

Valley. In April 1860, prospectors found gold in California Gulch. Oro City, a mining district was

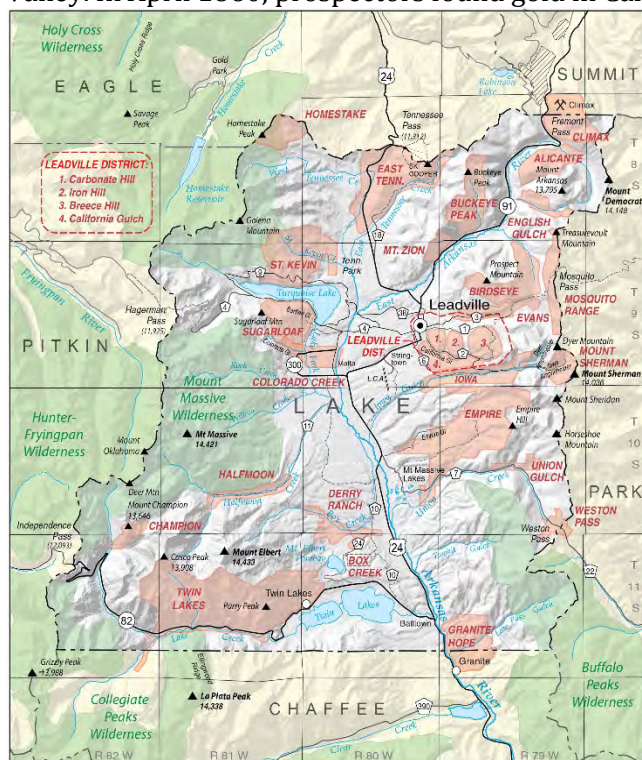


Figure 4. Lake County's Mining Districts (CGS 2018).

organized and claims staked and by the May the population within the area rose to 1,000. By June, the populations rose to 4,000 and by July to 8,000 inhabitants. By 1865, approximately \$4,000,000 of placer gold had been extracted. The placer gold eventually played out and by 1870 Oro City's population declined to less than 100 persons. Historically, Lake County had 12 mining districts (Figure 4). The Leadville District consisted of Carbonate Hill, Iron Hill, Breece Hill, and California Gulch. Other nearby gulches were intensely prospected for placer gold, but these had been scoured by Pleistocene glaciation that removed the gold placers; only California Gulch had significant quantities of alluvial gold (Thompson and Arehart, 1990). However, within the heavy sands, previously uncovered in the course of placer mining, was a lead carbonate mixture, rich in silver, and so began in 1876 a mining boom for lead and silver. By

1880, when the boom peaked, Leadville's population was 24,000, making it the second largest community in Colorado (first was Central City area). Silver assays yielded wealth to create one of the first "modern" communities in the west served by several railroad routes over Tennessee and Fremont passes and four wagon roads over Mosquito, Hagerman, Weston, and Independence passes.

The Twin Lakes area, known for its scenic beauty, was developed as a summer resort in the 1860s and 1870s. One of the most famous resorts at Twin Lakes on the south shore, was the Lakeside Hotel, built in 1879, later renamed Inter-Laken. The resort became a popular summer retreat for those that rode the train or wagon on their way over Independence Pass.

In 1893, the collapse of silver brought hard times to Lake County. Following the turn of the century, copper, lead, and especially zinc supplemented the area's gold and silver production. In 1910, Lake County's population was 10,600, slightly above its current population of 7,700. Molybdenum was discovered in the Climax area around Fremont Pass north of Leadville in 1879. The metal had no known uses at the time of its discovery; however, by World War I, it was used as an alloy for hardening steel for military equipment. The Climax Mine continued to increase production through World War II and into the 1970's. The Climax Mine produced ore until a price crash occurred in the mid-1980's, placing the mine into suspension by 1986. The Climax Mine began the process of re-opening in 2008, but the opening was suspended because the price of molybdenum fell from over \$30 per pound to under \$10 per pound in a matter of weeks. After a long shutdown, the Climax Mine has reopened and resumed shipment of molybdenum on May 10, 2012 (CGS 2018).

## 2.2 Physiography and Ecoregions

Lake County lies entirely within the Southern Rocky Mountains ecoregion as defined by The Nature Conservancy (The Nature Conservancy 1997, modified from Bailey 1995) (Figure 5). Ecoregions correspond to the large regions where climatic conditions and biotic/abiotic factors are relatively uniform (Bailey 2002). The Southern Rocky Mountain ecoregion includes the north-south trending mountain ranges with their intervening valleys and parks from southern Wyoming to northern New Mexico, while in Colorado, there are more westerly mountain ranges and high plateaus. The major ecological zones are alpine, subalpine, upper montane, lower montane and grassland (Neely et al. 2001).

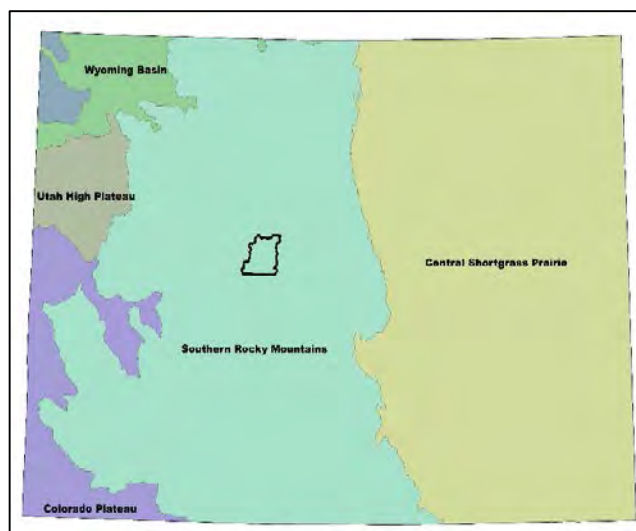


Figure 5. Lake County Location within Colorado's



Lake County is a broad basin or graben that is surrounded by two mountain ranges; the Sawatch Range on the west and the Mosquito Range on the east (Figure 6). The Upper Arkansas River Valley occupies a long, narrow, structural trough that was formed by faulting. The Mosquito and Sawatch ranges includes several peaks with altitudes above 14,000 feet, including Mount Elbert and Mount Massive. Twin Lakes in the south and Turquoise Lake in the north part of the county are natural lakes that have been enhanced by the Fryingpan-Arkansas Project to the west.

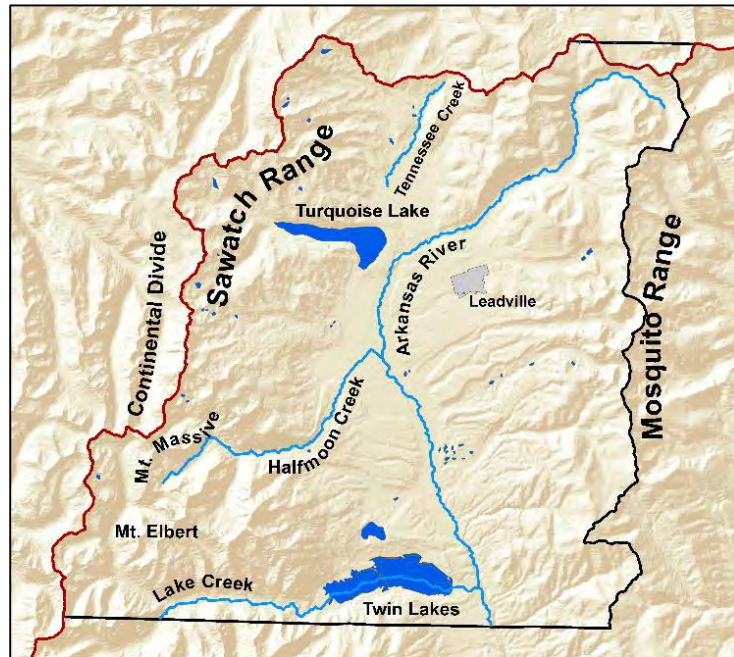


Figure 6. Physiography of Lake County.

## 2.3 Hydrology

Lake County lies entirely within the Arkansas River Headwaters Watershed (HUC 8—11020001) (Figure 7). The Arkansas River basin drains 24,904 square miles, making it Colorado's largest river basin (CWCB 2000). The East Fork of the Arkansas River headwaters are located in the northeast portion of the county at the base of Mount Arkansas. Tennessee Creek, a major tributary, confluent with the East Fork two miles west of Leadville forming the Arkansas River. Halfmoon Creek, which starts at the base of Mount Massive, joins the Arkansas River, southwest of Leadville.

The Arkansas River Compact of 1948 apportions the waters of the Arkansas River between Colorado (60%) and Kansas (40%) by limiting future water developments to projects that would not deplete useable flows. In 1995 Colorado was found to have depleted state-line flows in violation of the Compact (CWCB 2000). Water quality within the upper Arkansas River basin alluvium is generally potable with a few exceptions of elevated metals produced by natural acid rock drainage and septic system effluent contamination. Acid mine drainage from the California Gulch Superfund site has historically impacted both surface and ground water resources in the upper basin. Cleanup efforts have been successful with significant water quality improvements (see Hydrological Impacts).

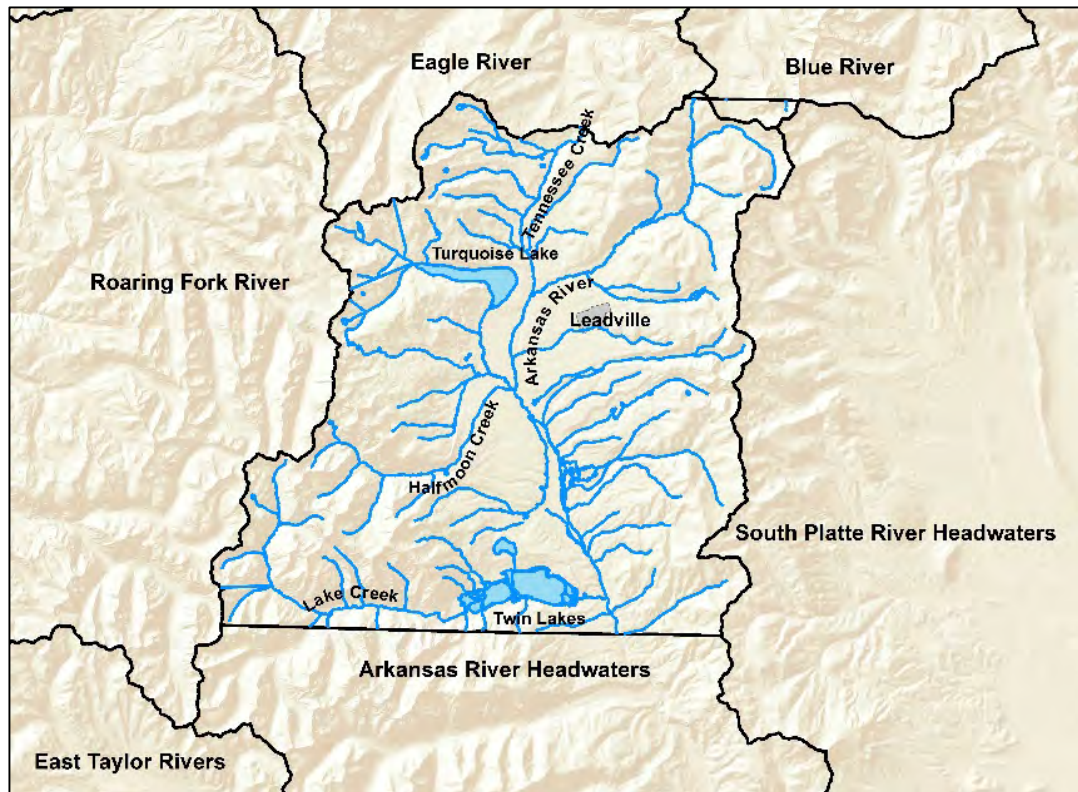


Figure 7. Hydrology of Lake County.

In the upper Arkansas River basin, the alluvial aquifer is limited to areas near the river and its tributaries (Topper et al. 2003) (Figure 8). The alluvial aquifer consists of unconsolidated river-deposited sediments. The sediments range from glacial silts to large boulders. In many areas along the upper Arkansas the alluvium is missing where the river is actively eroding in deep bedrock canyons. Recharge to the Arkansas River alluvium is primarily through infiltration of surface water through the streambed of the river.

The Leadville limestone aquifer is a geothermal aquifer located in west central Colorado and the northeast portion of the county (Figure 9). It is the source for many hot springs in the area as well as limestone caves (Hearne et al. 1986). Additionally, the globally imperiled, Leadville milkvetch (*Astragalus molybdenus*) flourishes on the Leadville limestone.





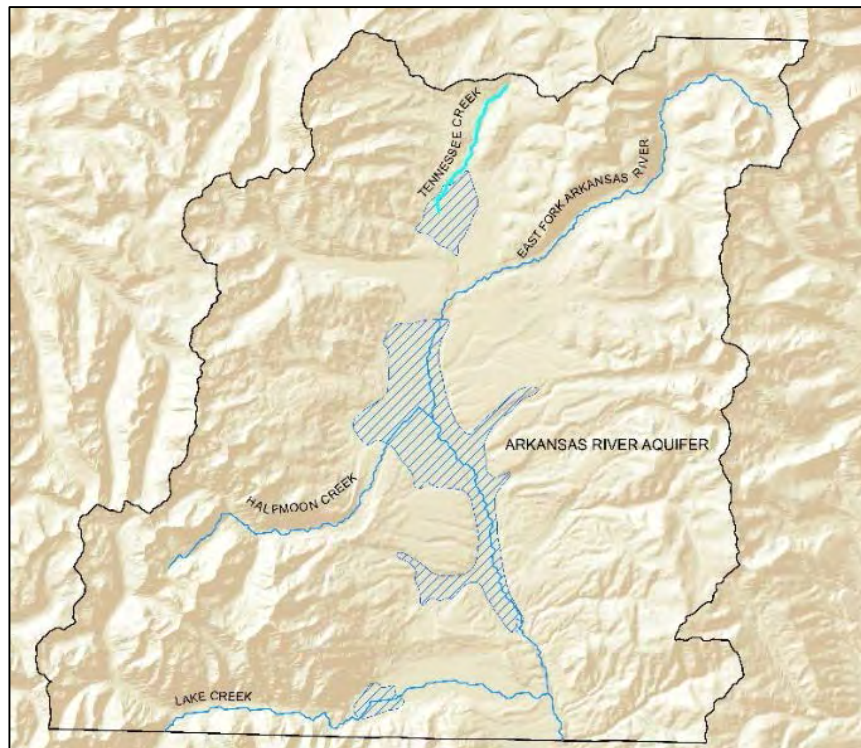


Figure 8. Location of the Upper Arkansas River Aquifer Lake County.

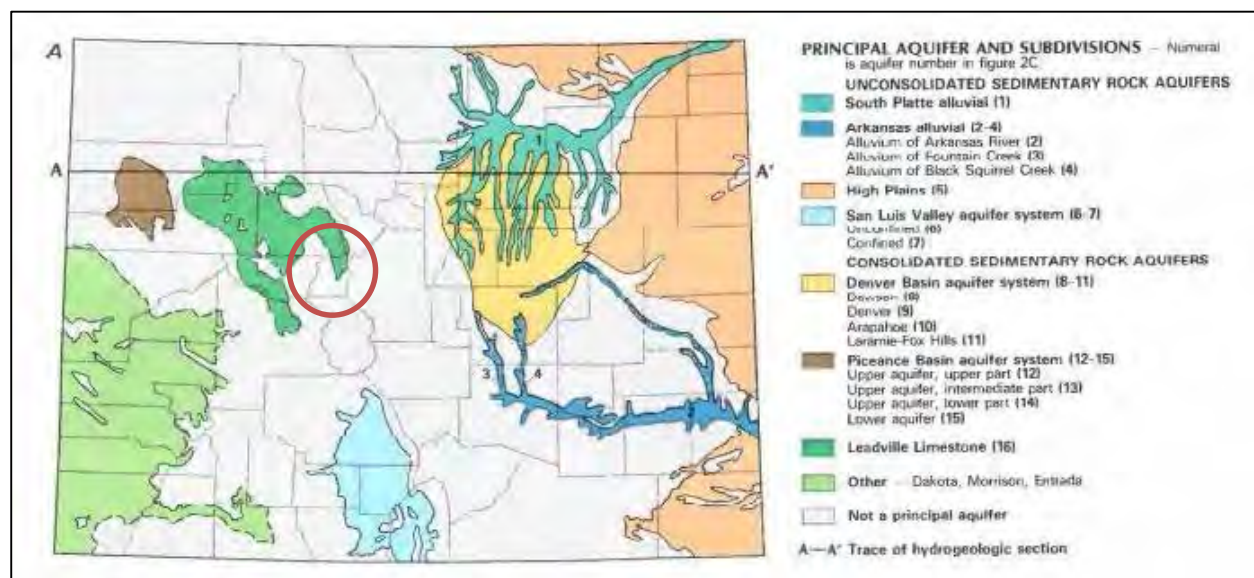


Figure 9. Leadville Limestone aquifer location in central Colorado and Lake County (Hearne et al. 1986).



## 2.4 Geology (adapted from Karnuta 1995 and Chronic and Williams 2002)

The Mosquito Range consists of Precambrian crystalline rock overlain by sedimentary rock with an easterly dip (Figure 10). To the west, the Sawatch Range also contains numerous peaks at and above 14,000 feet that consist of Precambrian crystalline rock, overlying Paleozoic and Mesozoic rock with a westerly dip. The Upper Arkansas Valley averages a width of 3 to 10 miles until it narrows at Granite.

Mountains in Lake County are the result of three distinct phases of orogeny (mountain building). Phase one occurred during the Late Paleozoic and Early Mesozoic Eras (320 mya), when plate-tectonic movement brought the southern part of North America into contact with northern South America. During this stage the Ancestral Rocky Mountains were formed. The second stage started about 70 mya during the Late Cretaceous Era, when plate movement once again increased. This is referred to as the Laramide Orogeny and lasted approximately 30 million years. The uplifts that resulted from the earth's crust being shortened are the where modern day mountain ranges are located. Phase three is characterized by more uplift and block faulting. The results of plate tectonics again affected the region, but the crust was not shorten as in the Laramide Orogeny, but began to pull apart. This extension caused the earth's surface to elevate, drop or tilt.

The Sawatch Range formed as a large anticline during the Laramide Orogeny. The large anticline was uplifted from the low-lying central Colorado Trough, which contained thick, over 5,000 feet deep, Paleozoic sedimentary rocks. Over a period, millions of years, most of the sediments were eroded from the surface, exposing the core of Precambrian rock. The Mosquito Range comprises the eastern flank of the Sawatch anticline.

The Upper Arkansas Valley is the northernmost valley or graben in the chain of grabens that comprise the Rio Grande Rift system. A graben is an elongated block of the earth's crust lying between two faults. The graben is displaced downward relative to the blocks on either side, as in a rift valley. The Upper Arkansas Valley rift system extends from Texas through New Mexico and terminates at Leadville and the Continental Divide. The ancient Arkansas River flowed south along the Rio Grande Rift into the San Luis Valley to its confluence with the Rio Grande. Volcanic activity later blocked the river at Poncha Pass and caused the river to change direction and flow east towards the eastern plains.

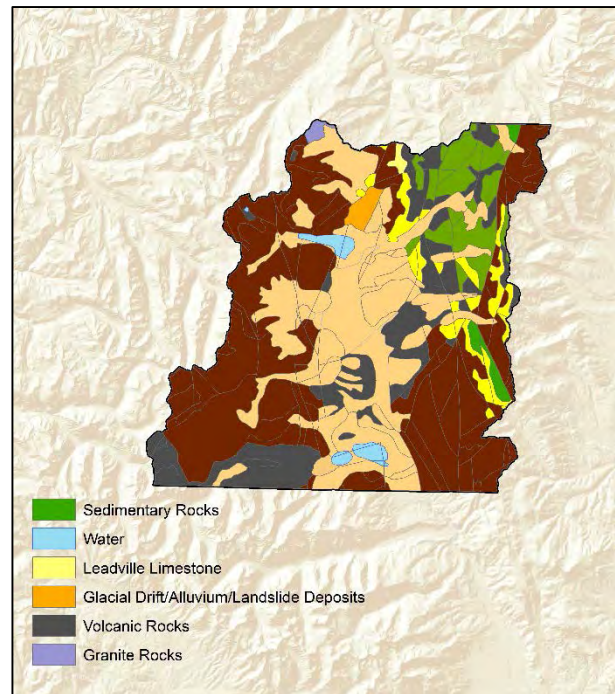


Figure 10. Simplified Geology of Lake County.

Colorado was not glaciated with a continental ice sheet like the northern states, but by alpine glaciation. Deep snow accumulated and compressed into mobile glacial masses creating cirques and U-shaped valleys that are found in headwater streams and side canyons, especially in the Sawatch Range (Figure 11). Turquoise Lake, west of Leadville, is dammed by an excellent example of an end moraine (Matthews 2009) (Figure 12). Large glaciers advanced east within Lake Creek watershed, forcing the Arkansas River against the east side of the valley into contact with the resistant granite or the Mosquito Range. Lake Creek was the largest glacial system in the upper Arkansas Valley. This immense glacier was estimated to be 2,000 feet deep. Twin Lakes are the result of the Lake Creek glacier. As ice began to recede, the cyclic recessions and halts formed the basins where Twin Lakes is now located (Matthews 2009) (Figure 12).

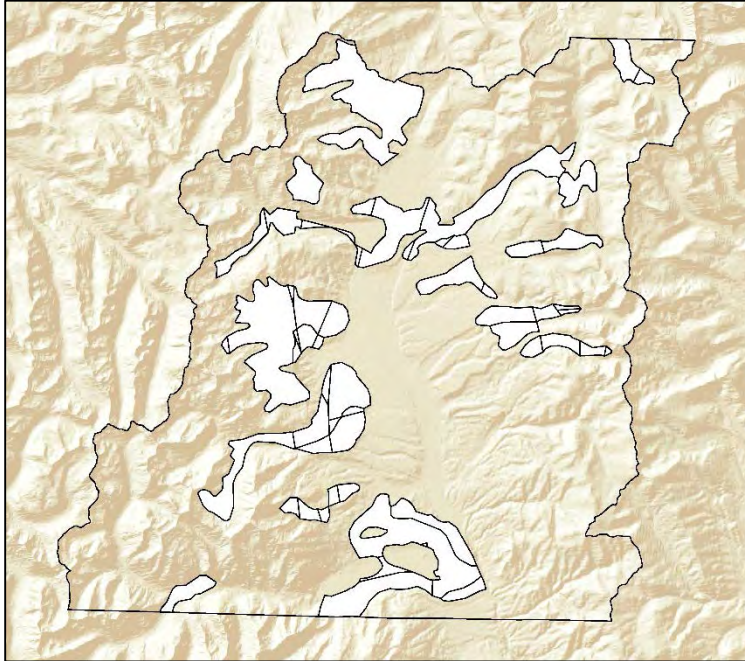


Figure 11. Extent of Glaciers in Lake County.



Figure 12. Turquoise Lake.



## 2.5 Soils

The Upper Arkansas River Valley soils are the only soils that have been mapped by USDA Natural Resources (2008) in Lake County. Valley soils are typically on sloping and very steep fans, terraces, ridges, and side slopes of the mountains (Figure 13). The Bross Association includes soils formed

mainly in glacial deposits. They have a surface layer and subsoil of strongly acid sandy loam that contains gravel and cobbles throughout. The Troutville-Leadville Association soils are located on gently sloping to steep, mountainous topography throughout Lake County formed in glacial outwash and till.

Leadville soils are deep, well-drained, and medium acid to neutral comprising soils associated with lodgepole pine forests. The Pierian-Poncha Association is on nearly level to steep high terraces in the county.

These soils are deep and well-drained with a surface layer of slightly acid gravelly sandy loam that is over stones, gravel, and cobbles. The Wet Alluvial Land

Association is on low terraces and

bottom lands along the Arkansas River. Where soils are poorly drained and formed in gravelly alluvium, consisting of gravel and sand bars with neutral pH. Newfork-Marsh –Rosane Association soils are located on low terraces, and bottom lands along the Arkansas River, East Fork of the Arkansas River, Tennessee Creek, Lake Creek, Iowa Gulch, and Half Moon Creek in Lake County. Soils are poorly drained and formed in mixed alluvium, consisting of gravelly sandy loam. Irrigated meadows are located on these soils (USDA NRCS 1975).

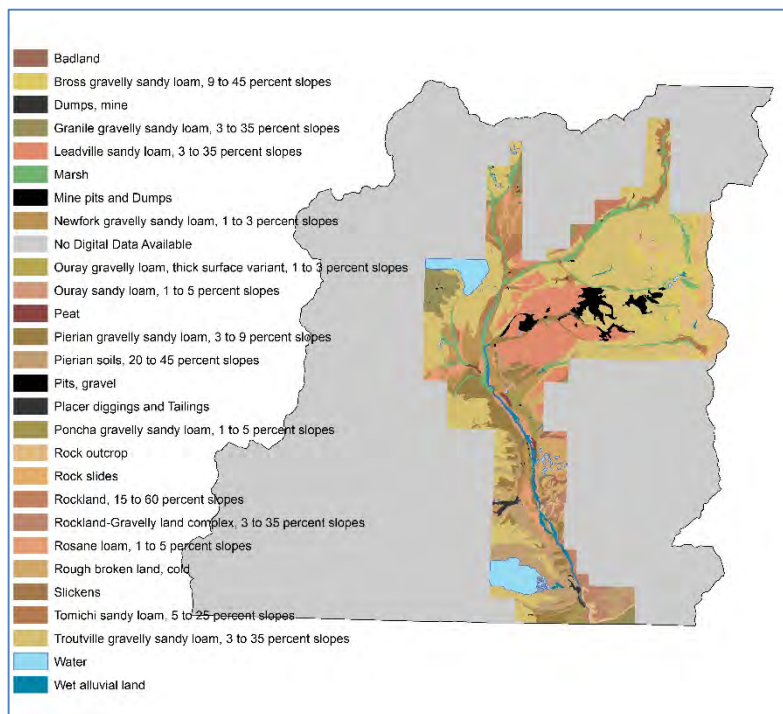


Figure 13. Soils of Lake County (USDA NRCS 2008).

## 2.6 Climate

Lake County's climate is dominated by the winter season, a long, bitterly cold period with short, clear days, relatively little precipitation mainly in the form of snow, with low humidity. The average yearly totals for Lake County are: 16-18 inches of rain (Figure 14, 15), 131 inches of snow per year (Figure 16), and 247 sunny days (WRCC 2018). Summer's average high temperature is around 71° F in July and winter average low is 5° in January. The warmest month on average is July with a temperature of 53.6° F. The coldest month is February, with an average temperature of 15° F (Figure 14). The lowest temperature on record from 1976-2008 is -38°F, and occurred in Leadville on January 1985. The highest temperature, 85°F, was recorded in July, 2003 (WRCC 2018). The

majority of precipitation occurs during April, July, and August (Figure 16). Annual average snowfall across the county is illustrated in Figure 16.

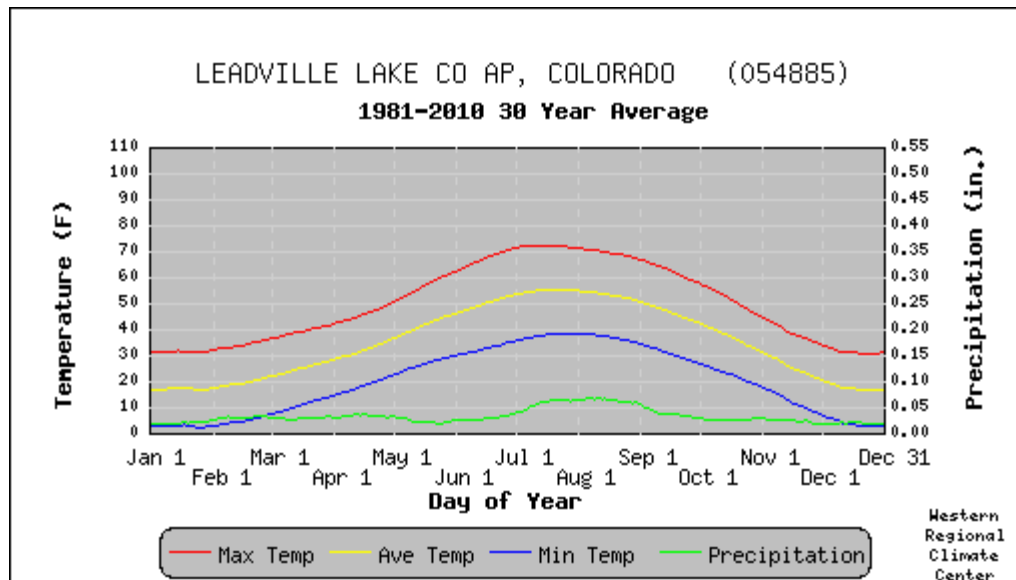


Figure 14. Average for temperature and precipitation for Leadville 1981-2010 (WRCC 2018).

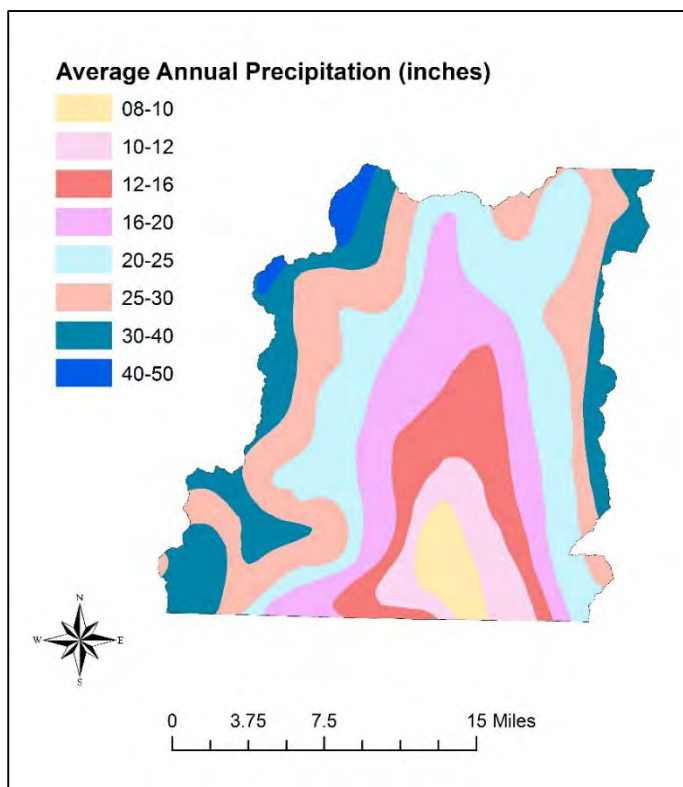


Figure 15. Annual Average Precipitation for Lake County.

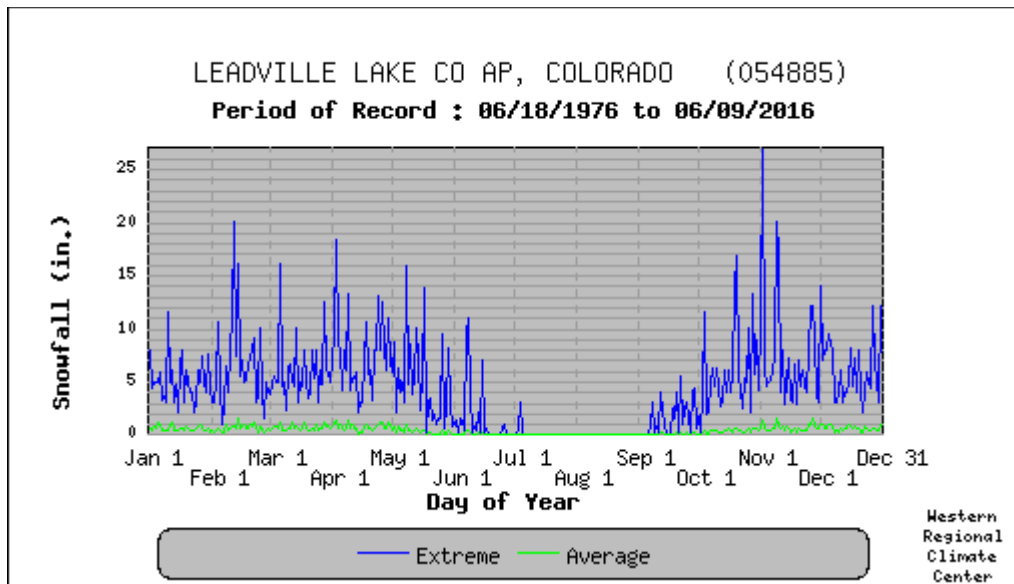


Figure 16. Forty year average for snowfall for Leadville 1976-2016 (WRCC 2018).

## 2.7 Population

As of 2018, the population estimate for Lake County was 7,705 (CO DOLA 2018). Lake County's population is ranked approximately 42<sup>th</sup> of 64 counties. The county seat and only municipality is Leadville. The largest racial/ethnic group is white (80.6%) followed by Hispanic (39.1%). The median income for a household in the county was \$46,928, and the mean household income was \$61,140. Males had a median income of \$30,977 versus \$24,415 for females. The per capita income for the county was \$18,524. About 4.2% of families and 12.90% of the population were below the poverty line, including 15.60% of those under age 18 and 6.30% of those age 65 or over (U.S. Census Bureau 2018).

## 2.8 Land Ownership

Lake County encompasses approximately 384 square miles or 245,760 acres. The largest landowner is the USFS San Isabel National Forest with 66% (161,280 acres). Private ownership accounts for 24% (58,880 acres), the Bureau of Land Management manages 7% (19,328 acres), 2.2% (5,760 acres) is owned by Colorado Parks and Wildlife and the State Land Board, and U.S. Fish and Wildlife Service owns 0.8% (512 acres) (CoMap 2017) (Figure 17). USFS lands include Mount Massive and Buffalo Peaks Wilderness areas. State Wildlife Areas include Paddock and Reddy State Wildlife Areas. The Arkansas Headwaters Recreation Area, a linear recreation area that follows the Arkansas River for 152 miles from Leadville to Lake Pueblo, is one of the nation's most popular locations for rafting and kayaking.

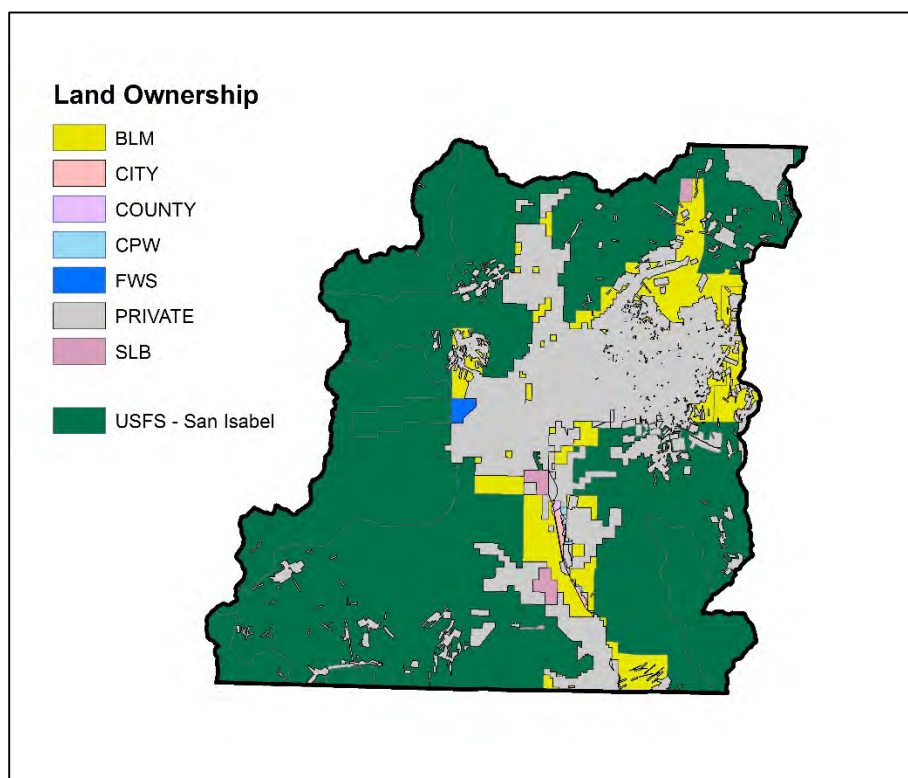


Figure 17. Land Ownership in Lake County.

## 2.9 Land Use (adapted from Lake County Comprehensive Plan 1988)

Almost 2/3 of Lake County's land area is managed and/or owned by the Federal government. Most of the private ownership in the county is concentrated in the central valley adjacent to the Arkansas River. The Climax Mine is the largest private land owner in the county. Along the Arkansas River, hay production is the principal use. Due to higher elevations and the short growing season, livestock grazing and crop production are minimal. Population is concentrated in the vicinity of Leadville and Stringtown. From these two locations the population gradient falls off steeply.



Mineral Belt Trail Sign.

Trail 100 Mountain Trail Bike Race are on the ultimate bucket list for athletes. The Colorado and Continental Divide trails run together through most of the county, from Tennessee Pass to Turquoise Lake to lower slopes of Mount Massive and Mount Elbert, around Twin Lakes to

Tourism is a major part of Lake County's economy. The county has abundant wildlife, fishing opportunities, and outdoor recreational opportunities. During the summer months, every weekend hosts a high elevation bicycle race or run. The Mineral Belt trail dedicated in 2000, is an 11.6 mile all-season, non-motorized trail that meanders through the Leadville Mining District with great views of the mountains. Additionally, there is almost 100 miles of trails that circle throughout the county. The Leadville Trail 100 Run and the Leadville



Interlaken. In the summer, there are ample opportunities to boat, camp, fish, horseback ride, and hike. In the winter, many of the summer time trails become accessible for cross-county and back county skiing, dog sledding, and snowmobiling. Ski Cooper is located at top of Tennessee Pass.

A unique system of recreational mountain huts was created in the 1980s to honor veterans from Camp Hale and the U.S. Army's Tenth Mountain Division. This area was created in the 1940s to train troops for wintery battlefields during WW II. In the 1980s a WW II veteran organized the nonprofit organization that honored the 10<sup>th</sup> Mountain Division by building a series of recreational mountain huts that are enjoyed year-round. In Lake County, there are four 10<sup>th</sup> Mountain Division huts; Uncle Bud's, Skinner, Sangree M. Froelicher, and the Continental Divide Cabin huts.



10th Mountain Division Hut in Lake County.

## 2.10 Ecoregions

Ecoregions are identified by analyzing the patterns and composition of biotic and abiotic factors that indicate the quality and integrity of similar ecosystems. The U.S. EPA follows the Omernik (1987) ecoregions classification. Lake County is located in Omernik Level 3 ecoregion: the Southern Rockies. Level 4 Ecoregions further divide the landscape into finer units based on vegetation, topography, and geology (Figure 18; Table 1).

**Table 1. Descriptions of Level 4 Ecoregions within Lake County.**

NAME	PERCENT IN COUNTY	DESCRIPTION
<b>21a: Alpine Zone</b>	28%	The <b>Alpine Zone</b> occurs on mountain tops above treeline, beginning at about 10,500 to 11,000 feet. It includes alpine meadows as well as steep, exposed rock and glaciated peaks. Annual precipitation ranges from about 35 to greater than 70 inches, falling mostly as snow. Vegetation includes low shrubs, cushion plants, wildflowers, and sedges in wet meadows. The forest-tundra interface is sparsely colonized by stunted, deformed Engelmann spruce, subalpine fir, and limber pine (krummholz vegetation). Rocky Mountain bristlecone pines are also found here, some of the oldest recorded trees in North America. Land use, limited by difficult access, is mostly wildlife habitat and recreation. Ecoregion 21a is snow-free only 8 to 10 weeks annually. Snow cover is a major source of water for lower, more arid ecoregions.

<b>NAME</b>	<b>PERCENT IN COUNTY</b>	<b>DESCRIPTION</b>
<b>21b: Crystalline Subalpine Forests</b>	17%	The <b>Crystalline Subalpine Forests</b> ecoregion occupies a narrow elevational band on the steep, forested slopes of the mountains, becoming more extensive on the north-facing slopes. The elevation range of the region is 8,500 to 12,000 feet, just below the Alpine Zone (21a). The lower elevation limit is higher in the south, starting at 9000 to 9500 feet. The dense forests are dominated by Englemann spruce and subalpine fir; aspen and pockets of lodgepole pine locally dominate some areas. Subalpine meadows also occur. Forest blowdown, insect outbreaks, fire, and avalanches affect the vegetation mosaic. Soils are weathered from a variety of crystalline and metamorphic materials, such as gneiss, schist, and granite, as well as some areas of igneous intrusive rocks. Recreation, logging, mining, and wildlife habitat are the major land uses. Grazing is limited by climatic conditions, lack of forage, and lingering snowpack.
<b>21c: Crystalline Mid-Elevation Forests</b>	10%	The <b>Crystalline Mid-Elevation Forests</b> are found mostly in the 7,000 to 9,000 feet elevation range on crystalline and metamorphic substrates. Most of the region occurs in the eastern half of the Southern Rockies (21). Natural vegetation includes aspen, ponderosa pine, Douglas-fir, and areas of lodgepole pine and limber pine. A diverse understory of shrubs, grasses, and wildflowers occurs. The variety of food sources supports a diversity of bird and mammal species. Forest stands have become denser in many areas due to decades of fire suppression. Land use includes wildlife habitat, livestock grazing, logging, mineral extraction, and recreation, with increasing residential subdivisions.
<b>21i: Sagebrush Parks</b>	11%	The <b>Sagebrush Parks</b> ecoregion contains the large, semiarid, high intermontane valleys that support sagebrush shrubland and steppe vegetation. The ecoregion includes North Park, Middle Park and the Gunnison Basin, and is slightly drier than the Grassland Parks (21j). Summers tend to be hot and winters very cold, with annual precipitation of 10-16 inches. Land use is mostly rangeland and wildlife habitat, with some hay production near streams. The sagebrush provides forage and habitat for many animals and birds. Sandy loam soils are typical, formed in residuum from crystalline and sedimentary rocks, glacial outwash, and colluvial or alluvial materials.
<b>21e: Sedimentary Subalpine Forests</b>	34%	The <b>Sedimentary Subalpine Forests</b> ecoregion occupies much of the western half of the Southern Rockies, on sandstone, siltstone, shale, and limestone substrates. The elevation limits of this region are similar to the crystalline (21b) and volcanic (21g) subalpine forests. Stream water quality, water availability, and aquatic biota are affected in places by carbonate substrates that are soluble and nutrient rich. Soils are generally finer-textured than those found on crystalline or metamorphic substrates of Ecoregion 21b, and are also more alkaline where derived from carbonate-rich substrates. Subalpine forests dominated by Engelmann spruce and subalpine fir are typical, often interspersed with aspen groves or mountain meadows. Some Douglas-fir forests are at lower elevations.

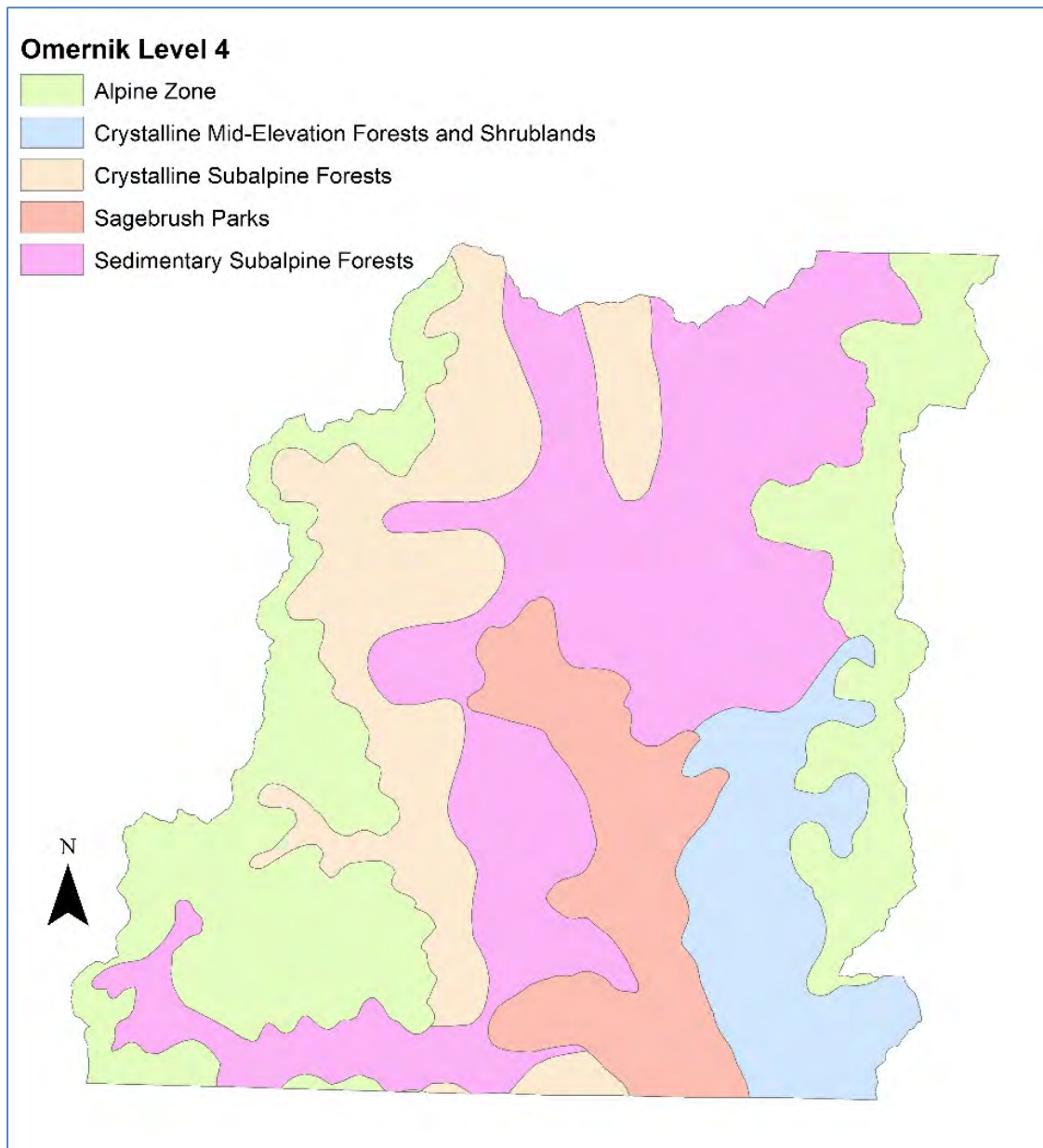


Figure 18. Omernik Level 4 Ecoregions in Lake County.

## 2.11 Ecological Systems

Lake County is dominated by subalpine and montane forests, and montane meadows—these ecological systems are characteristic of the Southern Rockies (Table 2) (Figure 19). The ecological system with the largest coverage is the Rocky Mountain Lodgepole Pine Forest that includes almost a quarter of the county (23.9%) covering 58,421 acres, the lowest coverage is High Intensity Residential development at less than 1% of the county (Table 2).

**Table 2. Ecological Systems of Lake County (Comer et al. 2003).**

Ecological Systems	Acres	Percent of County
Rocky Mountain Lodgepole Pine Forest	58,421	23.9%
Rocky Mountain Subalpine Mesic Meadow	20,393	13.8%
Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland	29,190	10.6%
Southern Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland	19,738	10.4%
Rocky Mountain Alpine Bedrock and Scree	28,793	9.8%
Southern Rocky Mountain Montane Grassland	21,151	7.4%
Rocky Mountain Alpine Dwarf - Shrubland	11,300	4.5%
Rocky Mountain Alpine Turf	10,699	4.3%
Rocky Mountain Subalpine - Montane Riparian Woodland and Shrubland	10,579	4.0%
Herbaceous Planted/Cultivated	8,803	3.0%
Rocky Mountain Cliff, Canyon, and Massive Bedrock	7,012	2.4 %
Rocky Mountain Aspen Forest and Woodland	4,720	1.6%
Quarries/Strip Mines/Gravel Pits	4,577	1.6%
Open Water	3,665	1.3%
Rocky Mountain Subalpine Mesic - Spruce-Fir Forest and Woodland	3,796	1.3%
High Intensity Residential	2,923	0.1%
<b>Total</b>	<b>245,760</b>	<b>100.0%</b>

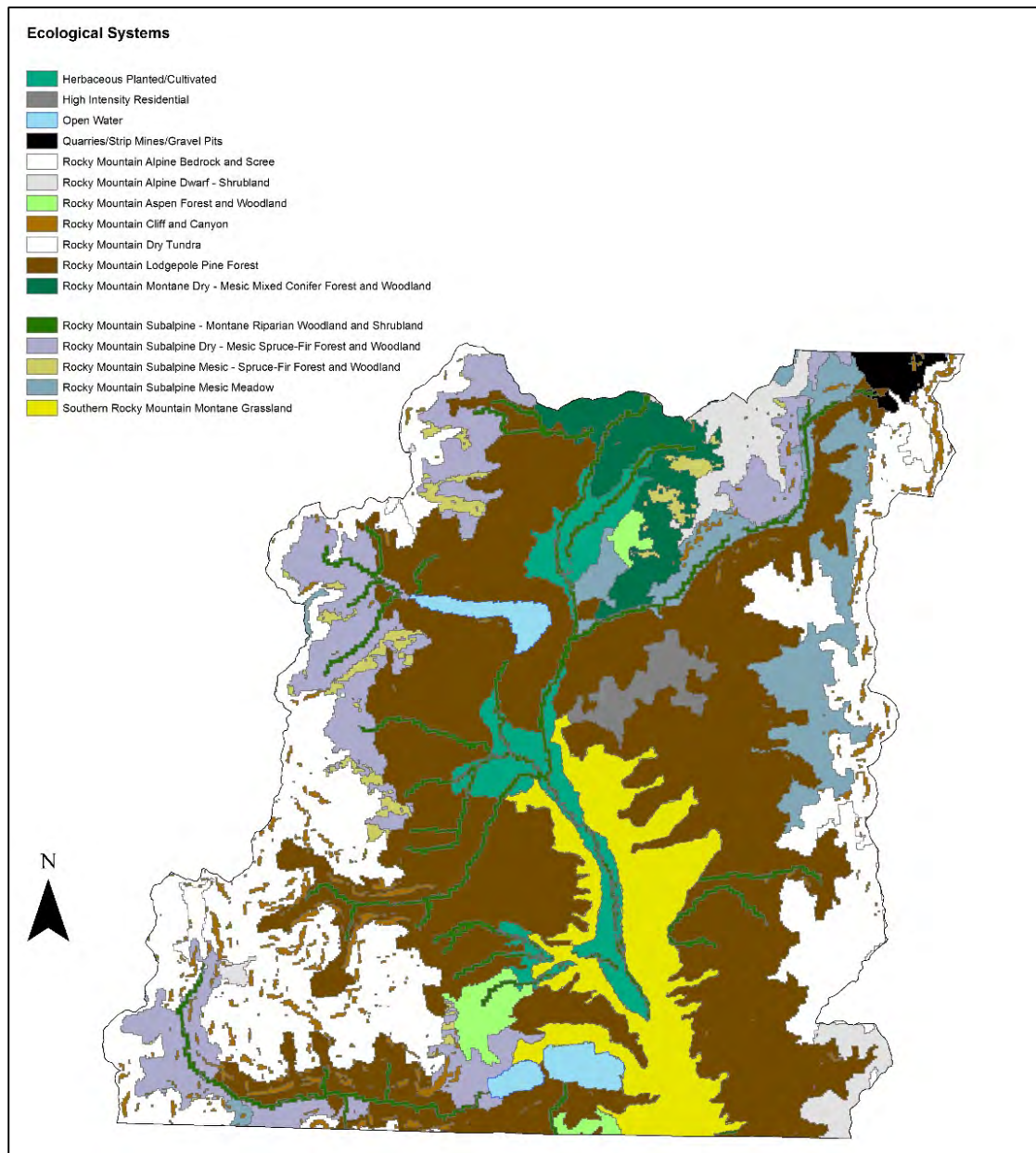


Figure 19. Major Ecological Systems in Lake County.



The following are brief descriptions of the major ecological systems found in Lake County as described from the NatureServe Explorer (2018).

### 2.11a. Rocky Mountain Lodgepole Pine Forest

The lodgepole pine (*Pinus contorta*) ecological system is the dominant (23.9%) ecological system in Lake County.

It is widespread in upper montane to subalpine elevations of the Rocky Mountains. Most forests in this ecological system occur as early- to mid-successional forests which developed following fires. Following stand-replacing fires, lodgepole pine will rapidly colonize and develop into dense, even-aged stands. This system includes lodgepole pine-dominated stands that, while typically persistent for >100-year time frames, may succeed to spruce-fir; in the southern and central Rocky Mountains it is seral to the Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland.

Soils supporting these forests are typically well-drained, gravelly, coarse-textured, acidic, and rarely formed from calcareous parent materials. These forests are dominated by lodgepole pine with shrub, grass, or barren understories. Sometimes there are intermingled mixed conifer/aspen (*Populus tremuloides*) stands, with the latter occurring with inclusions of deeper, typically fine-textured soils. The shrub stratum may be conspicuous to absent; common species include kinnikinnick (*Arctostaphylos uva-ursi*), twinflower (*Linnaea borealis*), Oregon grape (*Mahonia repens*), buffaloberry (*Shepherdia canadensis*), grouse-whortleberries (*Vaccinium cespitosum*, *Vaccinium scoparium*), and common juniper (*Juniperus communis*). The lodgepole pine forest in Lake County has not been as severely impacted by the massive mortality, as seen in the rest of the state, caused by the mountain pine beetle and the associated fungus that infects trees and interferes with its ability to transport water and nutrients.



Lodgepole pine forest.

### 2.11b. Rocky Mountain Subalpine Mesic Meadow

This Rocky Mountain grassland ecological system (13.8%) is restricted to sites from lower montane to subalpine where finely textured soils, snow deposition, or windswept dry conditions limit tree establishment. Many occurrences are small patch in spatial character, and are often found in mosaics with woodlands, denser shrublands, or just below alpine communities. In Lake County, it is typically found above 10,500 feet. This upland ecological system occurs on gentle to moderate-gradient slopes and relatively moist habitats. The soils are typically seasonally moist to saturated in the spring, but will dry out later in the growing



Mesic meadow by Timberline Lake.

season. These sites are not as wet as those found in Rocky Mountain Alpine-Montane Wet Meadow. Vegetation is typically forb-rich, with forbs often contributing more to overall herbaceous cover than graminoids. Some stands are composed of dense grasslands, these often being taxa with relatively broad and soft blades, but where the moist habitat promotes a rich forb component. Important taxa include: daisies (*Erigeron* spp.), bluebells (*Mertensia* spp.), beardstongues (*Penstemon* spp.), lupine (*Lupinus* spp.), golden rod (*Solidago* spp.), lovage (*Ligusticum* spp.), meadow rue (*Thalictrum occidentale*), valerian (*Valeriana edulis*), mountain coneflower (*Rudbeckia montana*), and mule's ears (*Wyethia amplexicaulis*). Important grasses include tufted hair-grass (*Deschampsia cespitosa*), Junegrass (*Koeleria macrantha*), perennial brome-grasses (*Bromus* spp.), and a number of sedges (*Carex* spp.). Shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*) and snowberries (*Symphoricarpos* spp) are occasional but not abundant. Burrowing mammals can increase the forb diversity.

### **2.11c. Rocky Mountain Subalpine Dry - Mesic Spruce-Fir Forest and Woodland**

In Lake County, the Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) ecological system comprises (10%) part of the subalpine forests. This system represents the highest elevation forests in the county. Sites within this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpack is deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. Despite their wide distribution, the tree canopy characteristics are remarkably similar, with Engelmann spruce and subalpine fir dominating either mixed or alone. Douglas fir (*Pseudotsuga menziesii*) may persist in occurrences of this system for long periods without regeneration. Lodgepole pine (*Pinus contorta*) is common in many occurrences, and patches of pure lodgepole pine are not uncommon, as well as mixed conifer/aspen (*Populus tremuloides*) stands. Disturbance includes occasional blowdown, insect outbreaks and stand-replacing fire.



Spruce-fir forest.

### **2.11d. Southern Rocky Mountain Montane Dry - Mesic Mixed Conifer Forest and Woodland**

The Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland makes up a 10.4% of total land area in the county. It is a highly variable ecological system of the montane zone of the Rocky Mountains. It occurs throughout the southern Rockies, north and west into Utah, Nevada, Wyoming and Idaho. Rainfall averages less than 15 inches per year, with summer "monsoons" during the growing season contributing substantial moisture. The composition and structure of the overstory are dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence. Douglas fir (*Pseudotsuga menziesii*) is most frequent, but lodgepole pine (*Pinus contorta*) may be present to codominant with limber pine (*Pinus flexilis*). Blue spruce (*Picea pungens*) is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations. As many as seven different species of conifers can be found growing in the same occurrence, and there are a number of cold-

deciduous shrub and graminoid species that are common, including: kinnikinnick (*Arctostaphylos uva-ursi*), Oregon grape (*Mahonia repens*), mountain lover (*Paxistima myrsinites*), mountain snowberry (*Symphoricarpos rotundifolius*), cliffbush (*Jamesia americana*), and Idaho fescue (*Festuca arizonica*). This system was undoubtedly characterized by a mixed-severity fire regime in its "natural condition," characterized by a high degree of variability in lethality and return interval.

### 2.11e. Rocky Mountain Alpine Turf

This widespread ecological system accounts for 4.3% of the cover in Lake County. It occurs above upper treeline throughout Lake County. It is found on gentle to moderate slopes, flat ridges, valleys, and basins, where the soil has become relatively stabilized and the water supply is more or less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. This system is characterized by a dense cover of low-growing, perennial graminoids and forbs. Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate, mat-forming plants with thick rootstocks or taproots characterize the forbs.

Dominant species include: boreal sagebrush (*Artemisia arctica*), blackroot sedge (*Carex elynoides*), dry sedge (*Carex siccata*), spikenard sedge (*Carex nardina*), needleleaf sedge (*Carex duriuscula*), blackroot sedge (*Carex elynoides*), Hayden's sedge (*Carex haydeniana*), curly sedge (*Carex rupestris*), sheep fescue (*Festuca brachyphylla*), Idaho fescue (*Festuca idahoensis*), alpine avens (*Geum rossii*), Bellardi's bog sedge (*Kobresia myosuroides*), cushion phlox (*Phlox pulvinata*), and alpine clover (*Trifolium dasyphyllum*). Many other graminoids, forbs, and prostrate shrubs can also be found, including purple reedgrass (*Calamagrostis purpurascens*), alpine stichwort (*Minuartia obtusiloba*), tufted hairgrass (*Deschampsia cespitosa*), mountain avens (*Dryas octopetala*), cinquefoils (*Potentilla* spp.), Arctic bluegrass (*Poa arctica*), saxifrages (*Saxifraga* spp.), Rocky Mountain spike-moss (*Selaginella densa*), creeping sabbaldia (*Sibbaldia procumbens*), moss campion (*Silene acaulis*), golden rods (*Solidago* spp.), and Parry's clover (*Trifolium parryi*). Although alpine dry tundra is part of the larger alpine zone, it typically intermingles with alpine bedrock and scree, ice field, fell-field, alpine dwarf-shrubland, and alpine/subalpine wet meadow systems.



Alpine ecological system near Native Lakes.



Pika harvesting plants in alpine (MT Field Guide).



### 2.11f. Southern Rocky Mountain Montane Grassland

This system (7.4% of land cover) occurs between 9,700 feet and 10,500 feet in Lake County on flat to rolling plains and parks or on lower side slopes that are dry. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. An occurrence usually consists of a mosaic of two or three plant associations with one of the following dominant bunchgrasses: timber oatgrass (*Danthonia intermedia*), Parry's oatgrass (*Danthonia parryi*), Thurber's fescue (*Festuca idahoensis*), Arizona fescue (*Festuca arizonica*), western wheatgrass (*Pascopyrum smithii*), or slimstem muhly (*Muhlenbergia filiculmis*). The subdominants include mountain muhly (*Muhlenbergia montana*), blue gramagrass (*Bouteloua gracilis*), sandberg bluegrass (*Poa secunda*), dry sedge (*Carex siccata*), or needleleaf sedge (*Carex duriuscula*). These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests.



Parry oatgrass meadow.

### 2.11g. Rocky Mountain Alpine Dwarf – Shrubland

The Rocky Mountain Alpine Dwarf – Shrubland constitutes 4.5% of the alpine ecoregion in Lake County. It is a widespread ecological system that occurs above upper timberline throughout the Rocky Mountain cordillera. Elevations are above 11,500 in this portion of the Southern Rocky Mountains. This system occurs in areas of level or concave glacial topography, with late-lying snow and sub-irrigation from surrounding slopes. Soils have become relatively stabilized in these sites, are moist but well-drained, strongly acidic, and often with substantial peat layers. Vegetation in these areas is controlled by snow retention, wind



Dwarf shrubland along Native Lake trail.

desiccation, permafrost, and a short growing season. This ecological system is characterized by a semi-continuous layer of ericaceous dwarf-shrubs or dwarf willows which form a heath type ground cover less than 0.5 m in height. Dense tufts of graminoids and scattered forbs occur. Within these communities, arctic willow (*Salix petrophila* = *Salix arctica*) and/or snow willow (*Salix reticulata*) can be dominant shrubs. Whortle berries (*Vaccinium* spp.) and alpine laurel (*Kalmia microphylla*) may also be shrub associates. The herbaceous layer is a mixture of forbs and graminoids, especially sedges, including, daisies (*Erigeron* spp.), louseworts (*Pedicularis* spp.), cinquefoils (*Potentilla* spp.), paintbrushes (*Castilleja* spp.), tufted hairgrass (*Deschampsia cespitosa*), marsh marigold (*Caltha leptosepala*), Parry's rush (*Juncus parryi*), Drummond rush (*Juncus*

*drummondii*), black alpine sedge (*Carex nigricans*), Bellardi bog sedge (*Kobresia myosuroides*), and American bistort (*Polygonum bistortoides*). Fell-fields often intermingle with the alpine dwarf-shrubland.

#### **2.11h. Rocky Mountain Alpine Bedrock and Scree**

This ecological system is restricted to the highest elevations of Lake County. Due to the large area above treeline, this system covers 9.8% of the land cover. It is composed of barren and sparsely



Alpine bedrock habitat.

vegetated alpine substrates, typically including both bedrock outcrop and scree slopes, with lichen-dominated communities. Exposure to desiccating winds, rocky and sometimes unstable substrates, and a short growing season limit plant growth. There can be sparse cover of forbs, grasses, lichens and low shrubs.

#### **2.11i. Rocky Mountain Subalpine-Montane Riparian Woodland and Shrubland**

This riparian woodland system is comprised of seasonally flooded forests and woodlands found at montane to subalpine elevations of the Rocky Mountain cordillera, from southern New Mexico north into Montana, and west into the Intermountain West region and the Colorado Plateau. In Lake County it makes up 4.0% of total land cover. This system contains the conifer and aspen woodlands that line montane streams. These are communities tolerant of periodic flooding and high water tables. Snowmelt moisture in this system may create shallow water tables or seeps for a portion of the



Wolf willow carr below Mosquito Pass.

growing season. This ecosystem is confined to specific riparian environments occurring on floodplains or terraces of rivers and streams, in V-shaped, narrow valleys, and canyons (where



there is cold-air drainage). Less frequently, occurrences are found in moderate-wide valley bottoms on large floodplains along broad, meandering rivers, and on pond or lake margins. Dominant tree species vary, although it usually includes Engelmann spruce (*Picea engelmannii*), Douglas fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), quaking aspen (*Populus tremuloides*), and Rocky Mountain juniper (*Juniperus scopulorum*). Other trees possibly present but not usually dominant include thin-leaf alder (*Alnus incana*), lodgepole pine (*Pinus contorta*), and narrowleaf cottonwood (*Populus angustifolia*).

The shrubland component occurs in montane to subalpine riparian areas as narrow bands of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Occurrences can also be found around seeps, fens, and isolated springs on hillslopes away from valley bottoms. Many of the plant associations found within this system are associated with beaver activity. This system often occurs as a mosaic of multiple communities that are shrub-and herb-dominated and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. The dominant shrubs reflect the large elevational gradient and include thin-leaf alder (*Alnus incana*), river birch (*Betula occidentalis*), Drummonds willow (*Salix drummondiana*), strap-leaf willow (*Salix ligulifolia*), Geyer willow (*Salix geyeriana*), and Rocky Mountain willow (*Salix monticola*).

### 2.11j. Rocky Mountain Cliff, Canyon and Massive Bedrock

This ecological system of barren and sparsely vegetated landscapes (generally <10% plant cover) covers 2.4% of land area in Lake County on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusive), sedimentary, and metamorphic bedrock types. It is located throughout the Rocky Mountains. Also included are unstable scree and talus slopes that typically occur below cliff faces. In general, these are the dry sparsely vegetated places on a landscape. The biota on them reflect what is surrounding them, unless it is an extreme parent material. There may be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Characteristic trees include species from the surrounding landscape, such as Douglas fir (*Pseudotsuga menziesii*), bristlecone pine (*Pinus aristata*), limber pine (*Pinus flexilis*), aspen (*Populus tremuloides*), or common juniper (*Juniperus communis*) at lower elevations. There may be scattered shrubs present, such as species of oceanspray (*Holodiscus dumosus*), gooseberries (*Ribes* spp.), roses (*Rosa* spp.), cliffbush (*Jamesia americana*), or serviceberry (*Amelanchier alnifolia*). Soil development is limited, as is herbaceous cover.



Bristlecone pine forest above Lake Creek.

### 2.11k. Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland

This ecological system constitutes approximately 1.3% of the total land cover in Lake County. It is a high-elevation system of the Rocky Mountains, dry eastern Cascades, and eastern Olympic Mountains dominated by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). Occurrences are typically found in locations with cold-air drainage or ponding, or where snowpack lingers late into the summer, such as north-facing slopes and high-elevation ravines. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateau-like surfaces, basins, alluvial terraces, well-drained benches, and inactive stream terraces.

### 2.11l. Rocky Mountain Aspen Forest and Woodland

This is a common ecological system in counties that contain lower elevation landscapes. However, in Lake County this system accounts for only 1.6% of the cover. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand. Secondly, it is limited by the length of the growing season or low temperatures. These are upland forests and woodlands dominated by aspen (*Populus tremuloides*) without a significant conifer component (<25% relative tree cover). The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Associated shrub species include snowberry (*Symphoricarpos rotundifolius*), raspberry (*Rubus idaeus*), serviceberry (*Amelanchier alnifolia*), and kinnikinnick (*Arctostaphylos uva-ursi*). Occurrences of this system originate and are maintained by stand-replacing disturbances such as avalanches, crown fire, insect outbreak, disease and wind-throw, or clearcutting by man or beaver, within the matrix of conifer forests. Aspen is the most widely distributed tree species in North America. The trees regenerate primarily by root suckering, therefore all the tree stems and roots are genetically identical. Aspen can also reproduce sexually from seeds, although this is rare. Of special interest, aspen is the only tree whose bark can photosynthesize.



Aspen forest



## 2.2 Flora

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In Colorado, 3,322 plant taxa are documented for the entire state (Ackerfield 2015), of these, 1,284 have been collected in Lake County (SEINet 2018). Therefore, 39% of the species known from the state can be found in Lake County, which occupies less than 0.5% of the state's land area. Boulder County by comparison, is almost twice as large, has a larger elevation range and contains 1,649 species and 24 rare species (Neid et al. 2009). Lake County, prior to this survey, was known to contain at least 22 rare plant species and after the survey, an additional 12 rare species were added. Many plants are naturally rare because they are adapted to specific habitats or geographically restricted. Many species, once more common, have declined in abundance, geographic range, or both because of disturbance and/or changes in climate or hydrology. Many of the plants known from the county are considered to be endemic, that is, they only occur in a restricted region. In Colorado, the distinct characters of the Southern Rocky Mountains (north-south orientation, migration barrier, distinctive east and west slope floras and isolated high altitude habitats) have led to a high degree of endemism (Weber 1964). Endemic species may all be contained entirely within a state or a region. Currently there are 17 species that are considered to be endemic that occur in Lake County; seven species are only known from Colorado and 10 species are considered to be regional endemics (see Results for details).

Of special note, Lake County has been under-collected as compared to other counties for botanical resources (such as Boulder County). Long winters, short field seasons and funding opportunities to conduct botanical research likely contribute to the dearth of information. The rich botanical diversity documented in this study is directly related to the amount of undeveloped landscapes, and the diversity of habitats from montane to alpine. The county has a large cover of forested lands dominated by Engelmann Spruce, subalpine fir along riparian areas, and lodgepole pine and Ponderosa pine intermixed with grasslands, as well as sagebrush uplands, and the spectacular tundra habitats on the high mountains. The riparian and wetland areas also contribute significantly to the health and floristic biodiversity of Lake County.

One federally listed threatened plant is currently known from Lake County, Mosquito Range mustard (*Eutrema penlandii*). It is only known from Lake, Park and Summit counties and more specifically, only along a 24-mile stretch of the Continental Divide above 12,000 feet. This particular area contains a unique set of habitat conditions that are perennially wet and calcareous. The known occurrences are in close proximity to mines and are threatened by mineral extraction activities, especially ditching, which is likely to alter the hydrology. In addition, the drainage from mine tailings could acidify the sites changing the chemistry of the soils. Recreational use and associated development are considered another significant threat. This listed threatened species is considered to be critically imperiled globally and statewide (G1S1). Currently, the threat level for the viability of this species is considered very high (NatureServe 2018).

The Leadville milkvetch (*Astragalus molybdenus*) is an endemic, alpine plant in the pea family with grayish leaves resembling the grayish color of molybdenum. It is a small statured member of the pea family, known only from the alpine tundra of the Rocky Mountains in Colorado and whose namesake is the county seat. It was first collected in 1873 about 12 air miles northeast of Leadville



on Mount Lincoln by John Merle Coulter (Ladyman 2003). The original scientific name was assigned in 1964 as *Astragalus plumbeus* with the species epithet referring to lead because of the prevalence of the metal in the Leadville area as well as the grayish color of the metal resembling the gray leaves of the plant. However, it turned out that name was already taken and was then changed to *A. molybdenus* as molybdenum is another common metal mined in the Leadville area that also has a grayish cast (Ladyman 2003). This milkvetch is found predominantly on a rocky calcareous substrate including the Leadville Limestone geologic layer.

The statewide distribution of the Leadville milkvetch includes alpine-tundra in parts of Gunnison, Park, Chaffee, Pitkin, Summit, Hinsdale and Lake counties (Figure 20) between 9,409-14,137 feet (2,900 and 4,054 m). It is currently considered to be globally and state vulnerable (G3S3) by CNHP and USFS sensitive (Ladyman 2003, Spackman et al. 1997).

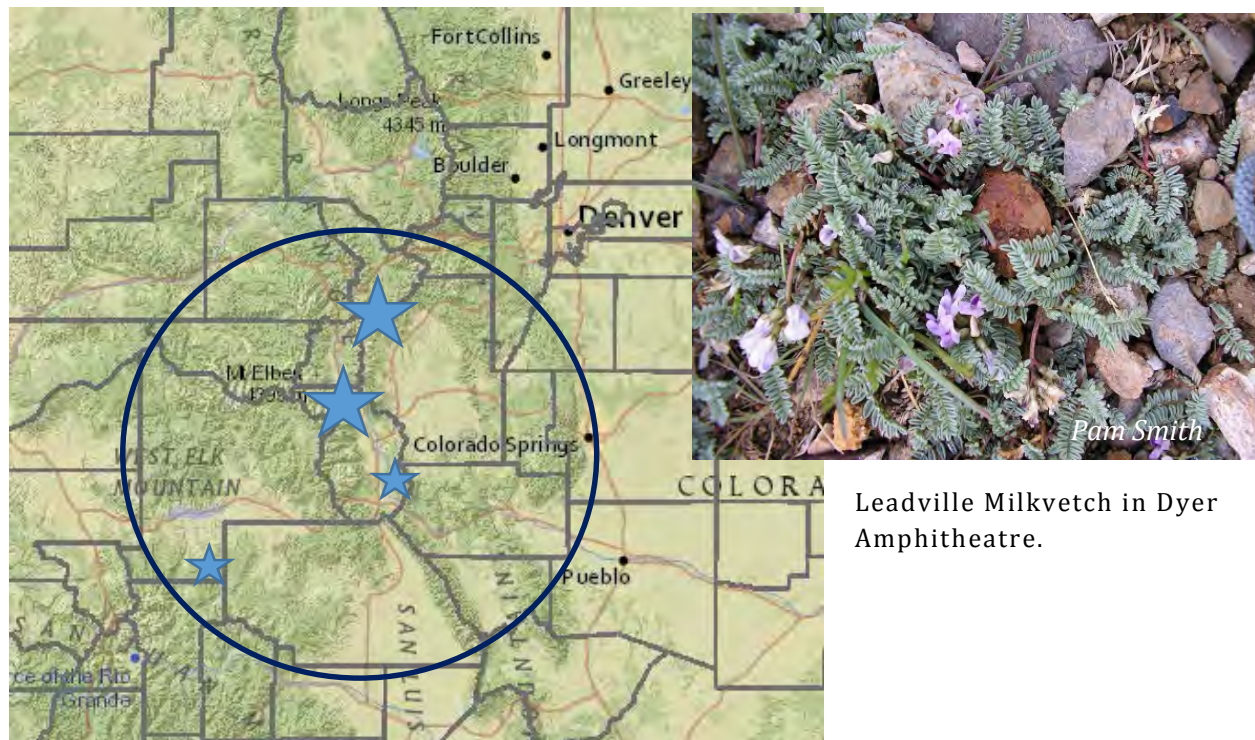


Figure 20. Distribution of Leadville milkvetch (*Astragalus molybdenus*) in Colorado.

The taxonomy of the Leadville milkvetch is a bit complicated as some of the distributions are based on plants that look very similar in Wyoming and in Montana that have more recently been found to be different morphologically and genetically distinct. A study published in 1997 (Lavin and Marriott 1997) demonstrated that there is evidence to support the taxon *Astragalus molybdenus* as being only from the State of Colorado



## 2.2a. Non-native Plant Species

In Colorado 16% of total flora is considered to be non-native (Ackerfield 2015). The Colorado Department of Agriculture Noxious Weed Program has recognized a subset of these species for the State of Colorado that are considered to be invasive into four lists. List A species are designated by the State Commissioner for eradication. No List A species were documented during the project. List B weed species are those for which the State develops and implements state noxious weed management plans designed to stop the continued spread of these species. There are ten List B noxious weed species known from Lake County (Table 3). List C weed species are those for which the Commissioner will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands. No List C species were observed by CNHP during this survey. The fourth list is a watch list of species that could move into Colorado. None of these species were identified during this survey or are currently documented from Lake County. Overall, Lake County has a very low level of noxious weeds compared to most other counties in Colorado.

**Table 3. List B noxious weeds documented in Lake County (CWMA 2018).**

List B species
Canada thistle ( <i>Cirsium arvense</i> )
Chamomiles ( <i>Anthemis cotula</i> , <i>A. arvensis</i> , <i>Matriacaria perforata</i> )
Common tansy ( <i>Tanacetum vulgare</i> )
Dalmatian toadflax ( <i>Linaria dalmatica</i> )
Houndstongue ( <i>Cynoglossum officinale</i> )
Leafy spurge ( <i>Euphorbia esula</i> )
Ox-eye daisy ( <i>Chrysanthemum leucanthemum</i> )
Plumeless thistle ( <i>Carduus acanthoides</i> )
Sulfur cinquefoil ( <i>Potentilla recta</i> )
Yellow toadflax ( <i>Linaria vulgaris</i> )



Canada



Butter and eggs.



Stinking Chamomile.

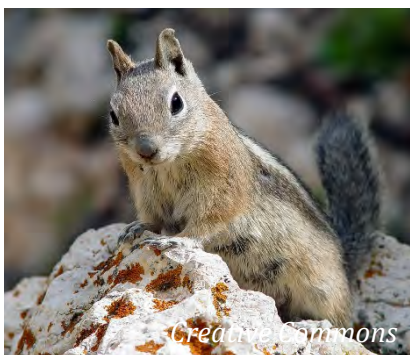
## 2.3 Fauna

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Animals do not occur randomly in nature; rather their occurrence in a particular habitat is a consequence of several variables including history, geology, physiography, climate and ecological relationships with plants and other animals (Mutel and Emerick 1992, Armstrong et al 2011). Because animals are adapted to use specific resources and tolerate a certain range of environmental conditions, they only occupy those ecosystems that meet their requirements (Mutel and Emerick 1992). Each type of ecosystem provides resources for a characteristic suite of animal species, and although many animal species are adapted to a wide range of environmental conditions and are able to utilize and move among habitats, the range of tolerance of many others is fairly restricted to specific habitats and conditions.

Historically, Colorado has been home to 130 species of mammals (Armstrong et al. 2011), 507 bird species (Colorado Bird Atlas Partnership 2016), 18 amphibian species, 35 snake species, 5 turtle species and 16 lizard species (Hammerson 1999). Lake County is home to at least 59 mammals (Armstrong et al. 2011), 246 bird species (CO Bird Atlas Partnership 2016), 3 amphibians, and 1 reptile (Hammerson 1999). Although many of these mammals are habitat specialists, some are generalists and use many different habitats. In Colorado and Lake County, those species that are present and tolerant of a broad range of habitats include:

- Small mammals such as dwarf shrew (*Sorex nanus*) which are found from the montane through the alpine in forested and shrubby habitat; deer mice (*Peromyscus maniculatus*) and the golden-mantled ground squirrel (*Spermophilus lateralis*) that occurs from the alpine down to the foothills and beyond in a variety of habitats;
- Carnivores such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), Canada lynx (*Lynx canadensis*) and several species in the weasel family including long-tailed (*Mustela frenata*) and short-tailed weasel (*Mustela erminea*), pine marten (*Martes caurina*) and historically gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), and wolverine (*Gulo gulo*) which occurred in a wide range of elevations and habitats, following their prey as they migrate between summer and winter range; and
- Ungulates such as mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), moose (*Alces alces*), mountain goats (*Oreamnos americanus*) and bighorn sheep (*Ovis canadensis*) migrate to make use of seasonally available foraging and breeding resources.



Golden-mantled squirrel.



Pine marten.



Bird distribution is related to habitat preference with vegetative type and structure exerting a major influence on bird distribution (Kingery 1998; CO Bird Atlas Partnership 2016) and the colorful diversity of Colorado habitats supports a rich bird community. Bird fauna, like mammalian fauna, is comprised of habitat generalists that are found in many ecosystems and elevations, as well as habitat specialists that are found in specific habitat types with a narrow range of environmental conditions. Bird generalists include Common Raven (*Corvus corax*), Red-tailed Hawk (*Buteo jamaicensis*), and American Robin (*Turdus migratorius*). Unlike mammalian fauna, most avian fauna in Colorado are long distance or elevational migrants moving into Colorado during spring and summer to breed and raise young and moving to lower elevations or latitudes during winter.



Big Horn Sheep (Colorado's State Mammal) at Independence Pass.

The montane grasslands in Lake County support a large number of mammal and bird species. Natural grasslands provide optimal forage for elk and mule deer. Small mammals include montane vole (*Microtus montanus*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and carnivores such as American badger (*Taxidea taxus*) and historically gray wolves which especially



Great Horned Owl at Hayden Ranch.

occupied habitats where large ungulates were plentiful (Mech 1970). Songbirds that nest in the county's montane grasslands include Vesper Sparrow (*Pooecetes gramineus*), Savannah Sparrow (*Passerculus sandwichensis*), Brewer's Sparrow (*Spizella breweri*) Western Meadowlark (*Sturnella neglecta*), Loggerhead Shrike (*Lanius ludovicianus*), and Mountain Bluebird (*Sialia currucoides*). Numerous raptors forage over the grasslands including Red-tailed Hawk (*Buteo jamaicensis*), Prairie Falcon (*Falco mexicanus*) and Peregrine Falcon (*Falco peregrinus*), Golden Eagle (*Aquila chrysaetos*), Sharp-shinned Hawk (*Accipiter striatus*), American Kestrel (*Falco sparverius*) and Great Horned Owl (*Bubo virginianus*).

Shrublands in Lake County are dominated by mountain sagebrush (*Artemisia tridentata* var. *vaseyana*). Small mammals such as the least chipmunk (*Tamias minimus*), Uinta chipmunk (*Neotamias umbrinus*), and dwarf shrew (*Sorex nanus*) are abundant in the sagebrush zone.

Carnivores include American badger (*Taxidea taxus*), coyote (*Canis latrans*), and red fox (*Vulpes vulpes*). Townsend's big-eared bats (*Corynorhinus townsendii*), documented in southern Lake

County, forage in these shrublands and use abandoned mines for day roosts has been. Breeding bird species include Loggerhead Shrike (*Lanius ludovicianus*) and Virginia's Warbler (*Vermivora virginiae*). Raptors include: Sharp-shinned Hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperi*), Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Great Horned Owl (*Bubo virginianus*), and Common Nighthawk (*Chordeiles minor*).

Coniferous forests cover the majority of the county. Lodgepole pine (*Pinus contorta*) forest habitat supports wide-ranging species such as Mountain Chickadee (*Parus gameli*), Yellow-rumped Warbler (*Dendroica coronata*), and Dark-eyed Junco (*Junco hyemalis*). Lodgepole pine and Douglas fir (*Pseudotsuga menziesii*) forests often intermix and have a similar fauna. Abert's squirrels (*Sciurus aberti*) are characteristic of ponderosa pine forests while pine squirrels (*Tamiasciurus hudsonicus*) are characteristic of



Red-tailed Hawk.

Douglas fir forests. Porcupine (*Erethizon dorsatum*) is common and carnivores including coyote and bobcat come to these forests to hunt the abundant small mammal populations. Songbirds that characterize these forests include Pygmy Nuthatch (*Sitta pygmaea*), Western Tanager (*Piranga ludoviciana*), Plumbeous Vireo (*Vireo plumbeus*), Grace's warbler (*Dendroica graciae*) and Yellow-rumped Warbler (*Dendroica coronata*). Northern Goshawk (*Accipiter gentilis*) hunt and nest in old-growth coniferous forests. The Northern Goshawk along with Mountain Chickadee (*Parus gambelii*), and Hermit Thrush (*Catharus guttatus*) are commonly seen or heard in coniferous forests (Andrews and Righter 1992).

Mixed conifer forests include stands of Engelmann spruce (*Picea engelmannii*), bristlecone pine (*Pinus aristata*) and limber pine (*Pinus flexilis*). Mammals that characterize these spruce forests include southern red-backed vole (*Clethrionomys gapperi*), pine squirrels (*Tamiasciurus hudsonicus*) and snowshoe hare (*Lepus americanus*). The carnivorous, arboreal pine marten (*Martes americana*) which hunts pine squirrels and songbirds is a common, but rarely seen inhabitant.

Characteristic songbird species here include Ruby-crowned Kinglet (*Regulus calendula*), Cordilleran Flycatcher (*Empidonax occidentalis*), Western Wood-Pewee (*Contopus sordidulus*), Red-breasted Nuthatch (*Sitta canadensis*), Mountain Chickadee (*Parus gambelii*), Clark's Nutcracker (*Nucifraga columbiana*), Pine Grosbeak (*Pinicola enucleator*), Red Crossbill (*Loxia curvirostra*), Gray Jay (*Perisoreus canadensis*) and raptors such as Northern Goshawk (*Accipiter gentilis*) and Northern Saw-whet Owl (*Aegolius acadicus*).



Cordilleran Flycatcher.



Aspen forests extend from the lower montane, e.g. along Lake Creek, to the subalpine zone and are home to a diverse and abundant suite of animal species. Small mammals are abundant in the lush understory and include montane and masked shrew (*Sorex monticolus* and *S. cinereus*), meadow and long-tailed voles (*Microtus pensylvanicus*; *M. longicaudus*) and the western jumping mouse (*Zapus princeps*). Elk and mule deer find cover and browse here and numerous mesopredators such as long-tailed and least weasel (*Mustela frenata* and *M. nivalis*) hunt in this rich habitat. Black bear (*Ursus americanus*) are common in these forests where they find a storehouse of insects, forbs and grasses to forage on. The bird community is especially diverse in this structurally complex habitat. Characteristic species include Warbling Vireo (*Vireo gilvus*), MacGillivray's Warbler (*Oporornis tolmiei*), House Wren (*Troglodytes aedon*), Red-naped Sapsucker (*Sphyrapicus nuchalis*), Downy and Hairy Woodpeckers (*Picoides pubescens*, *P. villosus*), Western Wood-Pewee (*Contopus sordidulus*) Tree and Violet-green Swallow (*Tachycineta bicolor*; *T. thalassina*),

The alpine zone in Lake County is a harsh environment and although many mammals (including humans) visit here during the summer, only a few species remain year-round. Summer visitors that come to forage or to breed include elk, mule deer, and big horn sheep as well as predators, including mountain lion and coyote that often follow to hunt their prey. Year-round residents include American pika (*Ochotona princeps*) which is also active year-round. Pika inhabit talus slopes, foraging during the summer in adjacent turf meadows and storing small “haypiles” of grasses and forbs for the winter. Northern pocket gophers (*Thomomys talpoides*) are common here and are also active year-round. Yellow-bellied marmots (*Marmota flaviventris*) survive the alpine environment by hibernating through the winter. Only a few bird species breed here but some breed here exclusively including White-tailed Ptarmigan (*Lagopus leucurus*), Brown-capped Rosy Finch (*Leucosticte australis*) and American Pipit (*Anthus rubescens*). White-crowned Sparrow (*Zonotrichia leucophrys*) and Horned Lark (*Eremophila alpestris*) nest here but they also nest in similar habitats at lower elevations. Only one bird species remains year-round, the White-tailed Ptarmigan and then only the male remains while the female moves down into the spruce forest.



Yellow-bellied Marmot.

Wetland and riparian habitats are essential for many animals. Many mammals utilize wetlands for forage, resting, or breeding, and some species are wetland or riparian obligates. Elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and moose (*Alces alces*) are common animals that utilize wetlands. Numerous bat species, especially the little brown bat (*Myotis lucifugus*), use open water from lakes, rivers, and beaver ponds to forage for insects. Water shrews (*Sorex palustris*) have fringed hind feet that are ideal for swimming and foraging underwater. Other shrews known to occur in Lake County's wetlands include masked shrew (*S. cinereus*), pygmy shrew (*S. hoyi*), and montane shrew (*S. monticolus*) (Armstrong et al. 2011). Other small mammals that can be found in riparian and wetlands include: long-tailed vole (*Microtus longicaudus*), meadow vole (*M. pennsylvanicus*), southern red-backed vole (*Clethrionomys gapperi*), and western jumping mouse (*Zapus princeps*) (Armstrong et al. 2011).

One of the most important mammals and a keystone to the viability of riparian systems is the American beaver (*Castor canadensis*). Beavers were historically abundant throughout the west prior to 1870, but by the early 1900s were extirpated from much of their historic habitat due to unregulated trapping (Cary 1911). Removal of the beaver changed the character of riparian areas all across Colorado (Neff 1957, Naiman et al. 1988, McKinstry et al. 2001). Beaver and western riparian ecosystems have evolved together and are essential to each other's sustainability. Beavers have adapted to their watery niche with webbed hind feet, a waterproof coat, a paddle-like tail, nostril and ear valves that close when diving, and small eyes that are able to see underwater. Beavers build dams that create ponds, alter watersheds and enhance important ecosystem functions. These functions include slowing spring runoff, raising water tables, promoting water storage, and trapping sediments. Beavers cache willow branches that eventually root and grow into dense willow shrublands, which provide forage for ungulates and nesting habitat for birds.



Pair of adult beavers.

The muskrat (*Ondatra zibethicus*) is often seen in beaver-created ponds. Muskrats are easily identified by their slender and hairless tail, small ears and partially webbed feet. They build small, dome-shaped lodges or burrows into streambanks and are an important indicator of a healthy wetland. Muskrats are perhaps North America's most valuable semi-aquatic furbearer (Huggins 2008). The mink (*Mustela vison*) is an uncommon occupant of the county's beaver ponds and slow-moving streams. It has a weasel-like appearance with a fully furred tail.

There are only three amphibians that are known from Lake County home; tiger salamander (*Ambystoma tigrinum*) (Colorado's state amphibian), western chorus frog (*Pseudacris triseriata*),



Tiger salamander in USFS bunkhouse.

and the Boreal toad (*Anaxyrus boreas boreas*). Tiger salamanders have two distinct stages; the larvae or mud puppies needs permanent water until they turn into terrestrial adults. Salamanders occur near wetlands and irrigated fields. Salamanders differ from frogs and toads in that fertilization of the eggs occurs inside the female. The stores the sperm in her body until eggs are laid. Internal fertilization is an advantage for the female does not need a male present for fertilization and it gives her flexibility in egg-laying sites. Tiger salamanders are common in Colorado; they occur in every county with a wide elevational range. The Western chorus frog is also a wide ranging species, found throughout Colorado, from urban ponds to mountain lakes.

The boreal (western) toad found in Lake County and Colorado is part of the Southern Rocky Mountain (SRM) group of the *Anaxyrus boreas* complex. Recent genetic work shows evidence for separating the SRM group of toads as a distinct species (Goebel et al 2009). In Colorado, boreal

toads are restricted to montane habitats at elevations of 8,000 – 12,000 feet (2,400 – 3,400 meters). Common habitats include beaver ponds, wet meadows, glacial kettle ponds and lakes in subalpine forests (Hammerson 1999).

Once common in the mountains of Colorado, southern Wyoming, and northern New Mexico, the boreal toad (SRM group) has declined throughout its range during the last 30 years (Corn et al. 1989, Carey 1993, Hammerson 1999, Loeffler 2001). Due to these declines, the boreal toad was listed in Colorado (1993) and in New Mexico (1976) as a state endangered species. The boreal toad was withdrawn from consideration for protection under the Endangered Species Act in the fall of 2017 by the U.S. Fish and Wildlife Service. The United States Forest Service currently classifies the Boreal Toad as a Region 2 sensitive species. The primary threat to Boreal Toad populations is from a pathogenic chytrid fungus (*Batrachochytrium dendrobatidis*). Many amphibian declines and extinctions have been associated worldwide with introduced chytrid fungus disease (Berger et al.



Adult boreal toad.

Bird species that occur in Lake County that rely on riparian and wetland habitats include: Green-winged Teal (*Anas crecca*), Mallard (*Anas platyhynchos*), Osprey (*Pandion haliaetus*), Great Blue Heron (*Ardea herodias*), Spotted Sandpiper (*Actitis macularia*), Common Snipe (*Gallinago gallinago*), Belted Kingfisher (*Ceryle alcyon*), American Dipper (*Cinclus mexicanus*), Killdeer (*Charadrius vociferous*), Veery (*Catharus fuscescens*), MacGillivray's Warbler (*Oporonis tolmiei*), Lincoln's Sparrow (*Melospiza lincolni*), Chipping Sparrow (*Spizella passerina*) and Fox Sparrow (*Passerella iliaca*).

1998; Green and Kagarise-Sherman 2001; Daszak et al. 2003). In Colorado, chytrid fungus has been implicated in dramatic declines in several populations of Boreal Toads since its discovery in the state in 1999 (Loeffler 2001).

The only reptile known to occur in Lake County is the Western terrestrial garter snake (*Thamnophis elegans*). It occurs throughout the state, except for the north and central plains. It feeds on a wide range of vertebrates and invertebrates obtained on land or in water (Hammerstein 1999).



White-crowned Sparrow.



## 3.0 WETLANDS OF LAKE COUNTY

### 3.1 Wetland Definitions

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The federal regulatory definition of a jurisdictional wetland is found in the regulations used by the U.S. Army Corps of Engineers (Corps) for the implementation of a dredge and fill permit system required by Section 404 of the Clean Water Act (Mitsch and Gosselink 2007). According to the Corps, wetlands are “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” For Corps programs, a wetland boundary must be determined according to the mandatory technical criteria described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it **must have all three** of the following criteria under normal circumstances: (1) wetland plants; (2) wetland hydrology; and (3) hydric soils.

The U.S. Fish and Wildlife Service defines wetlands from an ecological point of view. Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) maintains that “wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.” Wetlands **must have one or more** of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly un-drained hydric soil; and/or (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

CNHP adheres to the wetland definition used by the U.S. Fish and Wildlife Service, because it recognizes that some wetlands may display many of the attributes of wetlands without exhibiting all three characteristics required to fulfill the Corps’ criteria. For example, riparian areas, may include areas that do not meet all three of the Corps’ criteria, but perform many of the same functions as other wetland types, including maintenance of water quality, storage of floodwaters, and enhancement of biodiversity, especially in the western United States (National Research Council 1995). Thus, the U.S. Fish and Wildlife Service wetland definition is more suitable to CNHP’s objective of identifying ecologically significant wetlands.

### 3.2 Wetland Plants

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Wetlands are typically defined or classified by the vegetation they support. A commonly used term for a wetland plant is hydrophyte; a plant that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of soil saturation or inundation. Hydrophytes have evolved a number of adaptations for life in wet environments, including additional pore spaces, dimorphic (two distinct forms) leaves, and complex rooting systems. Phreatophytes are deep-rooted woody plants that obtain a significant portion of their water from groundwater (e.g.,



cottonwoods, alders, or willows). Phreatophytes are typically found along rivers and streams where the groundwater is near the surface. Wetland plants are at the base of the food chain and thus a major component of energy flow within a wetland. They provide habitat for major taxonomic groups, including vertebrates, invertebrates, phytoplankton, and zooplankton. Wetland plants influence water chemistry, acting as both a nutrient sink through uptake, and as a nutrient pump by moving compounds from sediment into the water column, thus improving water quality (Reddy et al. 1983, Reddy and DeBusk 1987). Plants also influence the sediment and hydrologic regime by stabilizing banks and shorelines providing surface roughness to slow the flow of water during peak flows.



Willows stabilize streambanks and mitigate floodwaters.

### 3.3 Wetland Types in Lake County (adapted from Culver and Lemly 2013)

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#### 3.3a Marshes

Marshes form in depressions created by landscape processes such as water, wind, and past glacial activity. Marsh wetlands contain deep water in spring and early summer, are frequently or continually inundated, and are characterized by emergent herbaceous vegetation. They form in depressions in the landscape (e.g. kettle ponds) or as fringes around lakes and along slow-flowing areas and side channels of streams and rivers. Marshes typically have mineral soils, but can also accumulate organic material in the top soil horizon, but not enough to form true organic soil. Vegetation is usually classified as emergent, including species like, cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.) and sedges (*Carex* spp.) along with woody species like, cottonwoods (*Populus* spp.), and willows (*Salix* spp.).



Subalpine marsh in Lake County.

### 3.3b Riparian Wetlands

Riparian wetlands are associated with moving water and intermittent flooding. They are located along creeks and rivers that are intermittently to seasonally flooded. In Lake County, many riparian



Michael Menefee

Lower Arkansas River.

wetlands are intermittently flooded during spring snowmelt. They typically have a seasonally high water table due to their close proximity to surface water. Riparian wetlands are commonly recognized by bottomland, floodplain, and streambank vegetation dominated by trees and shrubs. They are characterized by a combination of high animal and plant diversity and high biomass productivity. Riparian wetlands are particularly productive ecosystems, receiving large inputs of water and nutrients from upstream sources during flood events. Woody plants are the dominant vegetation in

many Lake County riparian areas with common species including: Geyer willow (*Salix geyeriana*), Rocky Mountain willow (*S. monticola*), and Drummond willow (*S. drummondiana*). Riparian wetlands and their associated aquatic habitat are important for nutrient cycling and food chain support, including fish, bird, and other wildlife habitat. The importance of riparian habitats to wildlife is well documented (e.g. Lohman 2004). Animal use includes moose, beaver, and large suite of land bird species (e.g. warblers, song sparrows, flycatchers, and woodpeckers).

### 3.3c Wet Meadows

Wet meadows are dominated by graminoids (sedges, rushes, grasses) and have soils saturated near the surface in early summer, but rarely have deep standing water and are typically dry by the end of



Denise Culver

Wet meadow along Willow Creek.

the growing season. In Lake County, wet meadow wetlands occur in alpine and subalpine zones around mountain lakes and basins that are fed by snowmelt and groundwater discharge throughout the summer. Wet meadows are also found adjacent to or within irrigated pastures and may be linked to irrigation practices. The most common wetland plants found in high elevation wet meadows are: Water sedge (*Carex aquatilis*), beaked sedge (*C. utriculata*), analouge sedge (*C. simulata*), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint (*Calamagrostis canadensis*). Soils in wet meadows

are mineral and demonstrate typical hydric soil characteristics such as low chroma matrix colors and

redoximorphic features. Subalpine wet meadows provide forage, cover, and nesting habitat for songbirds such as Brown-capped Rosy Finch (*Leucosticte australis*), White-crowned Sparrow (*Zonotrichia leucophrys*), Lincoln's Sparrow (*Melospiza lincolni*), and White-tailed Ptarmigan (*Lagopus leucurus*).



### 3.3d Fens

Fens, a type of peat accumulating wetlands, were documented in the county during this project.

Fens are an uncommon wetland type, usually found at or above 8,000 feet elevation. Fens primarily



Hayden Meadow Extreme Rich Fen.

receive water from groundwater discharge, with minimal inputs from snowmelt and direct precipitation.

In the Colorado Rocky Mountains, fens accumulate peat at a very slow rate, on the order of 20 cm (8 inches) per 1,000 years (Chimner 2000), and are essentially irreplaceable. Fens tend to be small in area (<5 acres) and typically support grasses and sedges, like tall cottongrass (*Eriophorum angustifolia*), analogue sedge (*Carex simulata*), boreal bog sedge (*C. magellanica* ssp. *irrigua*), water sedge (*C. aquatilis*), and fewflower

spikerush (*Eleocharis quinqueflora*). Forbs that were documented within the county's fens include: fringed gentian (*Gentianopsis thermalis*), falsegold groundsel (*Packera pseudoaurea*), shooting star (*Dodecatheon pulchellum*), and great blue lobelia (*Lobelia siphilitica* var. *ludoviciana*). Fens are federal land considered a Resource Category 1 within the U.S. Fish and Wildlife Service Mitigation Policy (USFWS 1999), signifying that every reasonable effort should be made to avoid impacting this habitat. In 2002, the U.S. Forest Service Rocky Mountain Region issued a statement to avoid impacts to fens on National Forest Lands due to their irreplaceability (USFS 2002). Fens in Colorado are further classified as poor, iron, intermediate, rich, and extreme rich. These terms refer to the levels of nutrients or minerals (calcium, magnesium, etc.) in fen soil water. Poor fens are similar to bogs, where pH and conductivity are low. Plants that thrive in these conditions include bladderworts (*Utricularia* spp.) and sundews (*Drosera* spp.). Iron fens also have low pH and are dominated by Sphagnum mosses, appearing superficially like bogs. However, the acidity in iron fens is caused by the oxidation of iron pyrite ( $\text{FeS}_2$ ) in the surrounding bedrock, which releases sulfuric acid along with high concentrations of minerals, particularly iron, that give surface water a reddish color. Iron fens only occur in mineral rich mountain areas in Colorado (e.g. the San Juan Mountains). Intermediate and rich fens are found throughout the granitic subalpine zone at breaks in slope, at the headwaters of streams, along spring-fed slopes, and in small water-filled depressions formed by glaciers. Intermediate and rich fens are typically dominated by sedges and willows and the pH tends to be slightly acidic (5.0-6.5). Extreme rich fens are closely associated with calcium-rich sedimentary bedrock such as the Mosquito Range in Lake and Park counties. They have a basic pH greater than 7.0 and very high calcium concentrations that are tolerated by specialized plants or calciphiles. During this project, CNHP documented the first known extreme rich fen west of the

Continental Divide near the Hayden Fishing Access. Four county plant records were recorded from this single fen.

### 3.4 Wetland Soils

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Wetland or hydric soils are very important in determining the frequency and duration of saturation or how long a soil is “underwater.” As a wetland is flooded or saturated, water replaces air in the soil pores, leading to anaerobic conditions that cause physical and chemical changes. Soil microbes deplete free oxygen and begin to utilize alternative metabolic pathways involving nitrogen, iron, manganese, and sulfur, producing chemical transformations in the soil. Evidence of these transformations can be seen in hydric soil indicators, such as mottling (redoximorphic features), oxidized root channels, gleying, and a distinct, rotten egg smell from  $H_2S$  gas (USDA NRCS 2018). If soils are permanently saturated or inundated with water such that the rate of plant growth and organic matter accumulation exceeds decomposition, thick organic soils known as histosols (peats and mucks) can form. Hydric soil indicators reveal the general hydrologic signature, or hydroperiod, of a wetland, including how long and how frequently the soil has been saturated.



Soil profile with peat in upper 12 inches.



Native Lakes with surrounding wetlands.



### 3.5 Wetland Ecological Functions and Services

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Wetland functions (see Colorado Wetland Information Center [www.cnhp.colostate.edu/cwic/](http://www.cnhp.colostate.edu/cwic/)) are natural processes that continue regardless of their perceived value to humans (Novitzki et al. 1996). These functions include:

- Water storage;
- Nutrient uptake, transformation, retention and supply;
- Growth of living matter; and
- Supporting aquatic and terrestrial plant and animal diversity.

Ecological services are the wetland functions that are valued by society (Millennium Ecosystem Assessment 2005). For example, biogeochemical (carbon, nitrogen, phosphorus, etc.) cycling (which includes retention and supply) is an ecological function whereas nutrient removal/retention is an ecological service to society. Overbank flooding and subsurface water storage are ecological functions, whereas flood attenuation is an important ecological service. Aside from regulatory protection, ecological services are the primary factor in determining whether a wetland remains intact or is converted for some other use (National Audubon Society 1993). The actual value attached to any given function or service listed above depends on the needs and perceptions of society (National Research Council 1995).

#### 3.5a Wetland Condition Assessment

For the Lake County Biological Survey and past county survey and assessment projects, CNHP utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP wetland ecologists using NatureServe Conservation Status Assessments (Faber-Langendoen et al. 2012). This assessment utilizes indicators to estimate and/or measure the condition of biotic and abiotic processes as well as landscape integrity and wetland size to assess ecosystem integrity. Factors used to assess ecological integrity will be threats e.g., hydrologic modifications (e.g. ditches, dikes, riprap, etc.), current and historical land use in the wetland (e.g. none, irrigation water source, grazing, etc.), and nutrient enrichment, exotic plants, and fragmentation.

Condition assessments are ‘holistic’ in that they consider ecological integrity to be an “integrating super-function” (Fennessy et al. 2004). Condition assessments or ecological integrity assessments provide insight into the integrity of a wetland’s natural ecological functions that are directly related to the underlying integrity of biotic and abiotic processes. In other words, a wetland with excellent ecological integrity will perform all of its functions at full levels expected for its wetland class or type. Ecological integrity assessments are simply concerned with measuring the condition of the wetland and assume that ecological functions follow a similar trend. This assumption may not be true for all functions, especially ecological services or those functions which provide specific societal value. For example, ecological services such as flood abatement or water quality improvement may still be performed even if ecological integrity has been compromised. However, given that one of CNHP’s project goals was to identify and prioritize ecologically significant wetlands, it is more appropriate to focus the assessment on ecological integrity or condition of each wetland rather than specific ecological functions, services, or values.

The element occurrence rank (see Methodology Section, Table 5) used by CNHP is a rapid assessment of the condition of on-site and adjacent biotic and abiotic processes that support and maintain the element. This method was used to assess wetland condition for this report. Recently, NatureServe and CNHP (Faber-Langendoen et al. 2005) revised this method making it more transparent and repeatable.

## 3.6 Wetland Mapping in Colorado

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### 3.6a National Wetland Inventory Maps

In the late 1970s, the U.S. Fish and Wildlife Service began an inventory of the extent and types of the nation's wetlands. Basic mapping units for the U.S. National Wetlands Inventory (NWI) were provided by the Cowardin et al. (1979) classification system. Photo-interpretation and field reconnaissance were used to refine wetland boundaries according to the Cowardin wetland classification system. In Colorado, maps east of the 106<sup>th</sup> parallel were created using 1970s black and white aerial photography. Maps west of the 106<sup>th</sup> parallel were created in the early 1980s using color aerial photography. The majority of maps produced for Colorado, however, were created as paper maps and had to be digitized by CNHP to be used in a GIS format. Converting existing NWI maps for Lake County from paper to digital data was conducted as part of a previous project, Arkansas Headwaters NWI Mapping Report (<https://cnhp.colostate.edu/cwic/tools/mapper/>). The NWI maps for Lake County and the rest of Colorado can be accessed via CNHP's Colorado Wetland Information Center <https://cnhp.colostate.edu/cwic/profile/?GeoUnitID=137>. *The Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) describes ecological taxa, arranges them in a system useful to resource managers, furnishes units for mapping, and provides uniformity of concepts and terms. Ecological systems form the highest level of the classification hierarchy; five are defined for the United States—Marine, Estuarine, Riverine, Lacustrine, and Palustrine (non-tidal).

## 3.7 Wetland Restoration

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Over 50% of Colorado's historical wetlands have been lost or altered by drainage, flooding from water storage reservoirs, changing stream flow regimes (including dams and diversions), groundwater withdrawals, peat mining, gravel and mineral mining, historical (and recent) beaver trapping, and urban development. Finding wetlands that have been converted to uplands requires evaluation of soils, hydrology, geology, and ecological processes associated with wetland formation. Some degraded historical wetlands are relatively simple to restore, such as floodplains where beaver can be reintroduced, while others have significant economic, technical, policy, and/or land ownership barriers for restoration (like sites with extensive historical mining and associated tailings piles and water quality concerns). Often, restoration planners and practitioners must weigh the potential increase, or lift, in ecological functions from a proposed restoration project against the cost and technical feasibility of restoration activities.

In 2018, CNHP launched the Watershed Planning Toolbox (Marshall et al. 2018) (<https://cnhp.colostate.edu/cwic/tools/toolbox/>), a comprehensive resource for incorporating wetland and streams into watershed planning, restoring wetlands to improve watershed health,

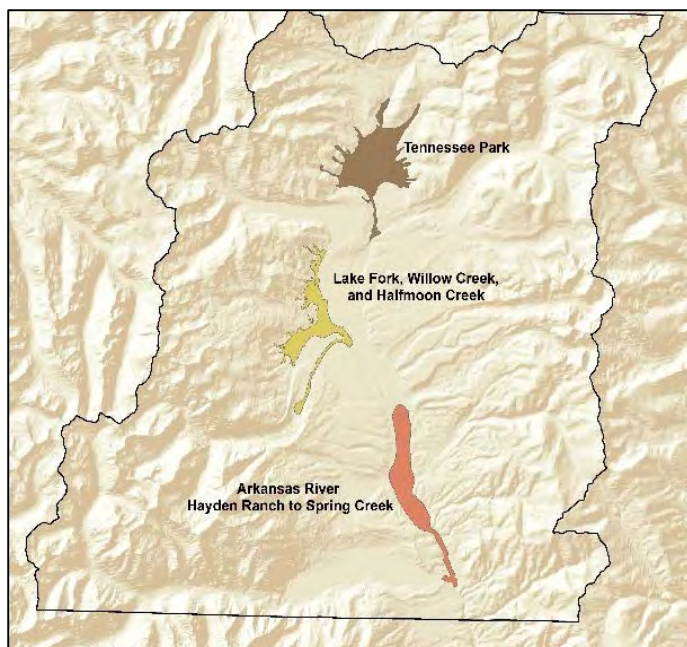


Figure 21. Wetland Focus Area Prioritized Restoration Projects .

and identifying opportunities for wetland conservation. Many Toolbox data layers have statewide coverage, while some more detailed layers for wetland functions and priority conservation and restoration areas are building out from the Arkansas Headwaters and Upper South Platte pilot area. The Toolbox includes an interactive mapping platform that allows users to view wetlands, streams, likely aquatic ecosystem functions, ecological stressors, and high-priority sites for conservation and restoration at the landscape scale (Marshall et al. 2018). The *Survey for Critical Biological Resources in Lake County* project capitalized on this project to assist in identifying target survey areas, as well as identifying key wetland areas for restoration or to be used as reference sites for restoration projects. The Arkansas Headwaters Wetland Focus Area Committee identified three priority restoration areas in Lake County:

Tennessee Park, the Lake Fork, Willow Creek and Halfmoon Creek drainages, and the Arkansas River and adjacent wetlands from Hayden Ranch to Spring Creek (Figure 21).

### 3.8 Wetland Regulation in Colorado

Wetlands in Colorado are currently regulated under the Section 404 of the Clean Water Act (US EPA 1972). A permit issued by the Corps is required before placing fill in a wetland and before dredging, ditching, or channelizing a wetland. The Clean Water Act exempts certain filling activities, such as normal agricultural activities or ditch clearing.

The 404(b) (1) guidelines, prepared by the Environmental Protection Agency in consultation with the Corps, are the federal environmental regulations for evaluating projects that will impact wetlands. Under these guidelines, the Corps is required to determine if alternatives exist for minimizing or eliminating impacts to wetlands. When unavoidable impacts occur, the Corps requires mitigation of the impacts. Mitigation may involve creation or restoration of similar wetlands in order to achieve an overall goal of no net loss of wetland area.

Colorado's state government has developed no additional guidelines or regulations concerning the management, conservation, and protection of wetlands, however a few county and municipal governments, including the City and County of Boulder, Summit County, and San Miguel County have more stringent regulations. For more information please see <https://cnhp.colostate.edu/cwic/work/regulation/>



## 4.0 POTENTIAL IMPACTS TO BIOLOGICAL DIVERSITY IN LAKE COUNTY

General threats that may affect biodiversity on a large, landscape-level scale in Lake County are summarized below. We understand that the issues discussed below are often important parts of a healthy economy and contribute to the well-being of our society. We mention these general “impacts to biodiversity” with the hope that good planning can minimize the impacts where critical habitat resides and that county residents can continue to benefit from the functions and services provided by intact uplands and wetlands.

### 4.0a Climate Change

Data from the Intergovernmental Panel on Climate Change (IPCC) (Ray et al. 2008), the Climate Change Vulnerability Assessment for Colorado (CNHP 2015), and the Colorado Climate Plan (CWCB 2018) clearly show that our Colorado climate will not be the same as it has been in the past 100 years. Climate models project that Colorado will warm by 2.5°F to 5°F by 2050. The projections show summers warming more (+5°F) than winters (+3°F) and suggest that typical summer temperatures in 2050 will be as warm as or warmer than the hottest 10% of summers that occurred between 1950 and 1999; from 1957 to 2006, the average year-round temperatures in the upper Arkansas River basin have increased by 2°F (Ray et al. 2008). The IPCC primary conclusions are: temperatures are increasing and will continue to increase; there is uncertainty with regard to precipitation projections; even with no change in precipitation, temperature increases alone will lead to a decline in runoff for most of Colorado’s river basins by the mid-21<sup>st</sup> century; synthesis of findings suggests a reduction in total water availability by the mid-21<sup>st</sup> century; and that a warming climate increases the risk to Colorado’s water supply even if precipitation remains at historical levels. Wetlands, especially alpine and ephemeral wetlands, are vulnerable to climate change due to the variable hydroperiods that will be exaggerated with global shifts in rainfall and temperature patterns (Dalu et al. 2017). Lake County wetlands are particularly vulnerable to forecasted climate change impacts like decreased snowpack, earlier spring snowmelt, and summer drought.

### 4.0b Drought

Lake County, and the entire state of Colorado, experience a prolonged drought in 2018. The 2018 water year (November 2017 - Oct. 2018) was the third warmest on record, behind 1934 and 2000, at about 3.6°F above the yearly average of 47.1°F (U.S. Drought Monitor 2018) (Figure 22). Lake County experienced a low snowpack and low summer precipitation during the summer of 2018.

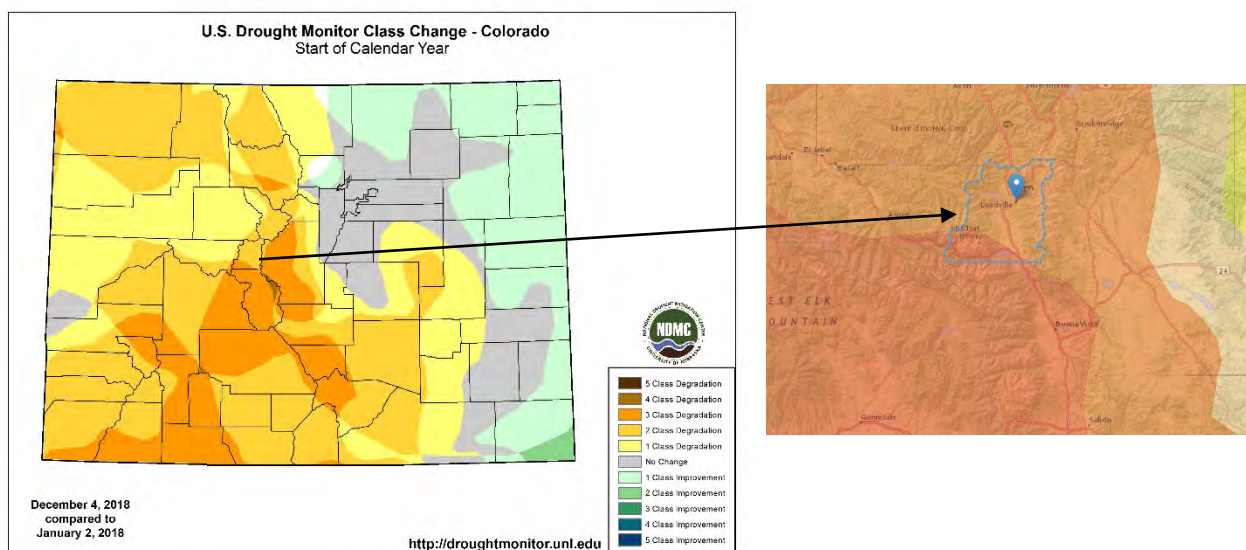


Figure 22. Drought Class Change for Colorado (www.drought.gov).

Many areas (including beaver complexes) that support high biodiversity also provide refugia for wetland obligate aquatic and terrestrial species, which allow species to persist and relocate/ disperse as needed during droughts or other extreme climate or disturbance events (e.g., Gregory et al. 1991). In areas with extensive bare ground, or where vegetation has been heavily grazed, stressed by heat or drought, or is dominated by shallow-rooted annual plant species, functions like the capacity of a wetland to capture and retain sediment will likely be reduced.

#### 4.0c Hydrological Impacts (adapted from Winchester 2001)

Lake County is historically one of the most heavily mined regions in the world producing large quantities of minerals, but water has become its most precious commodity (Figure 22). In 1890s, most of the upper Arkansas River's water was appropriated and decreed under Colorado Water Law. There are three major water storage projects (Table 4) and seven transmountain diversions in Lake County.

**Table 4. Major Storage Projects within Lake County.**

Reservoir	Normal Storage (AF)
Twin Lakes	141,000
Turquoise Reservoir	129,440
Mount Elbert Forebay	11,530

1. Arkansas Well (Stevens and Leiter Ditch) is owned by Climax Mine and diverts water from the East Slope to the West Slope. The Leadville Water Company use 38 cfs for municipal use and Leadville smelters. In 1964, 5.4 cfs was changed to industrial use for the Climax Mine. The pipeline is located at the headwaters of the East Fork of the Arkansas River, below Fremont Pass

2. Columbine Ditch diverts water from the headwaters of the East Fork of the Eagle River into Chalk Creek, to the west of Fremont Pass. The ditch was built in 1931 for irrigation water by the Pueblo Board of Water Works.

3. Ewing Ditch diverts water from Piney Creek, an Eagle River tributary, over Tennessee Pass and into Tennessee Creek. The ditch is 1.5 miles long and was constructed in 1880, making it the oldest transbasin diversion into the Arkansas River. The Ewing Ditch was purchased by Pueblo Board of Water Works in 1955.

4. Wurtz Ditch diverts water from the South Fork of the

Eagle River into Tennessee Creek. The Wurtz Ditch was constructed in 1929 to provide irrigation for agricultural purposes. When the Pueblo Board of Water Works purchased the ditch in 1938, the decreed use was converted from agricultural to municipal use.

5. The Homestake Project diverts water from the headwaters of the Eagle River into Turquoise Lake via the Homestake Tunnel at Lake Fork. Water is then moved to Twin Lakes Reservoir through the Mount Elbert conduit and power plant to Aurora and Colorado Springs.

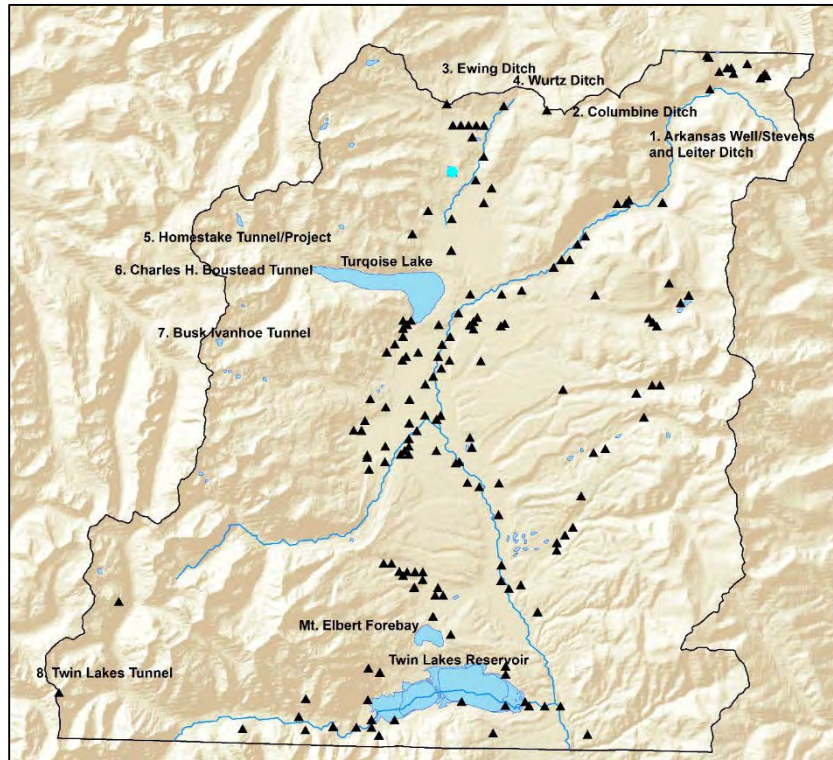


Figure 22. Ditches and Wells with Water Diversion Tunnels.



Mount Elbert Forebay.



6. Charles H. Boustead Tunnel or the Divide Tunnel transports water from the Fryingpan River under the Continental Divide to Turquoise Reservoir as part of the Fryingpan—Arkansas Project or Fry-Ark. The Fry-Ark, is a water diversion, storage, and delivery project that delivers water from the West Slope to southeastern Colorado for agriculture, hydroelectric power generation and to enhance recreation. The project was authorized 1962 by President Kennedy and was completed in 1981. It is one of Colorado's largest reclamation projects, second only to the Colorado-Big Thompson. The project required six storage dams, 17 diversion dams and structures, hundreds of miles of combined canals, conduits, tunnels, and transmission lines (Rogers 2006). The Ruedi Reservoir, located in Pitkin County, stores water from the Fryingpan River that is then transported underneath the Continental Divide for 5.5 miles through the Charles H. Boustead Tunnel into Turquoise Lake, which is impounded by Sugar Loaf Dam. Water is conveyed via the Mount Elbert Conduit, which runs nearly 11 miles to the Mount Elbert Forebay. Water is stored in the forebay to build up energy before it is released into the hydroelectric Mount Elbert Powerplant, the largest hydroelectric power plant in the State. The Mount Elbert Pumped-Storage Powerplant, a 13-story facility, with 12 stories built underground, is located at Twin Lakes. Water is pumped back to the forebay to generate electricity. Water exiting the power plant helps to fill Twin Lakes Reservoir, a natural lake that was enlarged and impounded by the Twin Lakes Dam (Rogers 2006).
7. Busk-Ivanhoe Tunnel or the Carlton Tunnel was originally built as a railroad tunnel. The tunnel diverts water from the headwaters of Ivanhoe Creek, Fryingpan River tributary, to Turquoise Reservoir. The Pueblo Board of Water Works purchased half of water in 1971.
8. Twin Lakes Tunnel is a collection and delivery system constructed in the 1930s to serve irrigation use for Crowley County, located in the lower Arkansas River watershed. Water is diverted from Grizzly Reservoir, part of the Roaring Fork River. Water flows under the Continental Divide through the Twin Lakes Tunnel, located at Independence Pass into the North Fork Lake Creek. Colorado Springs owns 54% of the Twin Lakes Reservoir and Canal Company with the remaining shares held by the Pueblo Board of Water Works, Pueblo West, and Aurora.



Boustead Tunnel discharges into and fills Turquoise Reservoir (U.S. Bureau of Reclamation).

The proposed Box Creek Reservoir, located to the north of Mount Elbert Forebay, is owned by the City of Aurora. The dam has a proposed height of 170 feet, total storage of 25,000 acre-feet and a crest length of 3,272 feet. Permitting for the project is expected to take 10 to 15 years, and construction is not likely to begin before 2035 (Herald Democrat 2018).



#### 4.0d Mining Impacts

Mining, mineral processing and smelting activities in Lake County have produced gold, silver, lead and zinc for more than 130 years. Wastes generated during the mining and ore processing activities contained metals such as arsenic and lead at levels posing a threat to human health and the environment. The wastes that remained on the land surface have migrated through the environment by washing into streams and leaching contaminants into surface water and groundwater. The California Gulch Superfund Site encompasses more than 18 square miles, including the town of Leadville. It contains more than 2,000 waste piles, as well as the Yak Tunnel which discharges drainage from numerous underground mines into California Gulch (US EPA 2018).

Proposed Box Creek Reservoir.

The California Gulch site was added to the U.S. Environmental Protection Agency National Priorities List in 1983. Investigation of the site began in the mid-1980s. Since 1995, the EPA and the potentially responsible parties have conducted removal and remedial activities to consolidate, contain and control more than 350,000 cubic yards of contaminated soils, sediments and mine-processing wastes. Cleanups by the potentially responsible parties have involved drainage controls to prevent acid mine runoff, consolidation and capping of mine piles, cleanup of residential properties and reuse of slag. As of September 2011, most of the cleanup had been completed so current risk of exposure is thought to be low, although pregnant women, nursing mothers and young children using drinking water in the area are still encouraged to have their blood-lead levels checked (Stratus Consulting Inc. 2010).



Superfund clean-up in California Gulch involved capturing run-off and channeling it away from mine waste piles.

#### 4.0e Livestock Grazing

Domestic livestock grazing has been a traditional livelihood in Lake County and a majority of the West since the mid-1800s, and has left a broad and sometimes subtle impact on the landscape. For some species and ecosystems, properly managed grazing can be a compatible activity. However, some range management practices can adversely affect the region's biological resources. Many

riparian areas in Lake County are included in rangeland and grazing allotments. Especially along the Arkansas River and its tributaries, livestock tend to congregate near wetland and riparian areas for shade, lush browse, and access to water. Long-term, incompatible livestock use of wetland and riparian areas can potentially erode stream banks, cause streams to down cut or spread out of an established channel causing additional erosion, lower the water table, alter channel morphology, impair plant regeneration, establish non-native species, shift plant community structure and composition, degrade water quality, and diminish general riparian and wetland functions (Windell et al. 1986). Depending on grazing practices and local environmental conditions, impacts can be minimal and largely reversible (slight shifts in species composition) to severe and essentially irreversible (extensive gullying and introduction of non-native species).

#### **4.0 f Recreation**

Recreation, once very local and perhaps even unnoticeable, is increasing and becoming a threat to natural ecosystems in Lake County and throughout Colorado. Different types of recreation (e.g., motorized versus non-motorized activities) typically have different effects on ecosystem processes. All-terrain vehicles can disrupt migration and breeding patterns, and fragment habitat for native resident species. This activity can also threaten rare plants and intact habitats found in forested and non-forested areas. ATVs have also been identified as a vector for the introduction of non-native plant species and a cause of soil erosion that smothers vegetation and results in excessive sedimentation in streams.

Non-motorized recreation, mainly hiking but also some horseback riding, mountain biking and rock climbing, presents a different set of issues (Knight and Cole 1991; Miller et al. 1998). Wildlife behavior can be significantly altered by repeat visits of hikers, horseback riders, or bicyclists. Trail placement should consider the range of potential impacts on the ecosystem. Considerations include minimizing fragmentation by leaving large undisturbed areas of wildlife habitat where possible. Miller et al. (1998) found lower nest survival for ground-nesting birds adjacent to trails; they also found that ground-nesting birds were more likely to nest away from trails with a zone of influence approximating 250 feet (75 meters). Alpine areas, mountain lakes, and riparian zones are routes and destinations for many established trails. Thus, impacts to native vegetation (mainly trampling) in these areas can be high.



Truck observed on Mosquito Pass parked on alpine turf.



## 5.0 METHODS

The methods for assessing and prioritizing conservation needs over a large area, such as a county, are necessarily diverse. CNHP follows a general method that is continuously being developed specifically for this purpose. *The Survey for Critical Biological Resources in Lake County* was conducted in several steps summarized below. Additionally, input from Lake County and its stakeholders was sought at all stages.

### 5.1 Survey Methods

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#### 5.1a Collect Available Information

CNHP databases were updated with information regarding the known locations of species and significant plant associations within Lake County. A variety of information sources were searched for this information including the Colorado State University, University of Colorado, and Rocky Mountain herbaria. Both general and specific literature sources were incorporated into CNHP databases, either in the form of locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage elements. Such information covers basic species and community biology including range, habitat, phenology (reproductive timing), food sources, and substrates. This information was entered into CNHP's Biodiversity Tracking and Conservation System (BIOTICS).

#### 5.1b Identify rare or imperiled species and significant plant associations with potential to occur in Lake County

The information collected in the previous step was used to refine a list of potential species and natural plant communities and to focus our search areas. Species and plant communities that have been recorded from Lake County or from adjacent counties are included in this list. Over 30 rare species and significant plant communities were targeted in this survey. A specific subset of species and communities were prioritized for our inventory efforts. Elements considered as priority included those with NatureServe global rankings of critically imperiled to vulnerable (G1—G3) and/or because they are known to occur in areas that are subject to various development pressures such as hydrological alterations and residential development.

#### 5.1c Identify Targeted Inventory Areas

Survey sites were chosen based on their likelihood of harboring rare or imperiled species or significant plant communities (see Results, Figure 23). Previously documented locations of species of concern were targeted, and additional potential areas were chosen using available information sources. Areas with potentially high natural values were selected using soil surveys, geology maps, vegetation surveys, aerial photos (color-infrared and natural color), personal recommendations from knowledgeable local residents, community stakeholders, and numerous roadside surveys by our field scientists. Using the biological information stored in the CNHP databases, areas having the highest potential for supporting specific elements were identified. Those chosen for survey sites appeared to be in the most natural condition. In general, this means those sites that are the largest,

least fragmented, and relatively free of visible disturbances such as roads, trails, fences, and quarries.

Roadside surveys were useful in further resolving the natural condition of these areas. The condition of shrublands is especially difficult to discern from aerial photographs, and a quick survey from the road can reveal such aspects as weed cover or vegetation composition. Because there were limited resources to address an overwhelming number of potential sites, surveys for all elements were prioritized by the degree of imperilment. For example, the species with Natural Heritage Program ranks of G1-G3 were the primary target of our inventory efforts. Although species with lower Natural Heritage Program ranks were not the main focus of inventory efforts, many of these species occupy similar habitats as the targeted species, and were searched for and documented if encountered.

#### **5.1d Contact Landowners**

Obtaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using GIS land ownership coverage obtained from the Lake County assessor's office or stakeholders. Landowners were then either contacted by phone or in person. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were private properties surveyed without landowner permission.**

#### **5.1e Conduct Field Site Surveys and Gather Data**

Survey sites where access could be obtained were visited at the appropriate time as dictated by the seasonal occurrence (or phenology) of the individual elements. It was essential that surveys took place during a time when the targeted elements were detectable. For instance, plants are often not identifiable without flowers or fruit that are only present during certain times of the year or breeding birds cannot be surveyed outside of the breeding season because they are most visible in breeding plumage and are easier to spot when singing to attract mates. Amphibians are best surveyed in spring when adults are calling and mating, in mid-summer when tadpoles are out and adults are still active and in late summer when metamorphs are present. The methods used in the surveys vary according to the elements that were being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion that would attempt to cover the area as thoroughly as possible in the given time. Where necessary and permitted, voucher specimens were collected and deposited in university museums and herbaria.

When a rare species or significant plant community was discovered, its precise location and known extent was recorded with a global positioning system (GPS) unit. Other data recorded at each occurrence include numbers observed, breeding status, habitat description, disturbance features, observable threats, and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the size of the population or community, the condition or naturalness of the habitat, and the landscape context (its connectivity and its ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the following section on Natural Heritage Program Methodology for more about element occurrence ranking.

## 1. **Animal surveys data collection**

Surveys varied according to the animal that was being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion, attempting to cover the area as thoroughly as possible in the given time. Some types of organisms require special techniques to document their presence. These are summarized below followed by specific reference sources:

- Amphibians: visual observation, vocal surveys, and capture using aquatic dip nets (Hammerson 1999)
- Birds: visual observation or identification by song or call (Kingery 1998, Andrews and Righter 1992, National Geographic Society 2006)
- Invertebrates: sweep netting (Opler et al. 2009, Scott 1986)

## 2. **Plant and plant community data collection**

- Lists of all plant associations in the survey area, including the percent cover by that community. In almost all cases, plant associations were immediately placed within both the International National Vegetation Classification (Anderson et al. 1998; Comer et al. 2003) and the Comprehensive Statewide Wetlands Classification (Carsey et al. 2003). Plant synonyms followed Kartesz (1999).
- Vegetation data using Ackerfield (2015) and Weber and Wittman (2001) for each major plant association in the wetland were collected using visual ocular estimates of species cover in a representative portion of the plant association.
- Soil description.
- Water chemistry.
- UTM coordinates and elevation from Garmin GPSmap 76CSx.
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent.
- Notes on geology and geomorphology.
- Reference photos of the site.
- Notes on indicators of disturbance such as logging, grazing, flooding, etc.



## 5.1f **Natural Heritage Methodology**

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 complete description of each of the Natural Heritage ranks is provided in Table 4.

This single rank system works readily for all species except those that are migratory. 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 3, 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 5. Definition of Natural Heritage Imperilment Ranks.**

<b>G/S1</b>	<b>Critically imperiled</b> -at very high risk of extinction due to extreme rarity (often 5 or fewer occurrences) in the world/statewide, very steep declines, or other factors.
<b>G/S2</b>	<b>Imperiled</b> - at high risk of extinction or elimination globally/statewide because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals) due to very restricted range, very few populations, steep declines, or other factors.
<b>G/S3</b>	<b>Vulnerable</b> -at moderate risk of extinction or elimination through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
<b>G/S4</b>	<b>Apparently secure</b> globally/statewide, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
<b>G/S5</b>	<b>Secure</b> -common; widespread and abundant globally/statewide, though it may be quite rare in parts of its range, especially at the periphery.
<b>G/SX</b>	<b>Presumed extinct</b> (species)/ <b>Eliminated</b> (ecological communities) globally, or extirpated within the state.
<b>G#?</b>	Indicates uncertainty about an assigned global rank.
<b>G/SU</b>	Unable to assign rank due to lack of available information.
<b>GQ</b>	Indicates uncertainty about taxonomic status.
<b>G/SH</b>	<b>Possibly Extinct</b> (species)/ <b>Eliminated</b> (ecological communities) known from only historically occurrences but still hope of rediscovery.
<b>G#T#</b>	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
<b>S#B</b>	Refers to the breeding season imperilment of elements that are not residents.
<b>S#N</b>	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.

<b>SZ</b>	Migrant whose occurrences are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.
<b>SA</b>	Accidental in the state.
<b>SR</b>	Reported to occur in the state but unverified.
<b>S?</b>	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 5 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

**Table 6. Federal and State Agency Special Designations for Rare Species.**

<b>Federal Status:</b>	
<b>1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996):</b>	
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.
<b>2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as “S”):</b>	
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.
<b>3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as “S”):</b>	
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.
<b>4. State Status:</b>	
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 the most viable ecologically, 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 factors such 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 and D representing a poor rank. These ranks 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 6.



**Table 7. Element Occurrence Ranks and their Definitions.**

<b>A</b>	Excellent viability.
<b>B</b>	Good viability
<b>C</b>	Fair viability.
<b>D</b>	Poor viability.
<b>H</b>	Historic: known from historical record, but not verified for an extended period of time.
<b>X</b>	Extirpated (extinct within the state).
<b>E</b>	Extant: the occurrence does exist but not enough information is available to rank.
<b>F</b>	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). PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence. 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 CNHP's 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 7 for a summary of these B-ranks.

**Table 8. Natural Heritage Program Biological Diversity Ranks and their Definitions.**

<b>B1</b>	Outstanding Significance (indispensable): <ul style="list-style-type: none"><li>• only known occurrence of an element</li><li>• A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence)</li><li>• concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)</li></ul>
<b>B2</b>	Very High Significance: <ul style="list-style-type: none"><li>• B- or C-ranked occurrence of a G1 element</li><li>• or B-ranked occurrence of a G2 element</li><li>• One of the most outstanding (for example, among the five best) occurrences range wide (at least A- or B-ranked) of a G3 element.</li><li>• Concentration of A- or B-ranked G3 elements (four or more)</li><li>• Concentration of C-ranked G2 elements (four or more)</li></ul>
<b>B3</b>	High Significance: <ul style="list-style-type: none"><li>• C-ranked occurrence of a G2 element</li><li>• or B-ranked occurrence of a G3 element</li><li>• D-ranked occurrence of a G1 element (if best available occurrence)</li><li>• 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)</li></ul>
<b>B4</b>	Moderate Significance: <ul style="list-style-type: none"><li>• Other A- or B-ranked occurrences of a G4 or G5 community</li><li>• C-ranked occurrence of a G3 element</li><li>• 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)</li><li>• Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more)</li><li>• D-ranked occurrence of a G2 element</li><li>• At least C-ranked occurrence of a disjunct G4 or G5 element</li></ul>
<b>B5</b>	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 occur. 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 8 summarizes the P-ranks and their definitions.

**Table 9. Natural Heritage Program Protection Urgency Ranks and their Definitions**

<b>P1</b>	Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.
<b>P2</b>	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.
<b>P3</b>	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.
<b>P4</b>	No protection actions are needed in the foreseeable future.
<b>P5</b>	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 PCA. Table 9 summarizes M-ranks and their definitions.



**Table 10. Natural Heritage Program Management Urgency Ranks and their Definitions.**

<b>M1</b>	Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
<b>M2</b>	New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
<b>M3</b>	New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
<b>M4</b>	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.
<b>M5</b>	No management needs are known or anticipated in the PCA.

### **5.1g Fen Mapping**

Potential fens in Lake County were identified by analyzing digital aerial photography and topographic maps. True color aerial photography taken by the National Agricultural Imagery Program (NAIP) in 2012 were used in conjunction with color-infrared imagery from 2001, 2019, and 2015. High (but variable) resolution World Imagery from Environmental Systems Research Institute (ESRI) was also used. To focus the initial search, all wetland polygons mapped by the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) program in the early 1980s with a "B" (saturated) hydrologic regime were isolated from the full NWI dataset and examined.<sup>1</sup> Wetlands mapped as Palustrine Emergent Saturated (PEMB) and Palustrine Scrub-Shrub Saturated (PSSB) were specifically targeted, as they can be the best indication of fen formation, and every PEMB and PSSB polygon in the study area was checked. However, photo-interpreters were not limited to the original NWI polygons and also mapped any fens they observed outside of B regime NWI polygons.

Potential fen polygons were hand-drawn in ArcGIS 10.4 based on the best estimation of fen boundaries. In most cases, this did not match the exact boundaries of the original NWI polygons because the resolution of current imagery is far higher than was available in the 1980s. The fen polygons were often a portion of the NWI polygon or were drawn with different, but overlapping boundaries. This will provide Lake County's stakeholders the most accurate and precise representation of fens in the Forest, as opposed to estimates based on the NWI polygons themselves. Each potential fen polygon was attributed with a confidence value of 1, 3 or 5 (Table 11). In addition to the confidence rating, any justifications of the rating or interesting observations were noted, including impoundments, beaver influence, floating mats and springs. On-the-ground fen surveys followed USDA methodology for Level I inventories (USDA 2012).

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<sup>1</sup> For more information about the National Wetland Inventory and the coding system, please visit: <http://www.fws.gov/wetlands/>

**Table 11. Description of potential fen confidence levels.**

<b>Confidence</b>	<b>Description</b>
<b>5</b>	<b>Likely fen.</b> Strong photo signature of fen vegetation, fen hydrology, and good landscape position. All likely fens should contain peat of 40cm or more throughout the entire area of the mapped feature.
<b>3</b>	<b>Possible fen.</b> Some fen indicators present (vegetation signature, topographic position, ponding or visibly saturated substrate), but not all indicators present. Some may be weak or missing. Possible fens may or may not have the required peat depth of 40cm, but may have patchy or thin peat throughout.
<b>1</b>	<b>Low confidence fen.</b> At least one fen indicator present, but weak. Low confidence fens are consistently saturated areas that do not show peat signatures in the aerial photography, but may contain fen or peat.





## 6.0 RESULTS

Results of the 2017-18 survey of Lake County confirm that there are many critical natural resources with biological significance. Prior to the summer field seasons, CNHP identified a total of 120 Targeted Inventory Areas (TIAs) (Figure 23). CNHP surveyed 56 TIAs or 47%. Survey efforts were prioritized by private ownership, last observed date, and access. Many of the TIAs, especially identified for rare alpine plants, were either difficult to access or had likely been visited, within the past five years, by other researchers.

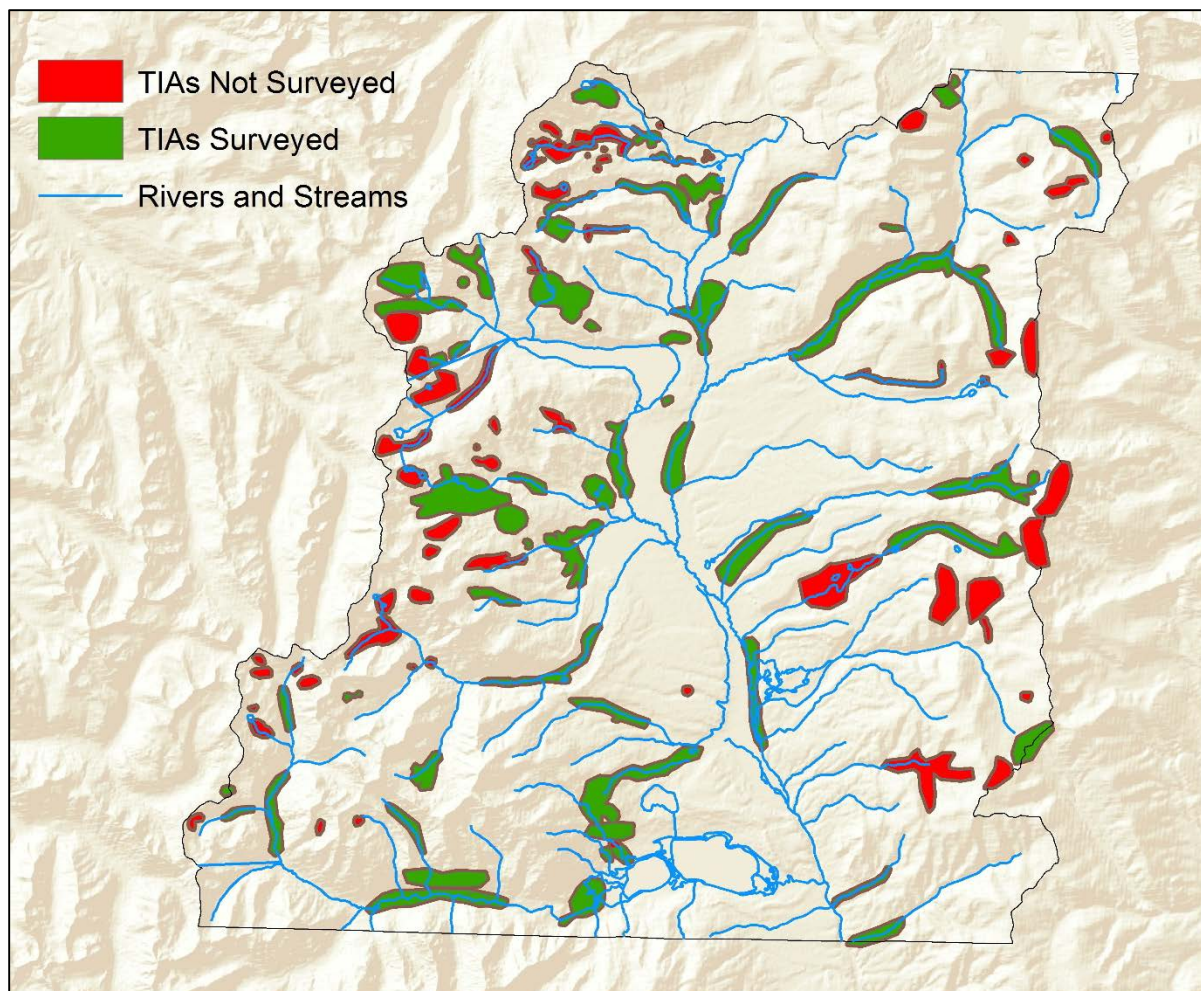


Figure 23. Target Inventory Areas Results.

A total of 41 new element occurrences (10 zoology, 13 ecology, and 18 botany) were documented and 37 element occurrences were updated (7 zoology, 13 ecology, and 17 botany). CNHP biologists documented or updated 42 rare or imperiled plants, 8 rare or imperiled animals, and 23 plant community occurrences (Table 12). This is not a comprehensive list of all elements of biological significance known to occur in Lake County, but rather only includes those elements associated with PCAs that are significant enough to be archived in CNHP's Biodiversity Tracking and Conservation Data System (BIOTICS).



**Table 12. List of Significant Animal and Plant Species and Plant Communities for Lake County.**

Scientific Name	Common Name	Global Rank	State Rank	USESA, Federal Sensitive	New Record	Updated Record	Updated and New Record
<b>AMPHIBIANS</b>							
<i>Anaxyrus boreas</i> pop. 1	Western Toad - Southern Rocky Mountains	G4T1Q	S1	USFS	X		
<b>BIRDS</b>							
<i>Accipiter gentilis</i>	Northern Goshawk	G5	S3B	BLM, USFS		X	
<i>Lagopus leucura</i>	White-tailed Ptarmigan	G5	S4	USFS			X
<i>Leucosticte australis</i>	Brown-capped Rosy-finch	G4	S3B, S4N	X			
<b>INSECTS</b>							
<i>Oeneis polixenes</i>	Polixenes Arctic	G5	S3		X		
<b>MAMMALS</b>							
<i>Corynorhinus townsendii pallescens</i>	Townsend's Big-eared Bat ssp	G3G4T3T4	S2		X		
<i>Lynx canadensis</i>	Lynx	G5	S1	LT			X
<b>MOLLUSKS</b>							
<i>Lymnaea stagnalis</i>	Swamp Lymnaea	G5	S2				X
<b>PLANT COMMUNITIES</b>							
<i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> / <i>Salix drummondiana</i> Forest	Subalpine fir-Engelmann spruce/ Drummond's willow Forest	G5	S4			X	
<i>Betula glandulosa</i> / <i>Sphagnum</i> spp. Shrub Fen	Bog birch/Sphagnum shrub fen	G2	S2		X		
<i>Cardamine cordifolia</i> - <i>Mertensia ciliata</i> - <i>Senecio triangularis</i> Herbaceous	Heartleaf bittercress-bluebell-arrowleaf ragwort Herbaceous Vegetation	G4	S4			X	

Scientific Name	Common Name	Global Rank	State Rank	USESA, Federal Sensitive	New Record	Updated Record	Updated and New Record
<i>Carex aquatilis</i> Herbaceous Vegetation	Water sedge Herbaceous Vegetation	G5	S4			X	
<i>Carex aquatilis</i> - <i>Sphagnum</i> spp. Fen	Water sedge- <i>Sphagnum</i> Fen	G2G3	S2S3		X		
<i>Carex simulata</i> Fen	Analogue sedge Fen	G4	S3		X		
<i>Carex utriculata</i> Herbaceous Vegetation	Beaked sedge Wet Meadow	G5	S4			X	
<i>Eleocharis quinqueflora</i> Fen	Fewflower spikerush	G4	S4		X		
<i>Populus angustifolia</i> / <i>Salix (monticola, drummondiana, lucida)</i> Riparian Forest	Narrowleaf cottonwood / Mixed willow Riparian Forest	G3	S2		X		
<i>Populus balsamifera</i> Forest	Balsam poplar Forest	GU	S2		X		
<i>Salix drummondiana</i> / Mesic Forbs Shrubland	Drummond's willow/ Mesic Forbs Shrubland	G4	S4			X	
<i>Salix geyeriana</i> / Mesic graminoides Wet Shrubland	Geyer willow / mesic grasses Wet Shrubland	G3?	S2		X		
<i>Salix geyeriana</i> - <i>Salix monticola</i> / Mesic Forbs Shrubland	Geyer willow - Rocky Mountain willow / Mesic Forbs Shrubland	G3	S3			X	
<i>Salix geyeriana</i> / <i>Carex aquatilis</i> Shrubland	Geyer willow / water sedge Shrubland	G3	S2			X	
<i>Salix geyeriana</i> - <i>Salix monticola</i> / Mesic Forbs Wet Shrubland	Geyer willow - Rocky Mountain willow / mesic forbs wet shrubland	G3	S3		X		
<i>Salix ligulifolia</i> Shrubland	Strap-leaf willow Shrubland	G2G3	S3			X	

Scientific Name	Common Name	Global Rank	State Rank	USESA, Federal Sensitive	New Record	Updated Record	Updated and New Record
<i>Salix monticola</i> / <i>Carex utriculata</i> Shrubland	Rocky Mountain willow / beaked sedge Shrubland	G3	S3			X	
<i>Salix monticola</i> / Mesic Graminoids Wet Shrubland	Rocky Mountain willow / mesic grasses shrubland	G3	S3		X		
<i>Salix planifolia</i> / <i>Caltha leptosepala</i> Shrubland	Planeleaf willow / marsh marigold Shrubland	G4	S4			X	
<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	Planeleaf willow / water sedge Shrubland	G5	S4		X		
<i>Salix wolfii</i> / <i>Carex aquatilis</i> Wet Shrubland	Wolf willow / water sedge wet shrubland	G4	S3		X		
<i>Salix wolfii</i> / <i>Carex utriculata</i> Wet Shrubland	Wolf willow / beaked sedge wet shrubland	G4	S1		X		
<i>Salix wolfii</i> / Mesic Forbs Wet Shrubland	Wolf willow / mesic forbs wet shrubland	G3	S3		X		
PLANTS							
<i>Aquilegia saximontana</i>	Rocky Mountain columbine	G3	S3				
<i>Astragalus leptaleus</i>	Park milkvetch	G3	S2	USFS	X		
<i>Astragalus molybdenus</i>	Leadville milkvetch	G3	S3				X
<i>Boechera crandallii</i>	Crandall's rockcress	G2	S2	BLM			
<i>Boechera oxylebula</i>	Glenwood Springs rockcress	G3	S3				
<i>Botrychium lineare</i>	Narrowleaf grapefern	G2G3	S2S3	USFS		X	
<i>Botrychium simplex</i>	Least grapefern	G5	S2				
<i>Braya humilis</i>	Low braya	G5	S2				
<i>Draba exunguiculata</i>	Clawless draba	G2	S2	USFS			
<i>Draba globosa</i>	Rockcress draba	G3	S1				



Scientific Name	Common Name	Global Rank	State Rank	USESA, Federal Sensitive	New Record	Updated Record	Updated and New Record
<i>Draba grayana</i>	Gray's Peak whitlow-grass	G2	S2	USFS			
<i>Draba oligosperma</i>	Few-seed-whitlow grass	G5	S2				
<i>Draba streptobrachia</i>	Colorado Divide whitlow-grass	G3	S3				
<i>Draba ventosa</i>	Wind River whitlow-grass	G3	S1				
<i>Elatine rubella</i>	Southwestern water-wort	G5	S2		X		
<i>Equisetum variegatum</i>	Variegated scouring rush	G5	S1		X		
<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cotton-grass	G4?T3T4	S3	USFS	X		
<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		X	
<i>Gastrolychnis kingii</i>	King's campion	G2G4Q	S1			X	
<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			X	
<i>Kobresia simpliciuscula</i>	Simple bog sedge	G5	S2	USFS	X		
<i>Listera borealis</i>	Northern twayblade	G4	S2				
<i>Lomatogonium rotatum</i>	Marsh felwort	G5	S2		X		
<i>Luzula subcapitata</i>	Colorado woodrush	G3	S3		X		
<i>Machaeranthera coloradoensis</i>	Colorado tansy-aster	G3	S3	USFS	X		
<i>Packera debilis</i>	Rocky Mountain ragwort	G5	S1		X		
<i>Phippsia algida</i>	Ice grass	G5	S2				
<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			X	
<i>Ptilagrostis porterii</i>	Porter's feathergrass	G2	S2	USFS			X
<i>Ranunculus gelidus</i>	Tundra buttercup	GNR	S1S2				
<i>Salix candida</i>	Hoary Willow	G5	S2	USFS		X	
<i>Saussurea weberi</i>	Weber's Saw-wort	G2G3	S2			X	
<i>Sisyrinchium pallidum</i>	Pale blue-eyed grass	G3	S2	BLM	X		

Scientific Name	Common Name	Global Rank	State Rank	USESA, Federal Sensitive	New Record	Updated Record	Updated and New Record
<i>Stipa (Achnatherum) richardsonii</i>	Canada mountain ricegrass	G5	S1				X
<i>Townsendia rothrockii</i>	Rothrock townsend daisy	G2G3	S2S3			X	
<i>Utricularia minor</i>	Lesser bladderwort	G5	S2	USFS	X		

## 6.1 Floristic Results

Lake County supports 17 plant species known only from Colorado or the surrounding region. Included among this list of rare species is one federally listed threatened species, two BLM, and eight USFS sensitive species (Table 12). Of these rare plant species, CNHP documented one critically imperiled (G1) species and 10 globally imperiled (G2) plant species as well as, five plant species that are ranked as vulnerable both globally and statewide (G3S3) and five plants that are considered globally vulnerable and state rare (G3S2G3S1).

### 6.1a Globally Rare Plant Species (G1-G2)

Plant species that are given a Natural Heritage ranking of G1 or G2 are considered to be the rarest species because they are not only rare in the state they are rare on a global scale. G1 plants are considered to be critically imperiled based on a number of factors including rarity and vulnerability to extirpation or extinction. Typically, five or fewer occurrences or less than 1000 remaining individuals may define a G1 species. A G2 species is considered imperiled with six to 20 occurrences or between 1,000 and 3,000 remaining individuals (see CNHP methods section). There are ten globally rare plants known from Lake County and one includes a USFWS listed threatened species, Mosquito Range mustard.

### **Mosquito Range Mustard (*Eutrema penlandii*) (G1G2 rounded rank is G1) LT**

The Mosquito Range mustard is the only USFWS federally listed plant species currently known from Lake County and is currently considered to be the rarest species in the county. It is considered to be globally critically imperiled (G1 S1) and is only known from the State of Colorado. It is a tiny plant ranging in size from less than one quarter of an inch to six inches tall. It has two different shaped leaves (dimorphic) with tiny white flowers and elliptical fruits (Spackman et al. 1997). The habitat is moist alpine tundra in Lake, Park and Summit counties and more specifically, only along a 24 mile (40 Km) stretch of the Continental Divide above 12,000 feet where the divide runs east-west. This particular area contains a unique set of habitat conditions that are perennially wet, and calcareous. The CNHP database lists 23 records for this species with nine ranked as good or excellent occurrences and about half are in poor condition (D-rank) or historical (H-rank). Three populations are known from Lake County including one that straddles the border with Park County near Weston Pass. The other two are located to the north, one is near Ptarmigan Mountain and the other near Mount Arkansas. The Mount Arkansas population is on private land while the other two are on San Isabel National Forest land. The Mount Arkansas population was documented in 2012 by CNHP. This occurrence was ranked as having a fair to good (BC rank) viability supporting approximately 175 individuals within six mapped areas. No trespassing signs posted by Climax Mine likely deter some potential visitors to the site. Mines are present in the area, but none were observed at the immediate area occupied by Mosquito Range mustard. However, molybdenum mining occurs all over this area. The Weston Pass population is also ranked fair to good (BC rank). The Ptarmigan Peak population consists of only six individuals and is ranked as having poor estimated viability (D rank-BIOTICS 2018.)



Mosquito Range Mustard

All known occurrences in Colorado are in close proximity to mines and are threatened by mineral extraction activities, especially ditching, which is likely to alter the hydrology. In addition, the drainage from mine tailings could acidify the sites changing the chemistry of the soils. Recreational use and associated development are considered another significant threat. Currently, the threat level for the viability of this species is considered very high (NatureServe 2018).



### **Crandall's rockcress (*Boechea crandallii*) G2S2 BLM Sensitive**

Crandall's rockcress is a mustard species that is found in dry areas and is a bit larger than Mosquito Range mustard at heights regularly reaching about half of a foot. It is considered a regional endemic known from Colorado and Wyoming and is globally and state imperiled (G2S2). The first observation of this species in Lake County was in 2000 and the last observation was in 2008. It is found on limestone chip-rock and stony areas often among sagebrush, ridges and steep hill slopes. Roads are considered to be a major threat along with habitat loss, resource extraction and activities associated with recreation, grazing and new road development (CNHP BIOTICS 2018; Spackman et al. 1997).



Crandall's rockcress.

### **Clawless draba (*Draba exunguiculata*) G2 S2 USFS Sensitive**

Clawless draba, is a small plant that finds its home on rocky, gravelly slopes and talus, usually at elevations above 12,000 feet. It is endemic to Colorado and is known from eight counties with only one location in Lake County near Weston Pass. There are 20 records in the CNHP BIOTICS database and at least seven have not been observed in more than 20 years (H rank), two populations are considered to have an excellent estimated viability (A rank), eight have a fair estimated viability (C rank) and two have not been evaluated (E rank- Spackman et al. 1997, CNHP BIOTICS 2018).



Clawless draba fruit on the left and habitat on the right.

### Gray's Peak whitlow-grass (*Draba grayana*) G2S2 USFS Sensitive

Gray's Peak whitlow-grass, a Colorado endemic species, with a global distribution in only central and northcentral Colorado, restricted to high peaks at elevations above 11,500 feet. There are only 22 known occurrences in Colorado with four in Lake County; one near the summit of Mount Massive, one near Independence Pass and two along the Continental Divide with the largest population near Mosquito Pass.

The biggest threats for this very small plant include trampling by hikers, trail development and collectors. (Spackman et al. 1997)



Gray's Peak whitlow-grass from Mosquito Pass.

### Hoosier Pass Ipomopsis (*Ipomopsis globularis*) G2 S2

The Hoosier Pass ipomopsis is a small, 4-6 inch tall, perennial alpine herb that grows above 10,500 feet on dry, rocky, talus slopes and alpine ridges (Spackman et al. 1997). It is considered to be globally imperiled (G2); endemic to the Mosquito Range of central Colorado and is found only in Lake, Park and Summit counties near mountain peaks. Currently there are 17 occurrences in CNHP database, three are known from Lake County. Two of the occurrences are along the eastern boundary of Lake County near West Dyer Mountain and at



Photo 37. Hoosier Pass Ipomopsis on Weston Pass.

Weston Pass and one occurrence is in the southeastern part of the county on Mount Elbert. Five of the 17 occurrences in the CNHP database are considered excellent occurrences (A ranks) including the one from Weston Pass which crosses over into Park County. The Weston Pass population contains hundreds of individuals that occur over a large area with low density (1,100 individuals within 11 mapped areas (CNHP BIOTICS 2018). The population near the summit of Weston Pass in Lake County was visited on July 26, 2018 and was found to be stable (Culver 2018, CNHP BIOTICS 2018).

Evidence of threats and disturbance include historic mining activities which still continue to impact the landscape; associated roads provide ongoing recreational vehicle access which results in habitat



disturbance and threatens system sustainability. The predominant land use is recreation. No exotic species were observed (CNHP BIOTICS 2018).

Hoosier Pass ipomopsis was originally located near the summit of Mount Elbert in 1887. This site was visited by a botanist in 2015 and it was found to have a good estimated viability (B-rank). The South Elbert trail is adjacent to the population, but there is little disturbance off of the trail as most hikers are in a hurry to summit and do not appear to linger in the areas. No disturbance from recreation was seen within the site. No domestic livestock use was observed in the area, but mountain goats are present. The West Dyer Mountain occurrence only contains one individual and is considered to have a poor estimated viability (CNHP BIOTICS 2018).

### **Avery Peak Twinpod (*Physaria alpina*) G2 S2**



Avery Peak twinpod in fruit and flower.

The Avery Peak twinpod is small low growing perennial herb with a basal rosette of bluish gray leaves. It is endemic to Colorado and is only known from Lake, Gunnison, Pitkin and Park counties and is considered to be globally imperiled (G2). It is found at elevations over 11, 400 feet on open, rocky tundra and ridge crests. The estimated total range is just 27 square miles (Spackman et al. 1997). Of the nine records from the CNHP database, there is only one location from Lake County and it is near Weston Pass on the east side of the County. This occurrence is considered to have an excellent estimated viability (A rank). The remaining occurrences in the CNHP database include two additional A ranked site; and one B ranked site or good estimated viability.

The surrounding landscape has been altered by historic mining activities. Although natural recovery is occurring, complete recovery will likely take many more centuries to be successful due to the short growing season and extreme environmental conditions. (CNHP BIOTICS 2018). Ecological processes, especially soil and hydrologic processes have been altered by historic mining activity; historic mining activity has also enabled a high level of ongoing anthropogenic disturbance which occurs from a two-track road and associated motorized recreation. (CNHP BIOTICS 2018). The Weston Pass occurrence was visited in 2018 and found to be stable on July 26, 2018 (CNHP BIOTICS 2018).



### **Porter feathergrass (*Ptilagrostis porterī*) G2 S2 USFS Sensitive**

Porter feathergrass is a perennial bunchgrass that is considered to be globally imperiled (G2) and is a USFS sensitive species. It is a regional endemic known from a few small areas in Colorado and one site in northern New Mexico. Currently, this species is known from four counties (Lake, Summit, Park and El Paso) in Colorado, with the majority of the occurrences in South Park. It is typically found in fen wetlands and willow carrs at elevations between 9,000 and 12,000 feet.



Porter feathergrass.



The original Lake County occurrence was first reported in 1873 at Twin Lakes. No plants have been found at this location despite multiple searches conducted by scientists from 1989 to 2018. Currently, there are two occurrences that are known from Lake County, one occurrence along Corske Creek at a heavily impacted gold dredging site that will be impacted in the near future with the construction of the Box Creek Reservoir. The second site is an area just two miles due east of the Corske Creek population from which the Porter feathergrass has been replanted into a recreated fen near Hayden fishing area along Highway 24. Both sites are located about three miles north of the historical occurrences at Twin Lakes.

### **Weber Saussurea (*Saussurea weberi*) G2G3 (rounded rank G2) S2**

Weber saussurea is dwarf perennial herb from 5-20 cm tall that is found in alpine habitats from 11,000-14,000 feet. It is considered to be globally imperiled (G2G3). This species is a regional endemic of southwest Montana, northwest Wyoming, and central Colorado. In Colorado it is known from Custer, Lake, Park and Summit counties. The habitats can be either wet or dry and the soils are usually derived from Leadville Limestone or Manitou Dolomite (O'Kane 1988, Spackman et al. 1997).

The primary threat at this time is considered to be mining (Rondeau et al. 2011). Additional threats include off-road vehicle use, mining activities (including associated road and other mine-related construction), and other construction, including residential development on private land (Spackman et al. 1997).

Weber saussurea is thought to have a naturally limited range and is not known to have suffered significant population or habitat loss as a result of human activities. In Colorado there are 14 occurrences with 7 of excellent or good viability. In Lake County, the species is known from two sites.



Weber saussurea at Weston Pass in 2018.

### **Narrowleaf Grapefern *Botrychium lineare* G2G3 (rounded rank G2) – USFS**

Grapeferns (also known as moonworts) are typically fairly small ranging in size from less than a couple centimeters up to six inches. They are an interesting fern that typically has one frond and one spore-bearing appendage. *Botrychium lineare* is one of the rarest and smallest of the moonworts and has been found in many parts of the US and Canada, however, many sites are currently thought to be extirpated. This tiny fern is found in grassy slopes with medium height grasses, along edges of streamside forests at elevations of 7,900-9,500 feet (Spackman et al. 1997). In the CNHP database, there are only six occurrences for *B. lineare* in Colorado and five of them are now considered to be historical (H-ranked), which means they have not been seen in greater than 20 years. It is likely that this species will not be as rare after results from taxonomic analysis will be published.

An herbarium specimen of *Botrychium lineare* was collected on August 11, 1992 on upper side of California Gulch near Leadville in a disturbed sagebrush dominated habitat and the species has



Narrowleaf Grapefern.

not been observed since then. Developments have occurred in the area including the construction of an asphalt bike trail and construction activities that are part of the Superfund site at California Gulch. In 2000, the area was searched extensively and no *B. lineare* were found but two other moonwort species were found (*B. lunaria* and *B. minganense* – BIOTICS 2018). Since they spread by spores and prefer a degree of disturbance it is possible the species still exists in California Gulch. In 2018, the area was searched by two CNHP botanists and two CNHP Botany field technicians on August 22, 2018 at the collection site and about a half mile either side in the habitat described and no *Botrychium* were found. However, it may have been too late in the season. *Botrychium lineare* is thought to produce the above ground fruiting plants from May to early July (Heidel 2015). We did note other *Botrychium* species in Lake County fruiting on August 27, 2017 and July 24, 2018. The original 1992 herbarium specimen was collected on August 11, 1992. We would recommend revisiting this site in June or July for future survey efforts. Moonworts have a largely subterranean life cycle so getting accurate counts can be very confusing for monitoring efforts. They reproduce by spores which can spread a good distance from the parent plant and they don't necessarily produce above ground parts on a yearly basis (Winther 2007).

### **Rothrock Townsend-daisy (*Townsendia rothrockii*) G2G3 S2S3 rounded rank G2S2**

As with a number of the rare plants found in Lake County, the Rothrock townsend-daisy is a Colorado endemic species with its entire global distribution in the central and southwestern region of the state. It grows in montane to alpine areas above timberline that retain snow into the summer as well as high plateau ridgetops in openings of ponderosa pine.



Rothrock Townsend-daisy.

There are 32 occurrences in the CNHP BIOTICS database, with only 8 having good to excellent estimated viability (A or B ranked). Two of the occurrences are found in Lake County, one at Empire Hill and one south of Weston Pass. The Empire Hill site was not visited, but the Weston Pass occurrence was updated. Motorized recreation is considered to be a primary threat to the species as well as, road and road related impacts, grazing, and mining.

### **6.1b Endemic Species - Flora**

Currently there are 17 plant species that are endemic to Colorado or the region that are known from Lake County. Nine of the 17 plant species known from Lake County are only found in Colorado and the remaining eight species are considered regional endemic species (Table 13). Most of these endemic species are rare and the majority of them are tracked by CNHP. Of the nine plants that are endemic to Colorado, five of them are globally rare; and are discussed above in the Globally Rare Species (G1 and G2) section. Three of them are obligate wetland species (Park milkvetch, Mosquito Range mustard, and the Colorado woodrush.

The Leadville milkvetch (*Astragalus molybdenus* - discussed in the Flora Section) is vulnerable both globally and in the state imperiled species and has been recently recognized to be endemic for Colorado. Regional endemics are those found in Colorado that also have distributions into adjacent or nearby states. There are eight regional endemics currently known from Lake County, two of them were discovered as part of the 2018 survey and are also county records. The four regional



endemics that are globally rare are discussed in detail above. Other regional endemics of conservation concern are discussed below.

A number of state and regional endemics are not globally rare but they are considered to be vulnerable to extirpation or extinction (G3). The pale blue-eyed grass (*Sisyrinchium pallidum*), a member of the Iris family, was documented for the first time in Lake County during the 2017-18 surveys and is a regional endemic. It is considered to be globally vulnerable and state imperiled (G3S2) as well as a BLM sensitive species. The pale blue-eyed grass is found in Colorado and Wyoming in moist meadows and fens at elevations from 7,000 – 9,500 feet. In Colorado, there are 10 occurrences with 3 good and excellent estimated viabilities. The Lake County occurrence is ranked as good (B ranked).

The Colorado woodrush (*Luzula subcapitata*) is a regional endemic that is considered to be both global and state vulnerable (G3 S3) species and is known from locations in Colorado and Wyoming. In Colorado, there are a total of 11 known occurrences, four of the 11 are either good or excellent condition. The Lake County occurrences were all good (B ranked).

The Colorado tansy-aster (*Xanthisma (Machaeranthera) coloradoensis*) is a regional endemic species known from two locations in Lake County and is considered to be global and state vulnerable (G3S3) species. The distribution for this plant is largely in southwestern Colorado and southeast Wyoming. It is a perennial herb that is found often in open habitats with gravely soils at elevations of 8,500-



Colorado tansy-aster in Lake County.

12,700 feet. There are 32 total occurrences in CNHP BIOTICS database with 18 either good or excellent estimated viability. The two Lake County occurrences are ranked as good. The threats for this species at the site near Tennessee Creek appear moderate to low at this time. A two track road separates the population but currently the campers and other users seem to not be adding any disturbance to the population. If the road is widened or paved this may impact the population. The EO rank for this population which is considered to have an excellent estimated viability is an A rank. The second location near Empire Hill (also A-rank) is potentially threatened because it is on a grazing allotment parcel owned by the USFS.

**Table 13. List of Plant Species Endemic to the State of Colorado or the Region, Lake County, CO.**

Scientific Name	Common Name	G Rank/ S Rank	Regional (R) State (S) Endemic	First Observation Lake County
<i>Aquilegia saximontana</i>	Rocky Mountain Columbine	G3/S3	S	2000
<i>Astragalus leptaleus</i>	Park milkvetch	G3*/S2	R	2018
<i>Astragalus molybdenus</i>	Leadville milkvetch	G3/S2	S	1948
<i>Boechera crandallii</i>	Crandalls rockcress	G2/S2	R	2000
<i>Boechera oxylobula</i>	Glenwood Springs rockcress	G3/S3	S	
<i>Botrychium lineare</i>	Narrowleaf grapefern	G2*/S2*	R	1992
<i>Draba grayana</i>	Gray's Peak whitlow-grass	G2/S2	S	1990
<i>Draba streptobrachia</i>		G3/S3	S	2015
<i>Eutrema penlandii</i>	Mosquito Range mustard	G1/S1*	S	1998
<i>Ipomopsis globularis</i>	Hoosier Pass Ipomopsis	G2/S2	S	1887
<i>Luzula subcapitata</i>	Colorado woodrush	G3/S3	R	1963
<i>Machaeranthera coloradoensis</i>	Colorado tansy-aster	G3/S3	R	1985
<i>Physaria alpina</i>	Avery Peak twinpod	G2/S2	S	1964
<i>Ptilagrostis porteri</i>	Porter feathergrass	G2/S2	R	1873
<i>Saussurea weberi</i>	Weber's saussurea	G2*/S2	R	1998
<i>Sisyrinchium pallidum</i>	Pale blue-eyed grass	G3/S3	R	2017
<i>Townsendia rothrockii</i>	Rothrock Townsend-daisy	G2*/S2*	S	1998

\*rounded rank

### County Records – Floristic Results

Although, there was some early botanical work done in Lake County near the turn of the century (Table 14), the county has not been comprehensively surveyed for plants. As a result of this survey, CNHP documented 42 plant species that had not been previously verified with an herbarium specimen in Lake County (Table 15). Many of the county records include plants that are very common (i.e. *Veratrum tenupetalum*) but had not been documented from the county. However, five are considered to be rare CNHP tracked plants: (*Astragalus leptaleus*, *Elatine rubella*, *Eriophorum chamissonis*, *Kobresia simpliciuscula*, *Packera debilis*, *Sisyrinchium pallidum* and *Utricularia minor*) (Table 13).

**Table 14. Species historically known from Lake County.**

Scientific Name	Common Name	Last Record in Lake
<i>Callitriche palustris</i>	Vernal water star-wort	1952 Twin Lakes
<i>Carex buxbaumii</i>	Buxbaum's sedge	1872 Twin Lakes in
<i>Carex canescens</i>	Gray sedge	1919 Twin Lakes
<i>Carex interior</i>	Inland sedge	1873 Twin Lakes

**Table 15. County Plant Species List of County Records for the CNHP 2017-2018 Survey\***

<b>Scientific Name</b>	<b>Common Name</b>
<i>Achnathrum pinetorum</i>	Richardson needlegrass
<b><i>Astragalus leptaleus</i></b>	<b>Park milkvetch</b>
<i>Beckmannia syzigachne</i>	Slooughgrass
<i>Callitriche hermaphroditica</i>	Northern water-starwort
<i>Carex heteroneura</i>	Different-nerve sedge
<i>Carex praeceptorum</i>	Early sedge
<i>Catabrosa aquatica</i>	Brookgrass
<i>Delphinium ramosum</i>	Mountain larkspur
<b><i>Elatine rubella</i></b>	<b>Southern waterwort</b>
<i>Elodea canadensis</i>	Canadian waterweed
<i>Elymus lanceolatus</i>	Thick-spike wheatgrass
<b><i>Eriophorum (altaicum v. neogaeum) chamissonis</i></b>	<b>Chamisso's cottongrass</b>
<i>Gnaphalium exilifolium</i>	Slender cudweed
<i>Goodyera oblongifolia</i>	Western rattlesnake plantain
<i>Isoetes bolanderi</i>	Bolander's quillwort
<i>Juncus alpinoarticulatus</i>	Northern green rush
<i>Juncus biglumis</i>	Two-flowered rush
<i>Juncus nevadensis</i>	Sierra rush
<i>Juncus torreyi</i>	Torrey's rush
<b><i>Kobresia simpliciuscula</i></b>	<b>Simple bog sedge</b>
<i>Lycopodium annotinum</i>	Clubmoss
<i>Menyanthes trifoliata</i>	Buckbean
<i>Mitella stauropetala</i>	Side-flowered mitrewort
<i>Muhlenbergia andina</i>	Foxtail muhly
<b><i>Packera debilis</i></b>	<b>Rocky Mountain ragwort</b>
<i>Petasites frigidus</i> var. <i>sagittatus</i>	Sweet coltsfoot
<i>Platanthera obtusata</i> ssp. <i>obtusata</i>	Bluntleaved orchis
<i>Potentilla biennis</i>	Biennial cinquefoil
<i>Potamogeton epihydrus</i>	Ribbonleaf pondweed
<i>Potamogeton natans</i>	Floating pondweed
<i>Senecio hydrophilus</i>	Water ragwort
<b><i>Sisyrinchium pallidum</i></b>	<b>Pale blue-eyed grass</b>
<i>Sparganium angustifolium</i>	Narrowleaf bur-reed
<i>Stellaria longifolia</i>	Long-leaved starwort
<i>Sueada calceoliformis</i>	Pursh seepweed
<i>Symphyotrichum spathulatum</i>	Western mountain aster
<i>Triglochin maritima</i>	Seaside arrowgrass
<i>Triglochin palustre</i>	Marsh arrowgrass
<i>Torreyochloa pallida</i> var. <i>pauciflora</i>	False mannagrass
<b><i>Utricularia minor</i></b>	<b>Lesser bladderwort</b>
<i>Veratrum (tenuipetalum) californicum</i>	California false hellebore
<i>Woodsia scopulina</i>	Rocky Mountain woodsia

\*(Bold are tracked species)



## 6.2 Fauna Results

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CNHP added or updated data on one Listed Threatened species (LT), three state vulnerable species (S1 or S2), and three species that are ranked as either BLM and USFS Sensitive species. (Table 12) for Lake County.

### **White-tailed Ptarmigan (*Lagopus leucura*) G5S4, USFS Sensitive and CPW Tier 1 species.**

Three new occurrences were documented for the White-tailed Ptarmigan, the smallest grouse in North America that inhabits alpine regions in western North America. The greatest threat to the long-term survival of Ptarmigan populations in Lake County is global climate change, which may lead to a gradual loss of alpine habitats as the treeline moves upward in response to large-scale atmospheric temperature changes. More immediate and localized threats include grazing, mining, water development, and recreation. While alpine ecosystems are hardy and resilient to natural environmental factors, they are particularly vulnerable to human-related disturbances and may require decades, if not centuries, to recover from such disturbances. Although substantial progress has been achieved in developing techniques to restore damaged alpine landscapes, this technology is still not capable of restoring alpine plant communities to their pre-disturbance condition. The single most important feature of habitats used by ptarmigan in Colorado is the presence of willow (*Salix* spp.), which is their primary food source from late fall through spring (Hoffman 2006).



### **Canada lynx (*Lynx canadensis*) G5S1, State Endangered, LT**

Canada lynx were introduced to Colorado in 1999 by the Colorado Parks and Wildlife. Lynx inhabit dense subalpine forest and willow corridors along mountain streams and avalanche chutes, hunting its prey, the snowshoe hare. In 2010, an estimated 150-250 lynx are in Colorado. CNHP updated two known occurrences and added four new lynx occurrences from the US Forest Service data exchange.



### Brown-capped Rosy-finch (*Leucosticte australis*) (G4S3BS4N) and CPW Tier 1 species

One new occurrence was documented in 2018 by CNHP. The Brown-capped Rosy finch is an endemic to the Southern Rocky Mountains alpine. It has been identified by the Colorado Parks and Wildlife State Action Plan (CPW 2015) as Species of Greatest Concern, due to declining numbers and habitat disturbance from climate change. The Brown-capped Rosy-finch has a very small breeding range of approximately 6,000 square miles (Figure 24). It breeds in alpine tundra ecosystems in the Colorado and northern New Mexico.

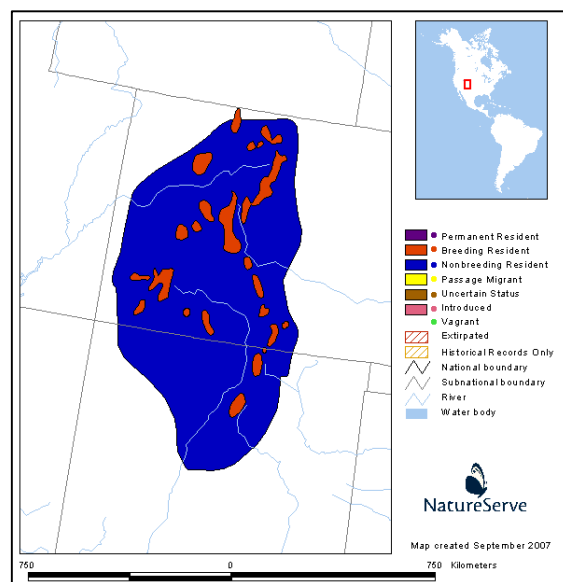


Figure 24. Distribution of Brown-capped Rosy Finch.

### Townsend's Big-eared bat (*Corynorhinus townsendii pallescens*) (G3G4T3T4S2) BLM and USFS Sensitive and CPW Tier 1 species

Two occurrences for the Townsend's Big-eared bat were updated for this project. The Townsend's Big-eared bat western North America, ranging from southern British Columbia to southern Mexico. Townsend's big-eared bat can be found throughout Colorado. Its distribution seems to be determined by availability of roosts, such as caves, mines, tunnels, crevices and masonry structures with suitable temperatures, making the conservation of suitable roosts essential to the management of this species.



### **Northern Goshawk (*Accipiter gentilis*) (G5S3B), USFS and BLM Sensitive species**

In a U.S. Forest Service data exchanged, CNHP added 21 new Lake County occurrences of the Northern Goshawks that mainly occupy and nest in mature lodgepole pine and Engelmann spruce forests (Ferland 2006). The primary threat to goshawk populations is alteration of its preferred habitat from timber management practices. Potential threats to habitat caused by various silvicultural treatments include forest fragmentation, creation of even-aged and monotypic stands, potential increase in area of younger age classes, and loss of tree species diversity. Goshawk nesting and foraging habitat has also likely been affected by fire suppression which has allowed increased forest density and created a shift from frequent low-intensity fire to more intense stand-replacement fires. Human disturbance associated with forest management and other activities may affect goshawks and can cause nest failure, especially during incubation (Kennedy 2003).



Northern Goshawk

### **Swampy lymnaea or great pond snail (*Lymnaea stagnalis*) (G5S2)**



CNHP updated one occurrence and added one new occurrence of the pond snail is globally secure, but in Colorado this snail is found only in mountainous portions of the Arkansas, Colorado and Rio Grande River drainages (Nelson and Guralnick 2010)

### **Boreal toad (*Anaxyrus boreas boreas*) (G4T1S1), BLM/USFS sensitive species, and CPW Tier 1 species**

The boreal toad has been known historically from Lake County from: Turquoise Lake/Timberline Lake (1983), near Climax (1960), Bear Lake (1998), Twin Lakes (1902), and Rainbow Lake (2009) (CNHP BIOTICS 2018). USFS biologists reported an observation of an adult boreal toad at Homestake Fishing Club in August 2017. During the project's field season in 2018, CNHP found an adult boreal toad dead on the road by Morton Lake at the Homestake Fishing Club. No breeding site has been discovered yet for these observations but hopefully with future surveys one will be located. There is currently only one active breeding site in Lake County in Birdseye Gulch that was discovered in 2011 (Lambert and Schneider 2013). Adult males were found in previous years (2008 – 2010) near the breeding site, but breeding was not observed until 2011. There appears to be a very small resident population at this site with sporadic breeding success. No evidence of breeding has been reported since 2012 at the Birdseye Gulch site despite annual site monitoring by CNHP.



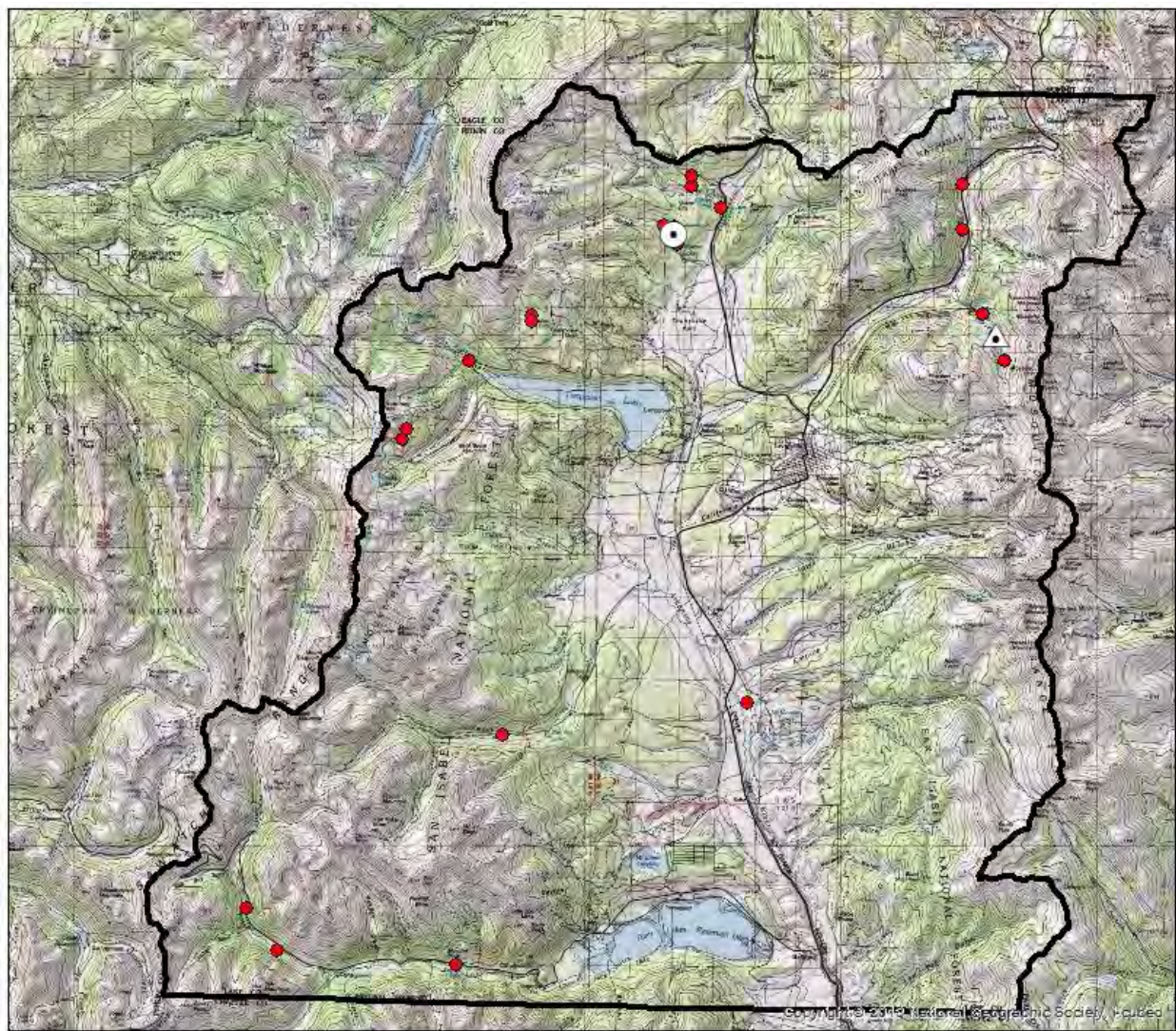
CNHP biologists completed amphibian surveys at 22 sites between 6/3/2017 and 8/17/2018 (Figure 25) for map of survey locations. Chorus frogs (*Pseudacris maculata*) were found to be abundant at numerous locations throughout Lake County, with especially large populations noted near Tennessee Pass and around Turquoise Lake. One adult male boreal toad was documented at Homestake Fishing Club. Suitable habitat for boreal toads was identified at various locations throughout the county including the Bear/Galena Lake area, Longs Gulch near Homestake Fishing Club and Lily Lake/West Tennessee Creek area. In the southwestern corner of Lake County there is potential for boreal toad populations as there is currently a large population in Sayre's Gulch in nearby Chaffee County (approximately 5 km from Lake County). The habitat along Highway 82 near the confluence with Graham Gulch (North Fork Lake Creek) has numerous potential breeding ponds and good habitat for boreal toads.

Boreal toads remain rare in Lake County and despite intensive surveys in recent years there does not appear to be more than a few small isolated populations in the county. Additional surveys are recommended in the Longs Gulch area as there are recent observations with good potential breeding ponds in that area. The West Tennessee Lakes area is another potential area for boreal toads as there is a population of boreal toads on the other side of the continental divide in Eagle County along the East Fork Homestake Creek (< 3 km away). An excellent potential breeding pond was surveyed approximately 300 m north of Galena Lake that had great shallows and habitat for boreal toads.



Boreal toad.





### Legend

-  Boreal Toad Breeding Sites
-  Boreal Toad Observation
-  2017-2018 CNHP Boreal Toad Surveyed Sites
-  Lake County Boundry

0 1.75 3.5 7 Miles



Figure 25. Locations of CNHP Boreal Toad Surveys in Lake County 2017-2018.



## 6.3 Fen Mapping Results

The final map of potential fens (Table 16, Figure 26) contained 1,068 potential fen locations (all confidence levels), covering 1,812 acres or 0.74% of the total land area (Table 16). This total included 288 **likely fens** (confidence level = 5), 463 **possible fens**, and 448 **low confidence fens**. The count of possible fens was slightly higher than the count of likely fens, and the average sizes were similar in all confidence classes, resulting in 525 acres of likely fens, 463 acres of possible fens, and 824 acres of low confidence fens. Figures 27 and 28 illustrate the delineation of fens on 7.5 min topography maps and color infrared photography.

**Table 16. Fen Mapping Results.**

Confidence Level	Count	Acres	Average size (acres)
5—Likely Fen	288	525	1.82
3—Possible Fen	332	463	1.40
1—Low Confidence Fen	448	824	1.84
<b>Totals</b>	<b>1,068</b>	<b>1,812</b>	<b>1.69</b>



Elephant-head lousewort.



Split-leaf paintbrush.



Narrow-leaf cottongrass.



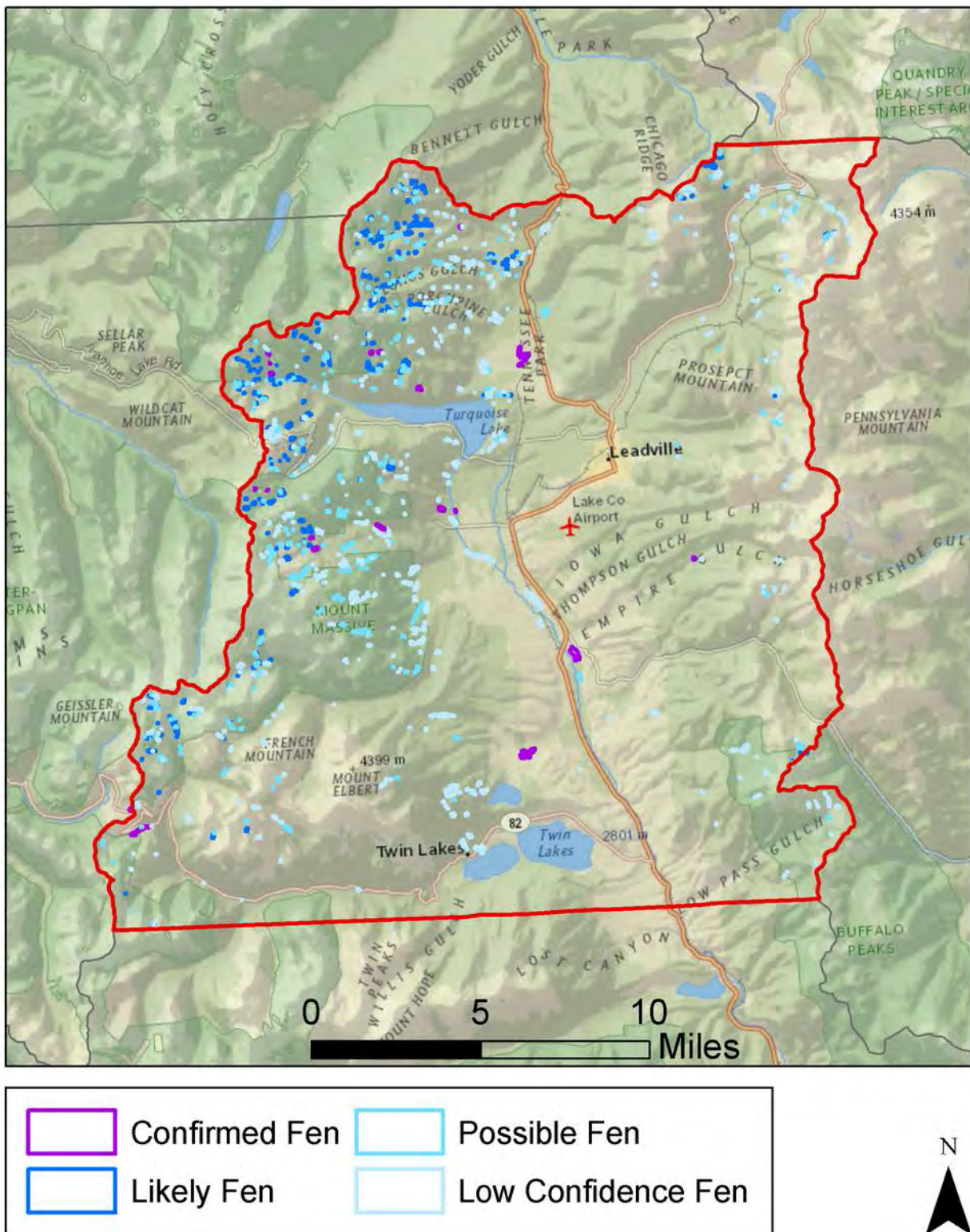


Figure 26. Fen mapping results for Lake County.



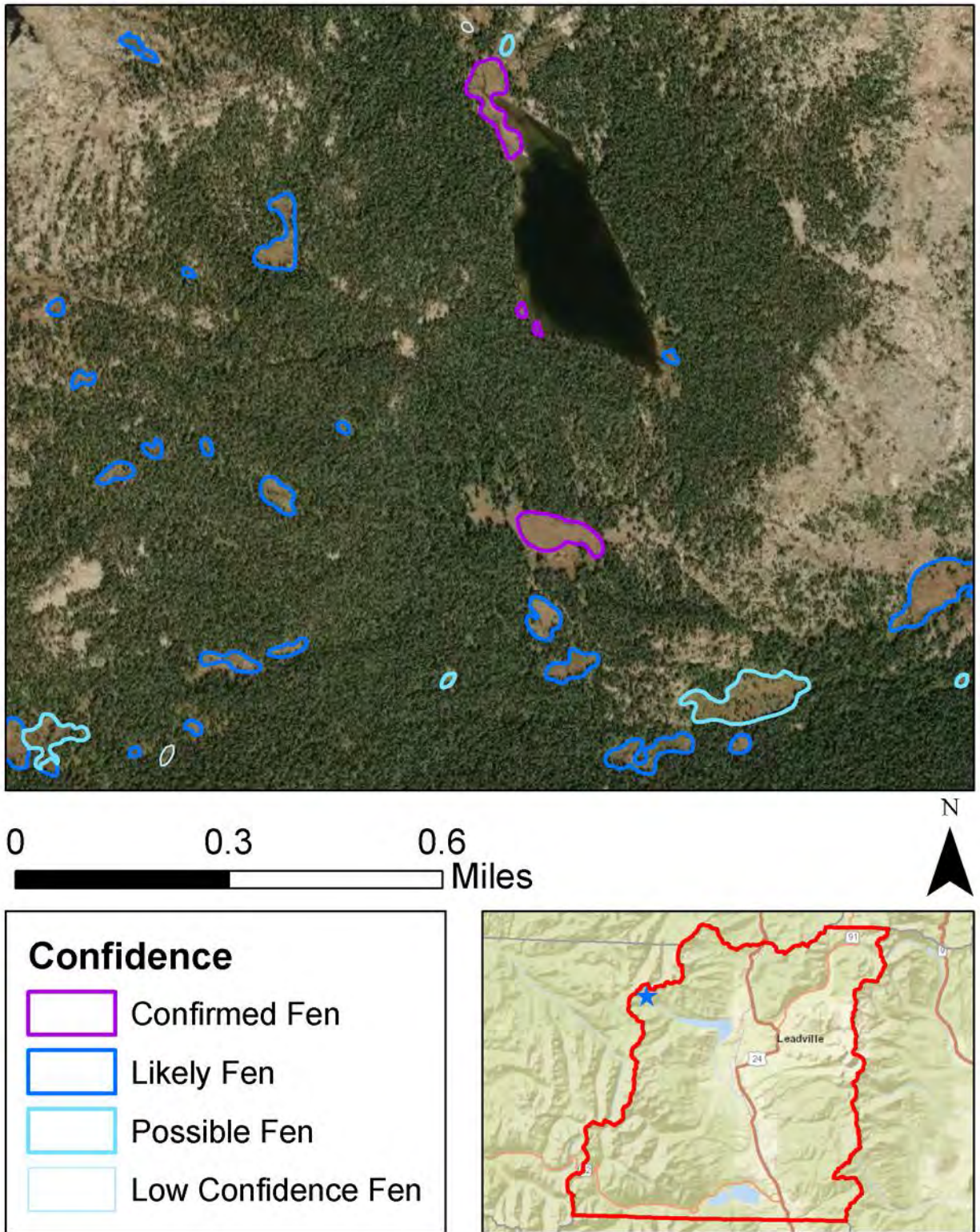


Figure 27. Example of fen mapping at Timberline Lake displayed on true color digital photos.



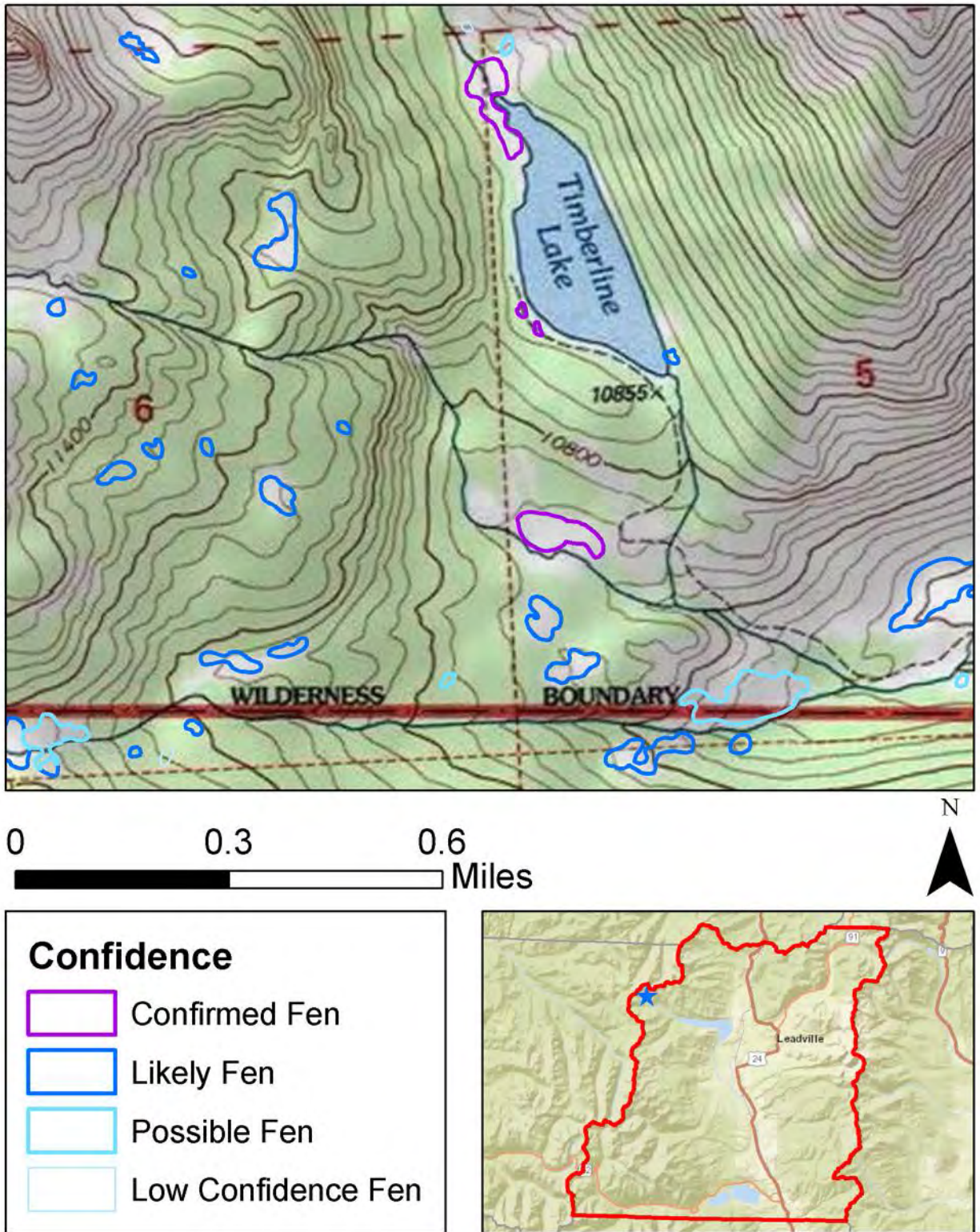


Figure 28. Example of fen mapping at Timberline Lake displayed on USGS 7.5' topographic map.



## 6.4 National Wetland Mapping Summary

Lake County has a total of 22,292 wetland acres or 9.07% of total land acres. The NWI System and Class for the county is as follows (Table 17, Figure 29).

**Table 17. National Wetland Mapping Compilation and Results.**

<i>Wetland and Waterbody Type</i>		<i>Acres</i>	<i>% of Basin Area</i>	<i>% of NWI Acres</i>	<i>% of Wetland Acres</i>
Total County Area		245,760	100.0%	---	---
Upland Area (not mapped by NWI)		223,468	90.93%	---	---
<b>Wetlands</b>					
NWI Code	Wetland Type				
PEM	Herbaceous Wetlands	7,765	3.16%	34.83%	47.45%
PSS	Shrub Wetlands	7,876	3.2%	35.33%	48.12%
PFO	Forested Wetlands	18	0.007%	0.08%	0.11%
PAB/PUB/ PUS	Ponds and Impoundments	707	0.29%	3.17%	4.32%
<b>Total Area of Wetlands</b>		<b>16,366</b>	<b>6.66%</b>	<b>73.41%</b>	<b>100.0%</b>
<b>Waterbodies</b>					
NWI Code	Waterbody Type				
L	Lakes and Shores	4,479	1.82%	20.09%	---
R3/R4	Large and Smaller Rivers	1,447	0.59%	6.50%	---
<b>Total Area of Waterbodies</b>		<b>5,926</b>	<b>2.41%</b>	<b>26.59%</b>	<b>---</b>
<b>Total Area of Wetlands and Waterbodies</b>		<b>22,292</b>	<b>9.07%</b>	<b>100%</b>	<b>---</b>

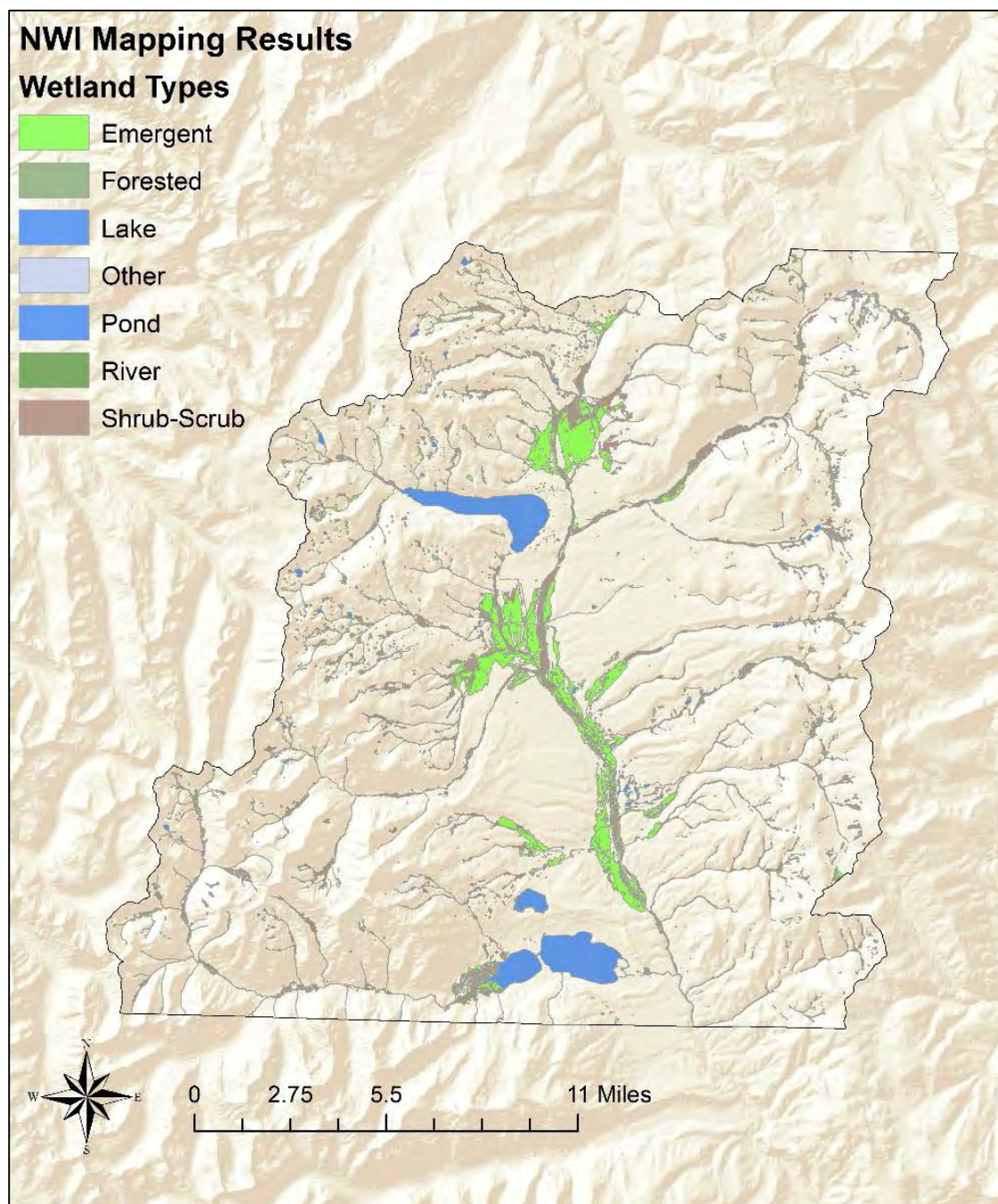


Figure 29. NWI Mapping Results for Lake County.



(1) Lacustrine Limnetic (L1)—

- 
- The map displays a complex land use pattern in the Los Angeles region. Various parcels are labeled with codes such as PSSC, PEMC, PUBF, PUSC, and others. The map includes topographical features like mountains and valleys, and a network of roads. A red box highlights a specific parcel in the bottom right corner.

—shoreline wetlands with vegetative cover less than



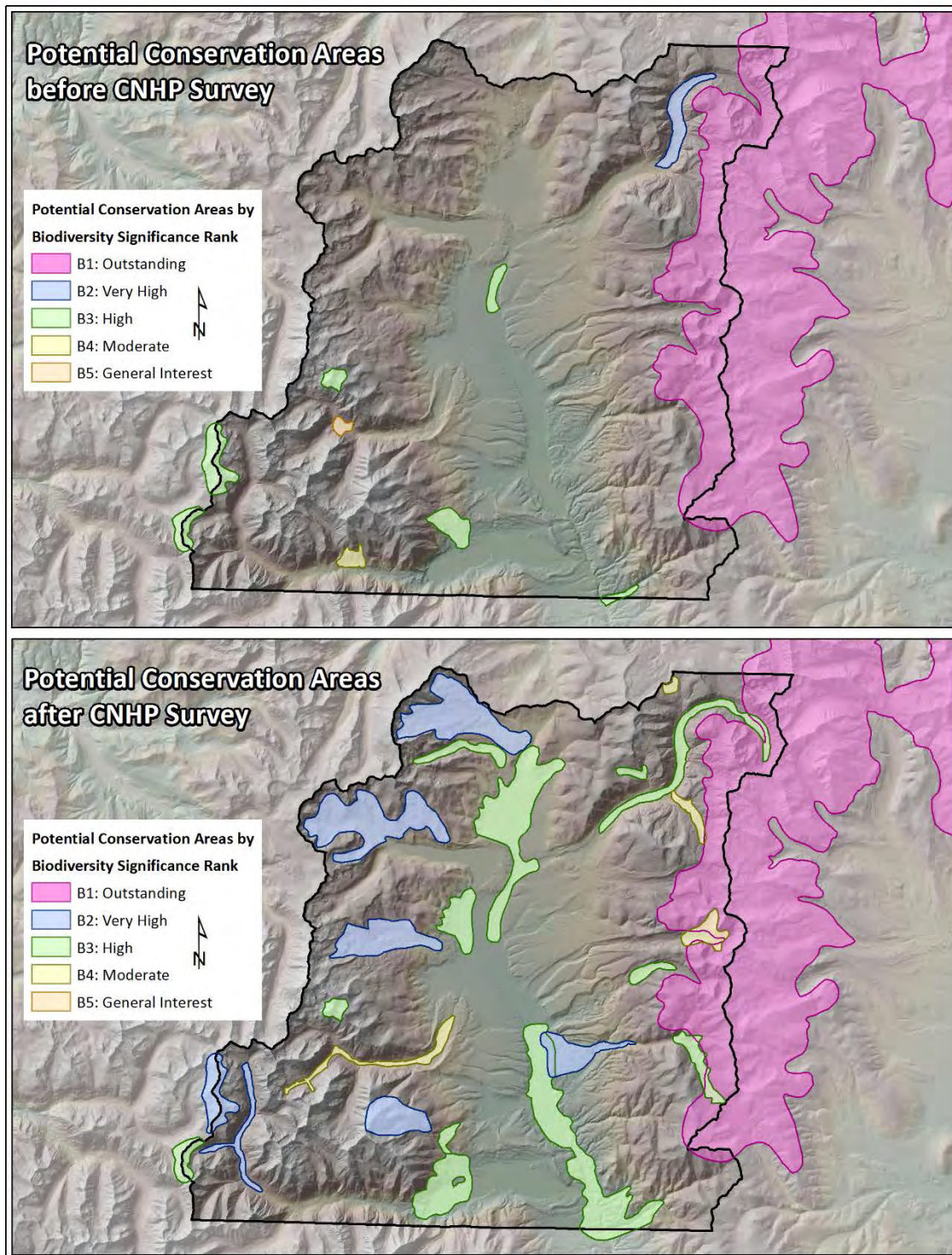
## 6.5 Potential Conservation Areas

Twenty-four Potential Conservation Areas (PCAs) were identified in Lake County (Table 18). These sites represent the immediate habitat needed for the viability of critical biological elements. Before the projects there were only 10 PCAs identified for Lake County (Map 1). Of the PCAs presented in this report (Map2):

- 1 is of outstanding biodiversity significance (B1)
- 7 are of very high biodiversity significance (B2)
- 13 are of high biodiversity significance (B3)
- 3 are of moderate biodiversity significance (B4)

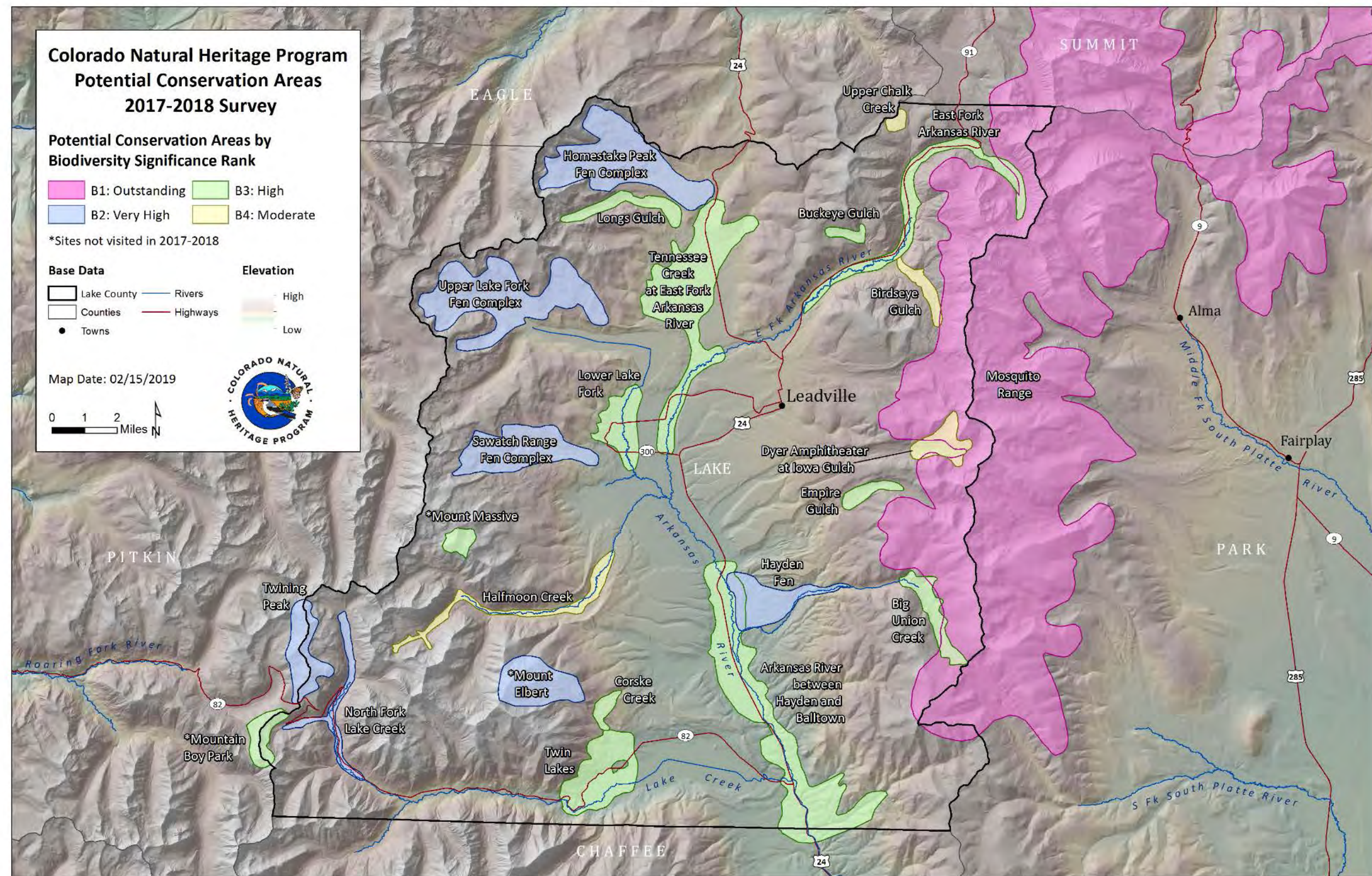
**Table 18. Potential Conservation Areas.**

Site Name	Biodiversity Rank
Mosquito Pass	B1
Hayden Fen	B2
Homestake Peak Fen Complex	B2
Mount Elbert	B2
North Fork Lake Creek	B2
Sawatch Range Fen Complex	B2
Twining Peak	B2
Upper Lake Fork Fen Complex	B2
Arkansas River between Hayden and Balltown	B3
Big Union Creek	B3
Buckeye Gulch	B3
Corske Creek	B3
East Fork Arkansas River	B3
Empire Gulch	B3
Longs Gulch	B3
Lower Lake Fork	B3
Mount Massive	B3
Mountain Boy Park	B3
Tennessee Creek at East Fork Arkansas River	B3
Twin Lakes	B3
Birdseye Gulch	B4
Dyer Amphitheatre at Iowa Gulch	B4
Halfmoon Creek	B4
UpperChalk Creek	B4



Map 1. Comparison of PCAs before and after survey.





Map 2. Potential Conservation Areas in Lake County.





## 7.0 Discussion

The biodiversity of Lake County exemplifies Colorado's world-renowned mountains. Lake County is already known for outdoor activities like hiking, mountain climbing, and fishing. Now we know how special Lake County is for biodiversity. The county's biodiversity is one of the reasons it is a popular vacation destination due to the high quality of life and ready access to open space and recreation. CNHP encourages the county's decision makers and planners to be mindful of informed land planning to keep Lake County's biodiversity intact, and to direct future growth to the most appropriate places while avoiding sensitive ecological habitats such as wetlands, stream corridors, and alpine tundra.

CNHP documented numerous fens throughout the county. Three large "complexes" stand out from a biodiversity stand point: Sawatch Range, Homestake Peak, and Upper Lake Fork Fen Complexes (Figure 31). Fens are defined as groundwater-fed wetlands with organic soils that typically support sedges and low stature shrubs (Mitch & Gosselink 2007). The strict definition of an organic soil (peat) is one with 40 cm (16 in) or more of organic soil material in the upper 80 cm (31 in) of the soil profile. Accumulation of organic material to this depth requires constant soil saturation and cold temperatures, which create anaerobic conditions that slow the decomposition of organic matter. By storing organic matter deep in their soils, fens act as a carbon sink. In the arid west, peat accumulation occurs very slowly; estimates are 20 cm (8 in) per 1,000 years in Colorado (Chimner 2000; Chimner and Cooper 2002). Long-term maintenance of fens requires maintenance of both the hydrology and the plant communities that enable fen formation. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service Mitigation Policy (USFWS 1999), signifying that every reasonable effort should be made to avoid impacting this habitat. In 2002, the U.S. Forest Service Rocky Mountain Region issued a statement to avoid impacts to fens on National Forest Lands due to their irreplaceability (USFS 2002).

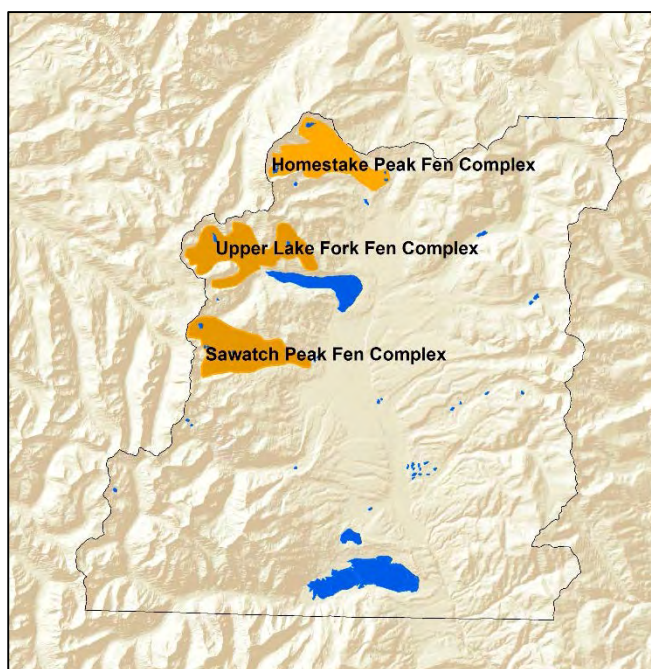


Figure 31. Fen Complexes in Lake County.

During this survey, CNHP discovered Hayden Fen, the first known extreme rich fen in the county, and perhaps the first known on the West Slope, was documented. Several extreme rich fens are known from Park County, on the eastern flank of the Mosquito Range. Extreme rich fens are associated with the calcium-rich sedimentary bedrock, limestone and dolomite, from the Mosquito Range. The Hayden fen supports most of the calciphilic (plants that thrive in high mineral soil) plants that have been documented in Park County. Using aerial photography, spring locations,

LiDAR-derived topographic data, and current wetland mapping it is apparent that the Upper Arkansas River once supported an even larger fen complex that was likely an extreme rich fen (Figure 32). This larger fen complex was reduced in size from its historical state by hydrological alterations (including ditching, stream channel-incision, and alteration of the Arkansas River flow regime) that lowered the groundwater table. The current plant community in this area is dominated by graminoids that are typical of drier conditions. In 1993, the CNHP riparian crew documented water sedge (*Carex aquatilis*) as the dominant graminoid layer. In 2017-18, CNHP documented Bellardi's bog sedge (*Kobresia myosuroides*) as the dominant. Bellardi's bog sedge is one of the common graminoids found in drier alpine turf habitats that support the theory that the area has been drying out.

Of special emphasis are the county's existing wetlands that provide many functions that are valued by society, (e.g., groundwater recharge, flood attenuation, removal of sediment, and channel stabilization). **Lake County has a total of 22,292 wetland acres or 9.07% of total land acres, triple the percent of wetlands for the state (<3%) as a whole!** One of the most important functions is the role of wetlands in providing clean water.

Wetland vegetation acts as a filter or sponge for water and sediment that may contain heavy metals, pesticides, or fertilizers. Wetland vegetation also provides a buffer for flood zones, especially along larger rivers, like the Arkansas River and Tennessee and Half Moon Creeks. In addition, wetlands are key in providing quality wildlife and fish habitat. In many areas of the Intermountain West, more than 90% of wildlife species depend on wetland and riparian areas at some point in their lives (Redelfs 1980 as cited in USGS 1996, McKinstry et al. 2004).

A total of 42 plants were added to the list of plants already documented from Lake County bringing the total from 1,284 to a total of 1,326 taxa in 2018. In comparison, the entire State of Colorado contains 3,322 taxa (Ackerfield 2015). **Therefore, Lake County, with only 0.5% of the State land area, contains 40% of the plant species known from the State.** There are 34 rare plants known from the county, and prior to this survey only 22 were known. The high biodiversity of plants in Lake County is due, at least in part, to the large land area with diverse habitats that are currently not developed or impacted. Even though the county land area is small, the biodiversity is quite high

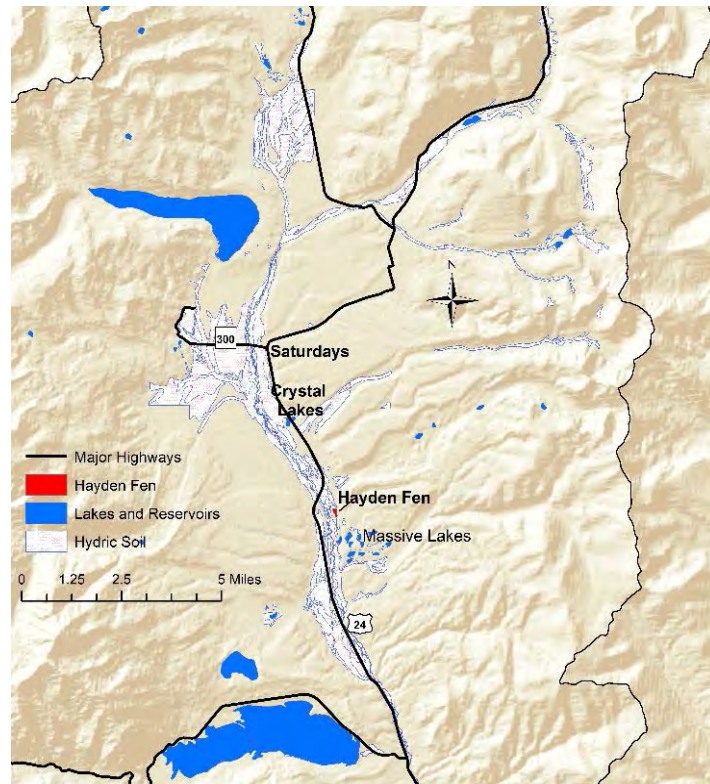


Figure 32. Likely boundaries for extreme rich fen before anglo settlement.



compared to other counties in Colorado. Boulder County by comparison, is almost twice as large, has a larger elevation range and contains 1,649 taxa that include 24 rare plant species while Lake County, as a result of this survey, has 34 rare CNHP tracked plant species. The protection of rare species helps protect our natural heritage, biodiversity of plants and animals, our quality of life and rare habitats. Rare plants are often indicators of high quality lands and low levels of disturbance. High quality habitats offer a range of ecological services that are not given by disturbed landscapes such as cleaner air and water, healthy habitats for wildlife, reduction in impacts for a changing climate in addition to better outdoor experiences for humans.

Lake County provides habitat for numerous mammals and birds due to both its high elevation and central location within the state. Animals do not occur randomly in nature; rather their occurrence in a particular habitat is a consequence of several variables including history, geology, physiography, climate and ecological relationships with plants and other animals (Mutel and Emerick 1992, Armstrong et al 2011). Because animals are adapted to use specific resources and tolerate a certain range of environmental conditions, they only occupy those ecosystems that meet their requirements (Mutel and Emerick 1992). Each type of ecosystem provides resources for a characteristic suite of animal species, and although many animal species are adapted to a wide range of environmental conditions and are able to utilize and move among habitats, the range of tolerance of many others is fairly restricted to specific habitats and conditions. There is strong evidence that climatic patterns are changing. Colorado, especially high elevation counties, may expect marked ecological effects from these changes (Armstrong et al. 2011, CWCB 2018).

## 7.1 Conservation Recommendations

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As part of the discussion regarding the county's biodiversity, CNHP would like to recommend the following conservation strategies to be considered by the Lake County Government and its stakeholders.

### **Integrate the results and specifically the PCAs profiled in this report in the Lake County Comprehensive Plan (1998).**

- Implement an action plan for the county's comprehensive plan that utilizes PCAs as priority areas for protection.
- Develop incentives that encourage biodiversity considerations in land-use planning and increase the likelihood of biodiversity conservation.

### **Increase efforts to protect biodiversity by promoting cooperation and incentives among landowners, pertinent government agencies, and non-profit conservation organizations.**

- Involve all stakeholders in land-use planning. The long-term protection of natural diversity in Lake County will be facilitated by the cooperation of private landowners, businesses, government agencies and non-government organizations.
- Consider incentive-based programs such as purchasing development rights or outright purchase from willing owners of land for significant sites that are in need of protection.

- Support local organizations, such as Central Colorado Conservancy and the Lake County Open Space Initiative (LCOSI), in purchasing or acquiring conservation easements for protection of biological diversity or open space.
- Explore opportunities to form partnerships to access state and federal funding for conservation projects, such as those offered through the Colorado Parks and Wildlife or land trusts e.g., Central Colorado Conservancy.
- Promote stronger ties among federal, state, local and private interests involved in the protection or management of natural lands will increase the chance of success.

**Take the data presented in this report into consideration when reviewing proposed activities in or near Potential Conservation Areas to determine whether or not those proposed activities may adversely affect elements of biodiversity.**

- Review PCAs when making land-use decisions.
- Avoid cumulative impacts on wetland and riparian areas that are particularly susceptible to off-site activities that affect water quality or hydrologic regimes.
- Incorporate the maps and associated GIS layers associated with the survey into land use plans.
- Contact persons, organizations, or agencies with the appropriate biological expertise for input in the planning process. CNHP is continually updating biodiversity data throughout the state and can provide up-to-date information in the area of concern. To contact CNHP's Environmental Review Coordinator call (970) 491-7331.

**Recognize the importance of larger, contiguous natural habitats.**

- Protect large contiguous riparian corridors to ensure protection of known and currently unknown species and other biological resources.
- Protect large blocks of land within the watershed that provide key movement corridors and necessary range size for native wildlife.
- Avoid fragmenting large natural areas unnecessarily with roads, trails, etc. to protect migrating animals like deer and elk.

**Encourage public education outreach, functions, and publications.**

- Provide educational opportunities for local citizens and other stakeholders on the value that such areas offer the public.
- Convey the value and function of these habitats and species to generate greater interest in conserving lands.
- Conduct forums or presentations that highlight the biodiversity of Lake County to increase awareness of the uniqueness of the habitats within the county.

**Promote wise management of the biodiversity resources that exist within Potential Conservation Areas. Development of a site-specific conservation plan is a necessary component of the long-term protection of a PCA.**

- Consult organizations and agencies in the development of conservation plans, including CNHP, CPW, Natural Resources Conservation Service, Colorado State University Extension,

The Nature Conservancy, and various academic institutions (e.g., Colorado Mountain College). With the current rate of population growth in Colorado, rare and imperiled species will likely decline if not given appropriate protection or management attention.

- Coordinate with managers of public parks or other public lands that support sensitive biological resources. Engage local citizens, groups, and organizations (e.g., the Central Colorado Conservancy, schools, 4-H clubs, the Greater Arkansas Nature Association, Trout Unlimited) in assisting with management and monitoring projects on public lands. Make a concerted effort to involve individual landowners in the conservation dialogue, as applicable.

**Continue species surveys and monitoring where necessary, including inventories for species that cannot be surveyed adequately in one field season and continue inventories on lands that CNHP could not access in 2017 and 2018.**

- Monitor rare species for presence/absence as well as trends, and monitor alpine species especially for species susceptible to extinction due to climate change impacts.

**Continue to take a proactive approach to weed and exotic species control. Recognize that weeds affect both agriculture and native plant communities.**

- Discourage the introduction and/or sale of non-native species that are known to significantly impact natural areas. These include, but are not limited to, wild chamomile, Dalmatian toadflax, butter and eggs, and Canada thistle.
- Remove established populations of noxious weeds and other problematic non-native species.
- Enforce the use of weed-free forage on horse trails, and at campgrounds, and trailheads.
- Encourage the use of native species for revegetation and landscaping efforts. Ideally, seed should be locally harvested.
- Refer to the Chaffee County Weeds Department (responsible for Lake County) for assistance on identifying and eradicating weeds (<http://www.chaffeecounty.org/weed-control>) and the CNHP's weed information (<https://cnhp.colostate.edu/projects/noxious-weed-inventory/>)

**Develop and implement a comprehensive program to address loss of wetlands.**

- Utilize resources and partnerships formed in the Arkansas Headwaters Wetland Focus Area Committee, which has identified priority areas for wetland conservation and restoration.
- Use the digitized National Wetland Inventory Maps and fen mapping for management. Also see CNHP's Colorado Wetland Information Center (<http://www.cnhp.colostate.edu/cwic/>) and the Watershed Planning Toolbox (<https://cnhp.colostate.edu/cwic/tools/toolbox>) for detailed wetland mapping in Lake County, including likely historical wetlands and priority restoration and conservation areas.
- Encourage and support statewide wetland protection efforts such as the Colorado Parks and Wildlife Wetland Wildlife Conservation Program (<http://cpw.state.co.us/aboutus/Pages/Wetlands.aspx>)



## 8.0 Sites of Biodiversity Significance

The 24 most important sites in Lake County are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Table 18, Map 2).

Each PCA is described in a standard PCA profile report that reflects data fields in CNHP's Biodiversity Tracking and Conservation System (BIOTICS). The contents of the profile report are outlined and explained below:

- PCA Profile Explanation.
- Biodiversity Rank: B#.
- The overall significance of the PCA in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see Natural Heritage Ranking System section for more details.
- Protection Urgency Rank: P#.
- A summary of major land ownership issues that may affect the long-term viability of the PCA and the element(s).
- Management Urgency Rank: M#.
- A summary of major management issues that may affect the long-term viability of the PCA and the element(s).
- USGS 7.5-minute Quadrangle name(s): A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.
- Size: Expressed in acres.
- \*Elevation: Expressed in feet.
- General Description: A brief narrative of the topography, hydrology, vegetation, and current use of the potential conservation area.
- \*Key Environmental Factors: A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.
- \*Climate Description: Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, and temperature and precipitation patterns is included.
- \*Land Use History: General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.
- \*Cultural Features: Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.
- Biodiversity Significance Rank Comments: A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the PCA, global and state ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 1 for explanations of ranks and Table 2 for legal designations.
- Boundary Justification: Justification for the location of the proposed PCA boundary delineated in this report, which includes all known occurrences of Natural Heritage resources and, in some cases, adjacent lands required for their protection.
- \*Protection Urgency Rank Comments: Brief comments to justify the rating assigned to the PCA.
- \*Management Urgency Rank Comments: Brief comments to justify the rating assigned to the PCA.

- \*Land Use Comments: Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.
- \*Natural Hazard Comments: If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.
- \*Exotic Species Comments: A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance, and their potential effect on the viability of the targeted elements within the PCA.
- \*Offsite Considerations: Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.
- \*Information Needs: A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

\*Optional fields may or may not be included in PCA descriptions.

## Mosquito Range

Biodiversity Rank - B1: Outstanding Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Breckenridge, Vail Pass, Alma, Climax, Como, Mount Sherman, South Peak, Jones Hill, Copper Mountain, Fairplay West, Boreas Pass, Frisco

**Size:** 105,323 acres (42,623 ha)      **Elevation:** 10,500 - 14,200 ft. (3,200 - 4,328 m)

**General Description:** This site incorporates nearly the entire alpine area of the Mosquito Range. The predominant habitats are characterized by alpine meadows, rock outcrops, scree slopes, boulder fields, alpine lakes, willow carrs, snowmelt streamlets, and permanent snow fields. Snow melt flows down the north and south-facing slopes in intermittent drainages from the top of the ridges. The slopes are typified by tufted hairgrass / golden avens (*Deschampsia cespitosa* / *Geum rossii*) and kobresia / golden avens (*Kobresia myosuroides* / *Geum rossii*) communities, with scattered patches of willows (*Salix glauca* and *Salix brachycarpa*) and krummholz Engelmann spruce (*Picea engelmannii*). Moist areas with mossy ground cover provide the necessary habitat for Penland alpine fen mustard (*Eutrema penlandii*), which is one of the elements of primary importance in this site. This site supports an extraordinarily high concentration of rare plant species. Twenty globally rare plant species and several state rare species have been documented within this site. High elevation outcrops of Leadville Limestone are said to be a predominant factor in setting the stage for such high densities of rare plant species. Many of the rarest plants in this site, including Penland alpine fen mustard, are thought to be restricted to this geologic substrate. Several 14,000 foot peaks occur in the site. This area is known for its gold mining at the turn of the 1900 century. Evidence of historic mining is prevalent in some areas while other areas are little affected. Particularly exemplary areas within this large site include Hoosier Ridge, North Star Mountain, and Blue Lakes.

**Key Environmental Factors:** Blue Lakes, located in Summit County near the Park and Lake county lines, are reservoirs that have been created by the town of Colorado Springs.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Countless mines, both active and inactive, are scattered throughout the site.

**Cultural Features:** Mosquito and Weston passes were essential roads connecting the eastern side of Colorado to the western mines and towns.

**Biodiversity Significance Rank Comments (B1):** The Mosquito Range site is of outstanding biodiversity significance (B1); it is irreplaceable. This site supports all the known occurrences in the world for two critically imperiled (G1) plants: Mosquito Range



mustard (*Eutrema penlandii*) and Weber's draba (*Draba weberi*). The site includes several excellent (A-ranked) and good (B-ranked) occurrences of Mosquito Range mustard (federally listed as a threatened species) and the only known occurrences in the world of Weber's draba. The Mosquito Range is one of the botanical "hotspots" in Colorado. There are few other areas in the state supporting the number and rarity of plant species found here. Many globally imperiled (G2) and globally vulnerable G3) plant species occur within the site including globe gilia (*Ipomopsis globularis*), another very narrowly restricted species whose known distribution is mostly in the Mosquito Range. Many of the globally common (G5) but state rare (S1 or S2) species that are found here are disjunct from arctic distributions, such as Sea pink (*Armeria maritima* ssp. *sibirica*), which is absent between Alaska/Northern Territories and Colorado and then occurs in a few alpine sites in our state. The Polixenes arctic butterfly is also known from this area as well as several globally and/or state imperiled plant communities.

## Natural Heritage element occurrences at Mosquito Range.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Birds	<i>Leucosticte australis</i>	Brown - capped Rosy - finch	G4	S3B,S4 N			SWAP Tier 1	E	2017-08-06
Birds	<i>Leucosticte australis</i>	Brown - capped Rosy - finch	G4	S3B,S4 N			SWAP Tier 1	E	2018-07-13
Birds	<i>Leucosticte australis</i>	Brown - capped Rosy - finch	G4	S3B,S4 N			SWAP Tier 1	E	2017-08-03
Insects	<i>Oeneis polixenes</i>	Polixenes Arctic	G5	S3				H	1972-07-16
Insects	<i>Oeneis polixenes</i>	Polixenes Arctic	G5	S3				H	1982-07-02
Insects	<i>Oeneis polixenes</i>	Polixenes Arctic	G5	S3				H	1949-08-06
Natural Communities	<i>Pinus aristata</i> / <i>Ribes montigenum</i> Woodland	Upper Montane Woodlands	G3	S2				C	2000-09-02
Natural Communities	<i>Phippsia algida</i> Wet Meadow	Alpine Wetlands	GU	S1				H	1979-99-99
Natural Communities	<i>Phippsia algida</i> Wet Meadow	Alpine Wetlands	GU	S1				BC	1995-09-06
Vascular Plants	<i>Draba weberi</i>	Weber's draba	G1	S1			SWAP Tier 1/USFS	CD	2018-08-02
Vascular Plants	<i>Draba weberi</i>	Weber's draba	G1	S1			SWAP Tier 1/USFS	C	2012-07-28
Vascular Plants	<i>Draba weberi</i>	Weber's draba	G1	S1			SWAP Tier 1/USFS	B	2018-08-09
Vascular Plants	<i>Draba weberi</i>	Weber's draba	G1	S1			SWAP Tier 1/USFS	B	2015-08-02
Vascular Plants	<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	AB	2017-08-11
Vascular Plants	<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	D	2012-07-08
Vascular Plants	<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	A	2018-08-01
Vascular Plants	<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	A	2017-08-17
Vascular Plants	<i>Eutrema penlandii</i>	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	BC	2012-07-19

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	B	2017-07-14
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	E	2010-07-25
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	A	2018-07-30
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	D	2012-07-29
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	C	2015-08-14
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	H	1994-08-03
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	A	2017-08-28
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	D	2012-06-21
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	C	2012-07-11
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	C?	2012-07-22
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	BC	2018-07-30
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	B	2018-07-30
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	D	2012-06-06
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	B	2017-07-27
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	B	2007-07-18
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	E	2010-10-07
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	CD	2003-07-99
Vascular Plants	Eutrema penlandii	Mosquito Range mustard	G1G2	S1S2	LT		SWAP Tier 1	AB	2017-07-24
Vascular Plants	Delphinium ramosum var. alpestre	Colorado larkspur	G2	S2			SWAP Tier 2	E	2008-07-29
Vascular Plants	Draba exungiculata	clawless draba	G2	S2			SWAP Tier 2/USFS	E	2002-08-09



Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	<i>Draba exunguiculata</i>	clawless draba	G2	S2			SWAP Tier 2/USFS	C	2000-07-15
Vascular Plants	<i>Draba exunguiculata</i>	clawless draba	G2	S2			SWAP Tier 2/USFS	A	2016-07-26
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	D	2014-08-12
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	A	2014-07-02
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2011-07-20
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	D	2012-07-04
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2014-08-06
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	1997-08-06
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2015-07-15
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	H	1959-07-07
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2016-07-26
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2014-07-23
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	A	2000-07-21
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	A	2012-08-01
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	D	2012-08-16
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	D	2011-09-01

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	A	2011-07-20
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	A	2018-07-26
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	B	2016-07-26
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	D	2012-07-03
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	CD	2012-07-18
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	H	1985-07-09
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	H	1985-07-16
Vascular Plants	<i>Ipomopsis globularis</i>	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	B	2012-07-08
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	A	2012-06-30
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	H	1951-07-28
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	C	2012-06-20
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	A	2012-07-28
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	A	2018-07-26
Vascular Plants	<i>Physaria alpina</i>	Avery Peak twinpod	G2	S2			SWAP Tier 2	B	2014-07-22
Vascular Plants	<i>Ptilagrostis porteri</i>	Porter feathergrass	G2	S2			SWAP Tier 2/USFS	H	1959-09-03
Vascular Plants	<i>Ptilagrostis porteri</i>	Porter feathergrass	G2	S2			SWAP Tier 2/USFS	H	1986-08-03
Vascular Plants	<i>Ptilagrostis porteri</i>	Porter feathergrass	G2	S2			SWAP Tier 2/USFS	B	2006-08-15
Vascular Plants	<i>Castilleja puberula</i>	Downy indian - paintbrush	G2G3	S2S3			SWAP Tier 2	B	2012-07-19
Vascular Plants	<i>Castilleja puberula</i>	Downy indian - paintbrush	G2G3	S2S3			SWAP Tier 2	B	2000-08-13

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	B	2017-08-08
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	H	1948-08-31
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	H	1986-09-02
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	A	2018-07-26
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	B	2016-07-26
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	H	1989-08-27
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	B	2017-08-09
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	E	2004-07-30
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	AB	2007-10-10
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	A	2014-07-22
Vascular Plants	Saussurea weberi	Weber saussurea	G2G3	S2			SWAP Tier 2	H	1989-08-26
Vascular Plants	Townsendia rothrockii	Rothrock townsend - daisy	G2G3	S2S3			SWAP Tier 2	B	2016-07-26
Vascular Plants	Townsendia rothrockii	Rothrock townsend - daisy	G2G3	S2S3			SWAP Tier 2	E	1998-06-27
Vascular Plants	Townsendia rothrockii	Rothrock townsend - daisy	G2G3	S2S3			SWAP Tier 2	C	2015-07-19
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				H	1973-07-29
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				C	2012-06-25
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				C	2000-06-21
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				C	2011-07-21
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				C	2012-06-13
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				A	2014-06-28
Vascular Plants	Aquilegia saximontana	Rocky Mountain columbine	G3	S3				C	2012-06-27



Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2016-07-26
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				H	1997-07-17
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2011-07-27
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2011-08-24
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2008-07-29
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				B	2018-08-08
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				A	2005-09-20
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				C	2018-07-26
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2012-06-18
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2012-06-11
Vascular Plants	Astragalus molybdenus	Leadville milkvetch	G3	S3				E	2011-07-26
Vascular Plants	Draba globosa	rockcress draba	G3	S1				A	2016-07-06
Vascular Plants	Draba globosa	rockcress draba	G3	S1				C	2016-07-06
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2015-08-23
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2014-08-12
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				H	1980-07-16
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2015-07-01
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2014-08-13
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2014-08-06
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				A	1994-06-30

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	<i>Draba streptobrachia</i>	Colorado Divide whitlow - grass	G3	S3				E	1995-07-24
Vascular Plants	<i>Draba streptobrachia</i>	Colorado Divide whitlow - grass	G3	S3				C	2012-07-04
Vascular Plants	<i>Draba streptobrachia</i>	Colorado Divide whitlow - grass	G3	S3				C	2015-08-12
Vascular Plants	<i>Machaeranthera coloradoensis</i>	Colorado tansy - aster	G3	S3			USFS	C	2011-08-15
Vascular Plants	<i>Machaeranthera coloradoensis</i>	Colorado tansy - aster	G3	S3			USFS	A	2005-09-20
Vascular Plants	<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3			USFS	B	2014-09-01
Vascular Plants	<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3			USFS	B	2000-07-20
Vascular Plants	<i>Eriophorum altaicum</i> var. <i>neogaeum</i>	Altai cottongrass	G4?T3T4	S3			USFS	H	1990-08-10
Vascular Plants	<i>Draba borealis</i>	northern rockcress	G4G5	S2				H	1959-07-10
Vascular Plants	<i>Draba borealis</i>	northern rockcress	G4G5	S2				H	1985-07-05
Vascular Plants	<i>Draba borealis</i>	northern rockcress	G4G5	S2					9999-99-99
Vascular Plants	<i>Salix calcicola</i>	lime - loving willow	G4G5	S1				C	2000-08-01
Vascular Plants	<i>Botrychium simplex</i>	least moonwort	G5	S2				E	2000-08-09
Vascular Plants	<i>Botrychium simplex</i>	least moonwort	G5	S2				E	2000-09-12
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				E	2012-06-24
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				E	2005-09-20
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				H	1985-07-17
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				B	2006-08-16
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				H	1985-07-19
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				H	1978-99-99
Vascular Plants	<i>Braya humilis</i>	alpine braya	G5	S2				E	2002-08-09

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Braya humilis	alpine braya	G5	S2				E	2014-07-15
Vascular Plants	Carex scirpoidea	Canadian single - spike sedge	G5	S2				H	1986-08-10
Vascular Plants	Collomia grandiflora	showy collomia	G5	S1				H	1986-06-23
Vascular Plants	Cystopteris montana	mountain bladder fern	G5	S1				B	1997-08-28
Vascular Plants	Draba incerta	Yellowstone whitlow - grass	G5	S1				E	2011-08-12
Vascular Plants	Draba incerta	Yellowstone whitlow - grass	G5	S1				E	2011-07-21
Vascular Plants	Draba oligosperma	woods draba	G5	S2				H	1970-07-03
Vascular Plants	Draba oligosperma	woods draba	G5	S2				H	1967-07-12
Vascular Plants	Draba oligosperma	woods draba	G5	S2				A	2014-07-10
Vascular Plants	Draba oligosperma	woods draba	G5	S2				A	2014-06-21
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2000-07-20
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2014-08-14
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2015-06-24
Vascular Plants	Draba oligosperma	woods draba	G5	S2				E	2012-06-18
Vascular Plants	Oxytropis parryi	Parry's crazy - weed	G5	S1				E	2012-06-21
Vascular Plants	Parnassia kotzebuei	Kotzebue's grass - of - parnassus	G5	S2			USFS	A	2015-08-21
Vascular Plants	Parnassia kotzebuei	Kotzebue's grass - of - parnassus	G5	S2			USFS	AB	2006-08-16
Vascular Plants	Phippsia algida	snow grass	G5	S2				H	1973-08-08
Vascular Plants	Phippsia algida	snow grass	G5	S2				H	1979-99-99
Vascular Plants	Phippsia algida	snow grass	G5	S2				H	1984-07-21



Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Phippsia algida	snow grass	G5	S2				E	2014-09-25
Vascular Plants	Phippsia algida	snow grass	G5	S2				E	2014-07-28
Vascular Plants	Phippsia algida	snow grass	G5	S2				B	2014-08-31
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				H	1978-07-25
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				H	1973-07-01
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				E	2007-07-16
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				E	2015-07-15
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				H	1970-07-03
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				E	2007-07-09
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				E	2014-08-12
Vascular Plants	Armeria scabra ssp. sibirica	sea pink	G5T5	S1			USFS	B	2016-07-26
Vascular Plants	Muscaria monticola	tundra saxifrage	G5T5	S2				B	2010-07-22
Vascular Plants	Braya glabella var. glabella	arctic braya	G5T5?	S1			USFS		2000-07-27

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** The Lynx and Wolverine are known here from historical documentation.

**Boundary Justification:** The boundary includes all known elements in the Mosquito Range alpine zone. This boundary is thought to incorporate a large enough area to support all of the ecological processes of the Mosquito Range. This area will provide suitable habitat where additional individuals can become established over time. In the Blue Lakes area, the site includes the reservoir spillway, which is vital to the survival of *Draba weberi*.

**Protection Urgency Rank Comments (P2):** This site is publicly owned and managed by the U.S. Forest Service with the exception of numerous small inholdings which are privately owned. During the last 10 years increasing numbers of mining claims (small inholdings) have been sold to individuals for home site development in the Mosquito Range. The Hoosier Ridge Research Natural Area was designated in 1997, and includes 1,025 acres. This site is one of the most important botanical areas in Colorado.

**Management Urgency Rank Comments (M3):** This area was extensively explored for minerals, particularly at the turn of the last century. There are extensive mine tailings, roads and historic disturbances from mining activities. The renewal of mining may threaten this site. There have also been water diversions, historical and present. Recreation is probably the biggest current management concern. Several of the imperiled alpine plant species are very small and easily overlooked. Therefore, these species are highly threatened by trampling. Foot and vehicle traffic creates direct disturbances. Unnatural erosion is created by these activities and often brings debris onto the rare plant occurrences. Recreationists could be educated to understand the importance of rare plant habitat and the direct threat of trampling. A few of the roads in the area have been blocked. A monitoring program designed to detect changes in the overall quality or condition of the element occurrences in this site would benefit the management of this important area. Grazing by elk and mountain goats is common in some areas such as Boreas Mountain.

**Information Needs:** In general, Hoosier Ridge is an excellent area for botanical research because of the high number of rare plant species that are found here, including species that are endemic to Colorado and species that are disjunct from their primary distributions. All research activities should be designed to have little or no impact on the imperiled species. The Research Natural Area designation includes detailed information on management guidelines which should be followed as much as possible.

### **References**

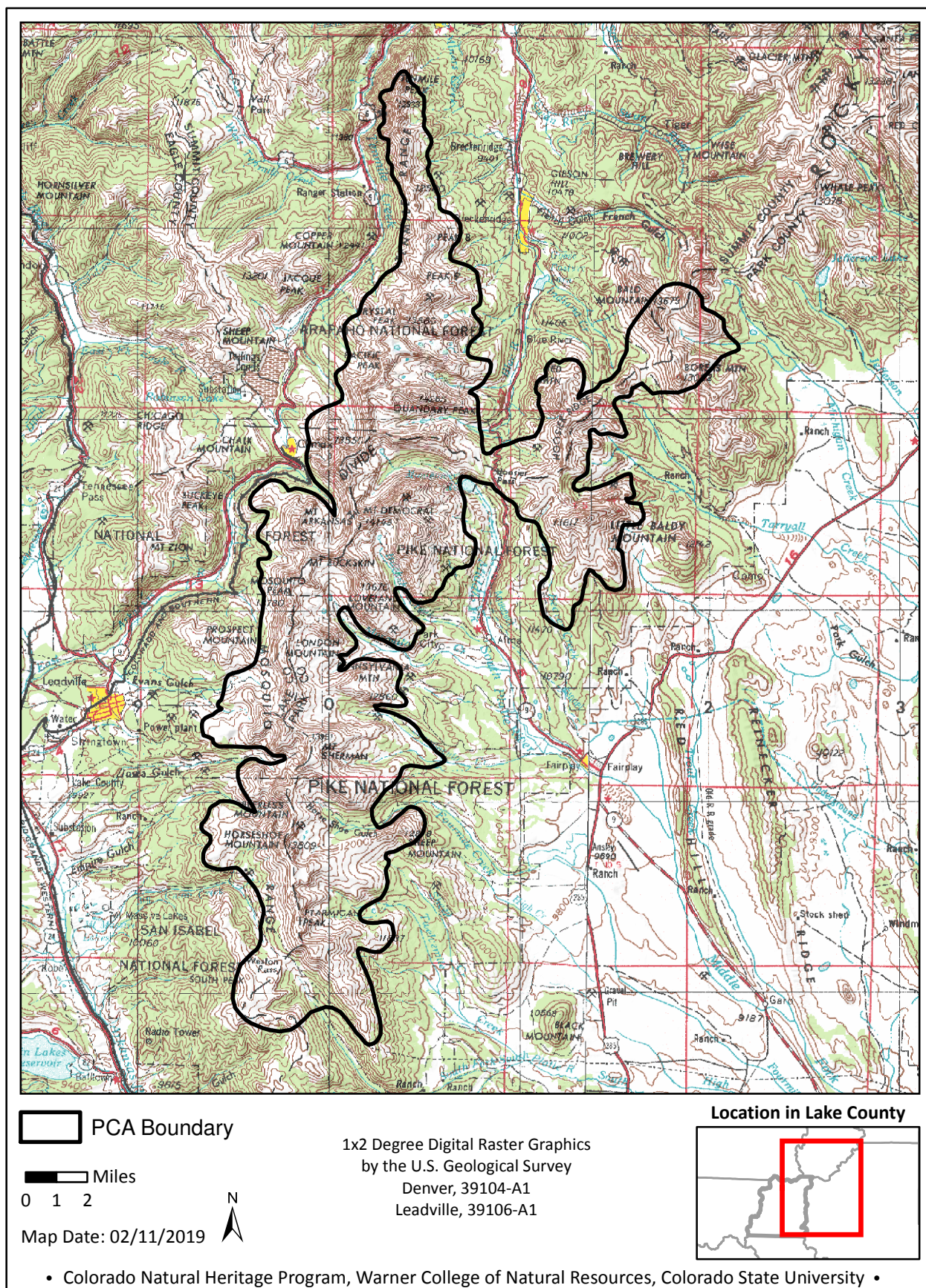
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**Version Author:** Culver, D.R.

**Version Date:** 02/15/2019



Mosquito Range Potential Conservation Area, B1: Outstanding Biodiversity Significance



## Hayden Fen

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Leadville South, Mount Sherman

**Size:** 1,791 acres (725 ha)

**Elevation:** 9,260 - 10,200 ft. (2,822 - 3,109 m)

**General Description:** The Hayden Fen site is located east of the Arkansas River and along the lower reach of Big Union Creek. The site is located at the base of an alluvial fan, formed from glacial deposits of Pinedale and Bull Lake Glaciations (Tweto 1979) of the Mosquito Range. There are numerous depressions located at the base of the alluvial fan that have formed on top of landslide and thick colluvial deposits, that are presently managed as a private subdivision for recreation e.g., boating and fishing. Big Union Creek, a second order stream, starts at Weston Pass and flows southwest from the Mosquito Range to its confluence with the Arkansas River. The lower portion of Big Union Creek supports a balsam poplar forest (*Populus balsamifera*), an understudied plant association. In Colorado, balsam poplar rarely forms stands larger than a few hundred yards long. The understory consists of mixed ages of balsam poplar, blue spruce (*Picea pungens*), Geyer willow (*Salix geyeriana*), Bebb willow (*S. bebbiana*), Rocky Mountain willow (*S. monticola*), Drummond willow (*S. drummondiana*), whitestem gooseberry (*Ribes inerme*), and rose (*Rosa* sp.) Balsam poplar is a common horticultural addition and may become established from cultivated areas, however this occurrence appears to be natural in terms of its location and the associated species. The site also supports an extreme rich fen, the first documented from the west side of the Mosquito Range. In general, a fen is a type of peatland that accumulates at least 40 cm (16 inches) of organic material in the upper 80 cm (32 inches) of the soil profile. Peat forms slowly over time where the production of organic matter is greater than the rate of decomposition due to saturation (Culver and Lemly 2013). The Hayden Fen is classified as extreme rich due to the levels of minerals in the soil water (pH of 8 or above). Extreme rich fens are closely associated with calcium-rich sedimentary bedrock, such as the Leadville Limestone found in the Mosquito Range. Caliciphiles, or plants that tolerate high calcium levels, are found throughout the site. The plant community is dominated by graminoids, in particular, analogue sedge (*Carex simulata*), a fen-obligate species, water sedge (*C. aquatilis*), and tufted hairgrass (*Deschampsia cespitosa*). A variety of forbs are present in lower cover e.g., seaside arrowgrass (*Triglochin maritima*), marsh arrowgrass (*T. palustris*), silvery primrose (*Primula incana*), pale blue-eyed grass (*Sisyrinchium pallidum*), elephanthead lousewort (*Pedicularis groenlandica*), shooting star (*Dodecathron pulchellum*), moss gentian (*Gentiana fremontii*), marsh felwort (*Lomatogonium rotatum*), and felwort (*Swertia perennis*). The open water from the groundwater discharge supported lesser bladderwort (*Utricularia minor*) and common mare's tail (*Hippuris vulgaris*). Shrubs are scattered throughout the fen, but are not dominant. They include planeleaf willow (*Salix planifolia*) and shrubby cinquefoil (*Dasiphora fruticosa*). The uplands consist of mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and/or hay meadow to the north of the site.

**Key Environmental Factors:** The key environmental factor is undisturbed groundwater discharge from snowmelt on the Mosquito Range to maintain seasonally high groundwater tables for the riparian forest and, most importantly, for the extreme rich fen.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Residential, recreation, and ranching.

**Biodiversity Significance Rank Comments (B2):** The Hayden Fen site is of very high biodiversity significance (B2) due to the presence of the only known extreme rich fen on the west side of the Continental Divide in Colorado (as of 2018). Even on a global basis, extreme rich fens are globally rare, known only from Park and Gunnison counties, northwestern Wyoming and northern California. Fens, in general, are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013). The site supports a good (B-ranked) occurrence of the analogue sedge fen (*Carex simulata*) with a suite of state rare plants in good (B-ranked) condition: simple bog sedge (*Kobresia simpliciuscula*) (G5/S2), marsh felwort (*Lomatagonium rotatum*) (G5/S2), lesser bladderwort (*Utricularia minor*) (G5/S2), and Rocky Mountain ragwort (*Packera debilis*) (G4/S1). There is also a state rare snail, swampy lymnaea (*Lymnaea stagnalis*). Along the lower portion of Big Union Creek, there is a good (B-rank) occurrence of a state rare (GU/S2) balsam poplar (*Populus balsamifera*) riparian forest. This community has not been described for Lake County previously but is known from tributaries of the Colorado, Cache La Poudre, and Gunnison River basins.

## Natural Heritage element occurrences at Hayden Fen.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Mollusks	<i>Lymnaea stagnalis</i>	Swampy Lymnaea	G5	S2				E	2018-07-19
Natural Communities	<i>Carex simulata</i> Fen	Wet Meadow	G4	S3				B	2017-07-06
Natural Communities	<i>Populus balsamifera</i> Woodland	Montane Riparian Woodland	GU	S2				B	2018-08-08
Vascular Plants	<i>Sisyrinchium pallidum</i>	Pale blue - eyed grass	G3	S3			BLM	C	2017-07-27
Vascular Plants	<i>Packera debilis</i>	Rocky Mountain ragwort	G4	S1				C	2017-07-27
Vascular Plants	<i>Kobresia simpliciuscula</i>	simple kobresia	G5	S2			USFS	B	2017-07-27
Vascular Plants	<i>Lomatogonium rotatum</i>	marsh felwort	G5	S2				B	2017-08-02
Vascular Plants	<i>Utricularia minor</i>	lesser bladderwort	G5	S2			USFS	B	2017-08-24

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** In Colorado, this is the first documented extreme rich fen west of the Mosquito Range.

**Boundary Justification:** Boundary is drawn with at least a 2 km buffer to capture the immediate hydrological processes that support the fen and riparian forest. The boundary includes the Mt. Massive residential area. Only private lands with written permission were accessed.

**Protection Urgency Rank Comments (P3):** The site is privately owned within the Mt. Massive residential area. The extreme rich fen is located on the federally owned Arkansas Headwaters Recreation Area and the upper portion is owned by U.S. Forest Service. There are large utility lines that bisect the fen from the Mt. Elbert Power Plant. It is unclear what the access is through the fen.

**Management Urgency Rank Comments (M1):** Undisturbed groundwater is the most important factor to manage. Water monitoring is advised.



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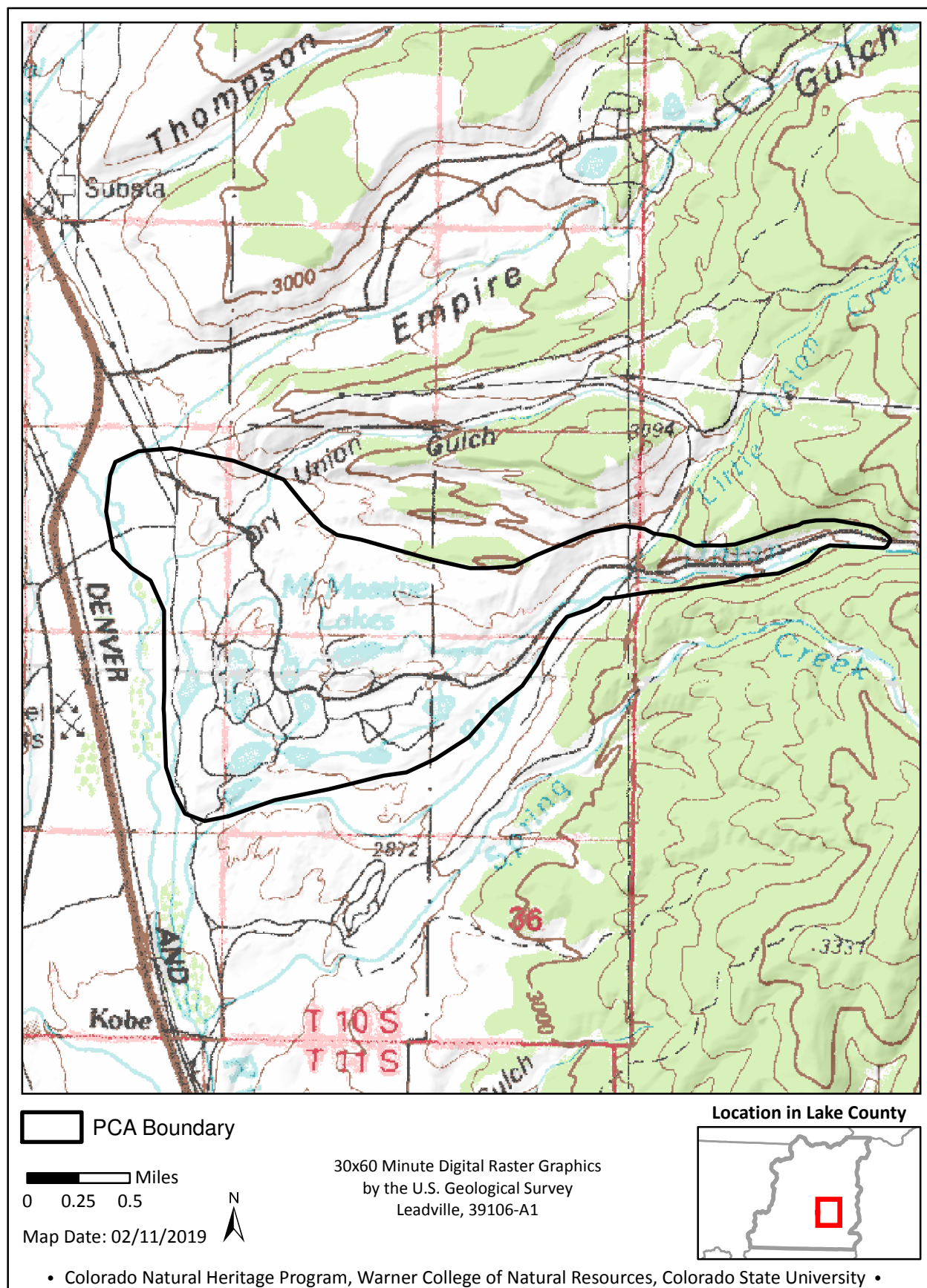
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**Version Author:** Culver, D.R.

**Version Date:** 01/03/2019



Hayden Fen Potential Conservation Area, B2: Very High Biodiversity Significance

## Homestake Peak Fen Complex

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Mount of the Holy Cross, Leadville North, Homestake Reservoir

**Size:** 4,550 acres (1,841 ha)

**Elevation:** 10,580 - 12,000 ft. (3,225 - 3,658 m)

**General Description:** The Homestake Peak Fen Complex is located at the southeastern slope of Homestake Peak, within the San Isabel National Forest. The fens are located between lateral and terminal moraines and glacial drift from of the Pinedale and Bull Lake glaciations (Tweto 1979). Soil pits reveal that the fens have over 40 cm of fibric peat with much of the wetland quaking, therefore the fen is over 2,000 years old. The water sedge (*Carex aquatilis*) - *Sphagnum* spp. fen plant association is an uncommon wetland type limited to peat-accumulating wetlands fed by groundwater discharge. The fens are scattered throughout the area, around Lily Lake and West Tennessee Creek and the North Fork of West Tennessee Creek. Associated species within the fens are boreal bog sedge (*Carex magellanica* ssp. *irrigua*), tall cottongrass (*Eriophorum angustifolium*), and fewflower spikerush (*Eleocharis quinqueflora*). Associated forbs include elephanthead lousewort (*Pedicularis groenlandica*), marsh marigold (*Caltha leptosepala*), and heartleaf bittercress (*Cardamine cordifolia*). Other graminoids include tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), inland sedge (*Carex interior*), silvery sedge (*C. canescens*), and sheep sedge (*C. illota*). Buckbean (*Menyanthes trifoliata*) and coltsfoot (*Petasites frigida*) were documented along the muddy shores of open water. Planeleaf willow (*Salix planifolia*) and bog birch (*Betula glandulosa*) surrounded the fen with the drier areas supporting an Engelmann spruce (*Picea engelmannii*) subalpine forest.

**Key Environmental Factors:** Key environmental factors include undisturbed hydrology, in particular groundwater discharge from snowmelt in adjacent mountains. Beaver are also key to maintain groundwater levels sufficient to fens to thrive.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Biodiversity Significance Rank Comments (B2):** The site supports globally imperiled (G2G3/S2S3) fens, water sedge (*Carex aquatilis*) - *Sphagnum* ssp., in excellent (A-ranked) condition, healthy occurrences of the globally vulnerable (G3/S3) Colorado woodrush (*Luzula subcapitata*), and a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix wolfii* / mesic forbs wet shrubland. Fens are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013).



### Natural Heritage element occurrences at Homestake Peak Fen Complex.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2017-09-13
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2018-08-15
Natural Communities	Salix wolfii / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2018-07-16
Vascular Plants	Luzula subcapitata	Colorado wood - rush	G3	S3				A	2018-07-16
Vascular Plants	Luzula subcapitata	Colorado wood - rush	G3	S3				B	2018-07-16

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Lynx (*Lynx canadensis*) have been documented in the area.

**Boundary Justification:** Boundary is drawn to capture the immediate hydrological processes that support the fens and the watershed to indicate importance of maintaining groundwater flow.

**Protection Urgency Rank Comments (P2):** The majority of the site is USFS San Isabel National Forest. However, the water rights are owned by the city of Pueblo. In the lower reaches, numerous beaver dams had either been blown out by humans or spring runoff.

**Management Urgency Rank Comments (M2):** Monitor the existing fens and ensure that beaver are present to maintain high groundwater for the wetlands to thrive.

### References

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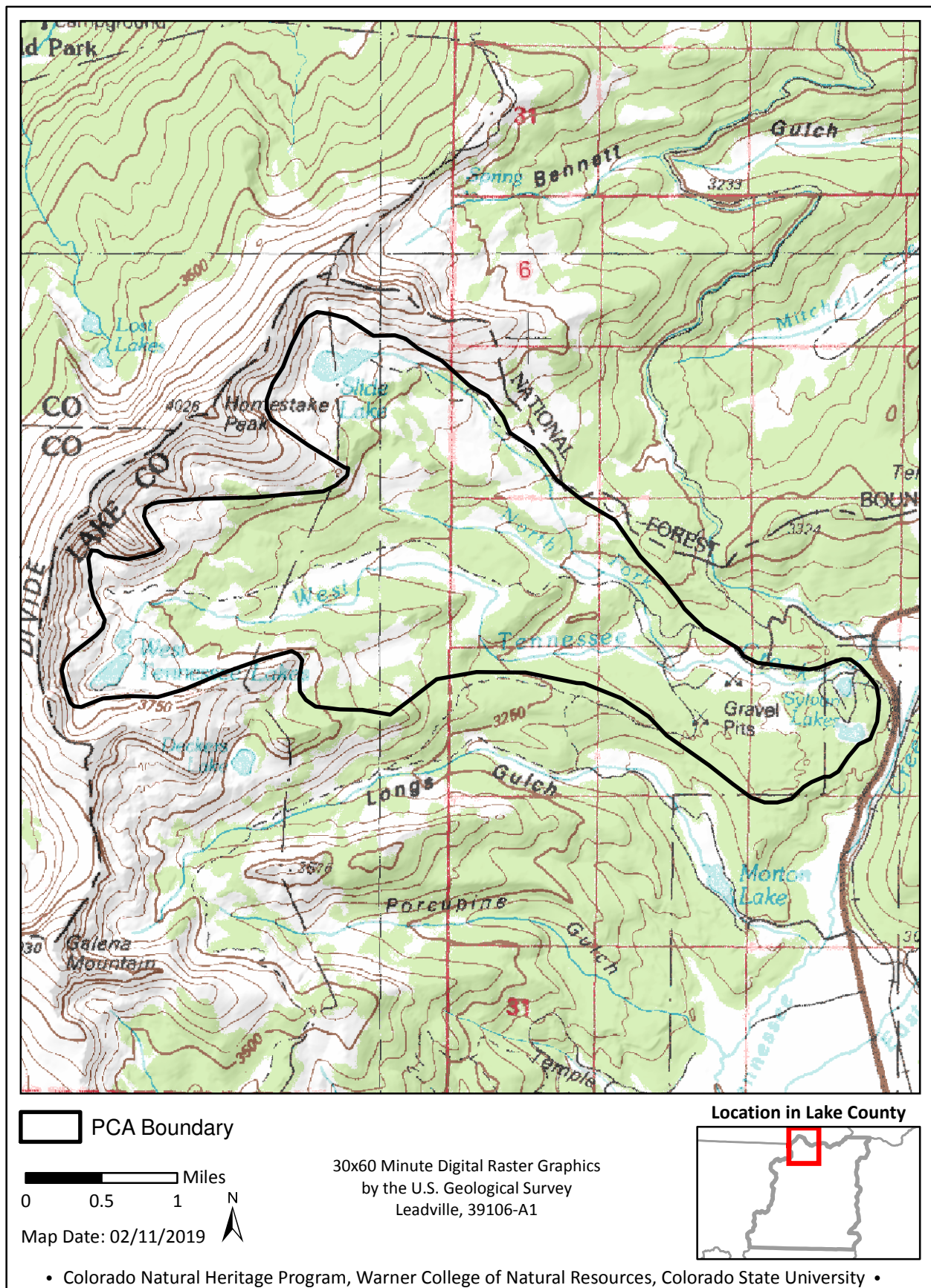
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**Version Author:** Culver, D.R.

**Version Date:** 01/04/2019



Homestake Peak Fen Complex Potential Conservation Area, B2: Very High Biodiversity Significance

## Mount Elbert

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Elbert, Mount Massive

**Size:** 1,909 acres (772 ha)

**Elevation:** 11,200 - 13,900 ft. (3,414 - 4,237 m)

**General Description:** The Mount Elbert site is located within the Sawatch Range, south of Mount Massive. Mount Elbert is the highest summit in Colorado and the Rocky Mountains. The headwaters of Elbert, Box, Mill, Herrington creeks and Bartlett Gulch are located at the eastern and southern slopes of Mount Elbert. There are numerous alpine tarn lakes throughout the site. The granite and talus slopes were created during the Pinedale and Bull Lake glaciation (Tweto 1979). The site topology is characterized with steep to moderate slopes and talus slopes, where the soil has become relatively stabilized and the water supply is more or less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. The alpine plant community system is characterized by a dense cover of low-growing, perennial graminoids and forbs.

Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate, mat-forming plants with thick rootstocks or taproots characterize the forbs. Dominant species include boreal sagebrush (*Artemisia arctica*), blackroot sedge (*Carex elynoides*), dry sedge (*Carex siccata*), spikenard sedge (*Carex nardina*), needleleaf sedge (*Carex duriuscula*), blackroot sedge (*Carex elynoides*), Hayden's sedge (*Carex haydeniana*), curly sedge (*Carex rupestris*), sheep fescue (*Festuca brachyphylla*), Idaho fescue (*Festuca idahoensis*), alpine avens (*Geum rossii*), Bellardi's bog sedge (*Kobresia myosuroides*), cushion phlox (*Phlox pulvinata*), and alpine clover (*Trifolium dasyphyllum*). Many other graminoids, forbs, and prostrate shrubs can also be found, including purple reedgrass (*Calamagrostis purpurascens*), alpine stichwort (*Minuartia obtusiloba*), tufted hairgrass (*Deschampsia cespitosa*), mountain avens (*Dryas octopetala*), cinquefoils (*Potentilla* spp), arctic bluegrass (*Poa arctica*), saxifrages (*Saxifraga* spp.), Rocky Mountain spike-moss (*Selaginella densa*), creeping sibbaldia (*Sibbaldia procumbens*), moss campion (*Silene acaulis*), golden rods (*Solidago* spp.), and Parry's clover (*Trifolium parryi*).

**Key Environmental Factors:** Key factors include sufficient snow pack to ensure longevity of alpine turf ecological system.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Cultural Features:** Mount Elbert was named in honor of a Colorado statesman, Samuel Hitt Elbert. The first written record of ascent was in 1874.

**Biodiversity Significance Rank Comments (B2):** Mount Elbert site is of very high



biodiversity significance (B2). It supports a good (B-ranked) occurrence of the globally imperiled (G2/S2) Hoosier Pass ipomopsis (*Ipomopsis globularis*), a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) Colorado Divide whitlow-grass (*Draba streptobrachia*), and an extant occurrence of the state rare (G5/S1S2) tundra buttercup (*Ranunculus gelidus*). This site represents a range expansion for Hoosier Pass ipomopsis which was previously known only from the Mosquito Range.

#### Natural Heritage element occurrences at Mount Elbert.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Ipomopsis globularis	Hoosier Pass ipomopsis	G2	S2			SWAP Tier 2	B	2015-08-03
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				C	2015-08-05
Vascular Plants	Ranunculus gelidus	tundra buttercup	G5	S1S2				E	2015-08-05

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The site is drawn to protect the rare plant occurrences from direct impacts such as trampling or other surface disturbances. A buffer is drawn to provide suitable habitat where additional individuals can become established over time.

**Protection Urgency Rank Comments (P3):** Mount Elbert is located within Pike-San Isabel National Forest, but not within the Mount Massive Wilderness Area. It is recommended to include this site and the summit for wilderness designation.

**Management Urgency Rank Comments (M3):** A trail through the rocky areas could threaten some individuals. Trail designation and signs requesting that people stay on the trail through the rare plant habitat are recommended. There is very high recreational use in this area.

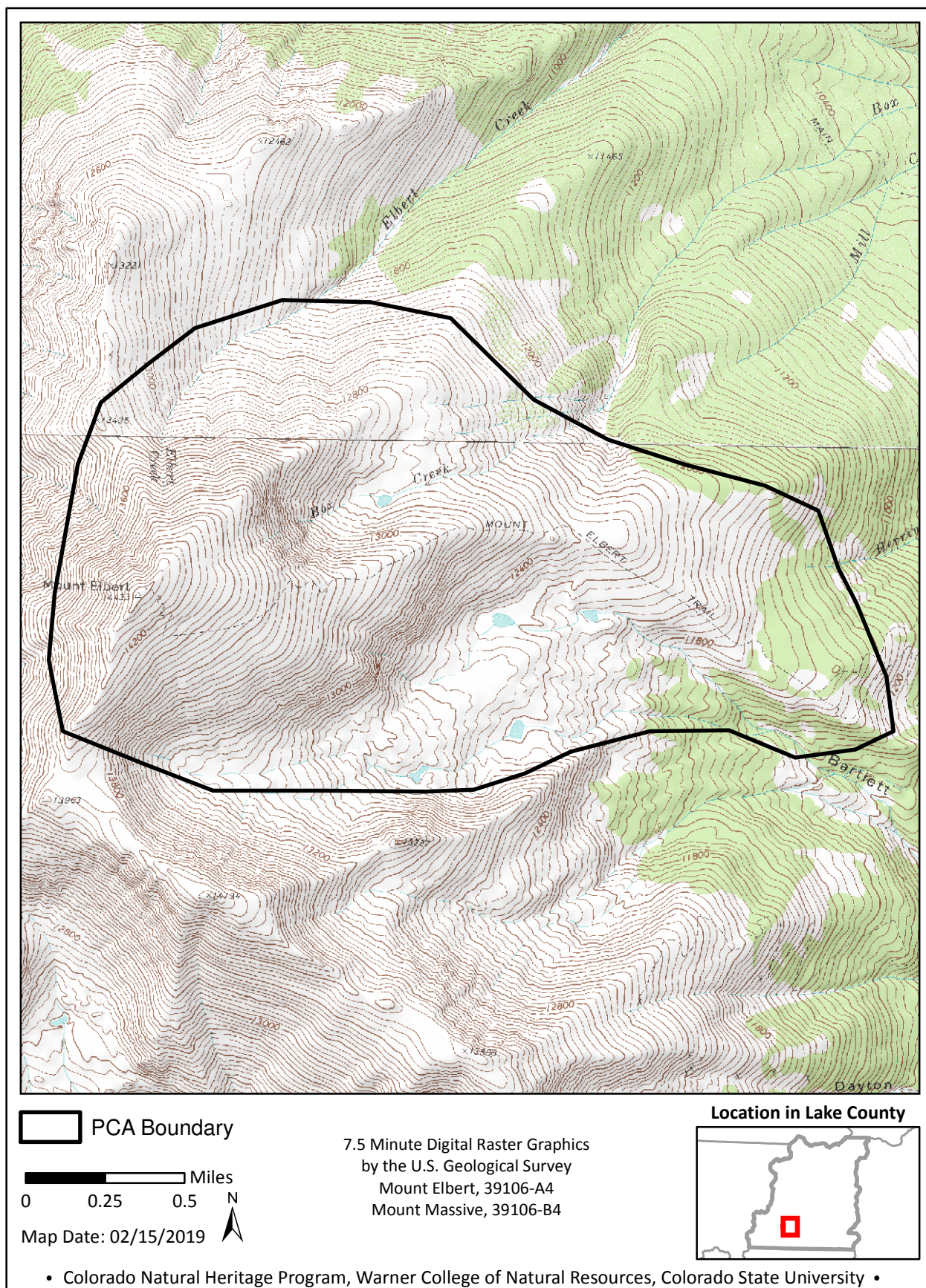
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**Version Author:** Culver, D.R

**Version Date:** 02/15/2019



Mount Elbert Potential Conservation Area, B2: Very High Biodiversity Significance

## North Fork Lake Creek

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Mount Champion, Independence Pass

**Size:** 939 acres (380 ha)

**Elevation:** 10,200 - 11,600 ft. (3,109 - 3,536 m)

**General Description:** The North Fork Lake Creek site is at the western flank of Mount Elbert and east of Independence Pass. The wetland is located between lateral moraines created during the Pleistocene glaciation that created Twin Lakes. The geology of the site is composed of glacial drift materials as well as landslide deposits (Tweto 1979). The site supports numerous fens, peat-accumulating wetlands, fed by groundwater discharge from adjacent mountains. A fen is a type of peatland that accumulates at least 40 cm (16 inches) of organic material in the upper 80 cm (32 inches) of the soil profile. Peat forms slowly over time where the production of organic matter is greater than the rate of decomposition due to saturation (Culver and Lemly 2013). Vegetation within the fens are dominated by graminoids, chiefly water sedge (*Carex aquatilis*) with needle spikerush (*Eleocharis acicularis*). The fens are surrounded by short willows, e.g., planeleaf willow (*Salix planifolia*), shortfruited willow (*S. brachycarpa*), wolf willow (*S. wolfii*) and bog birch (*Betula glandulosa*). There are *Sphagnum* spp. mounds scattered throughout with alpine laurel (*Kalmia microphylla*) and licorice-root (*Ligusticum tenuifolium*) growing on "drier hummocks". The fens have been accumulating peat for over 2,000 years. The soils are saturated throughout the growing season with patches of open water and areas that quake. The occurrence is surrounded by Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) subalpine forest.

**Key Environmental Factors:** Key environmental factors include undisturbed hydrology, in particular groundwater discharge from snowmelt in adjacent mountains. Beaver are also key to maintain groundwater levels sufficient for fens to thrive.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Historical mining adits dot the mountainsides. Current use is recreation hiking and horseback riding.

**Biodiversity Significance Rank Comments (B2):** The North Fork Lake Creek is one of very high biodiversity significance (B2) due to the concentration of numerous globally vulnerable (G2G3/S2S3) fens, water sedge (*Carex aquatilis*) - *Sphagnum* ssp. fen, that are in excellent (A-ranked) condition. An occurrence of the globally vulnerable (G3/S3) and state endemic Colorado woodrush (*Luzula subcapitata*) was also documented. Fens are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow



rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013).

Natural Heritage element occurrences at North Fork Lake Creek.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Mollusks	<i>Lymnaea stagnalis</i>	Swampy Lymnaea	G5	S2				E	2018-07-19
Natural Communities	<i>Carex aquatilis</i> - Sphagnum spp. Fen		G2G3	S2S3				A	2018-08-19
Natural Communities	<i>Carex aquatilis</i> - Sphagnum spp. Fen		G2G3	S2S3				A	2017-07-23
Vascular Plants	<i>Luzula subcapitata</i>	Colorado wood - rush	G3	S3				A	2018-08-21

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Southern Rocky Mountain boreal toad (*Anaxyrus boreas* pop. 1) (G4T1Q/S1) and lynx (*Lynx canadensis*) have been documented in the site.

**Boundary Justification:** Boundary is drawn to capture the immediate hydrological processes that support the fens and the immediate watershed to indicate importance of maintaining groundwater flow.

**Protection Urgency Rank Comments (P4):** The site is located within National Forest lands. Threats are mainly from off trail use from hikers, mountain bikes, and ORV.

**Management Urgency Rank Comments (M4):** Monitor potential impacts from recreation. Prevent water diversion from watershed.

### References

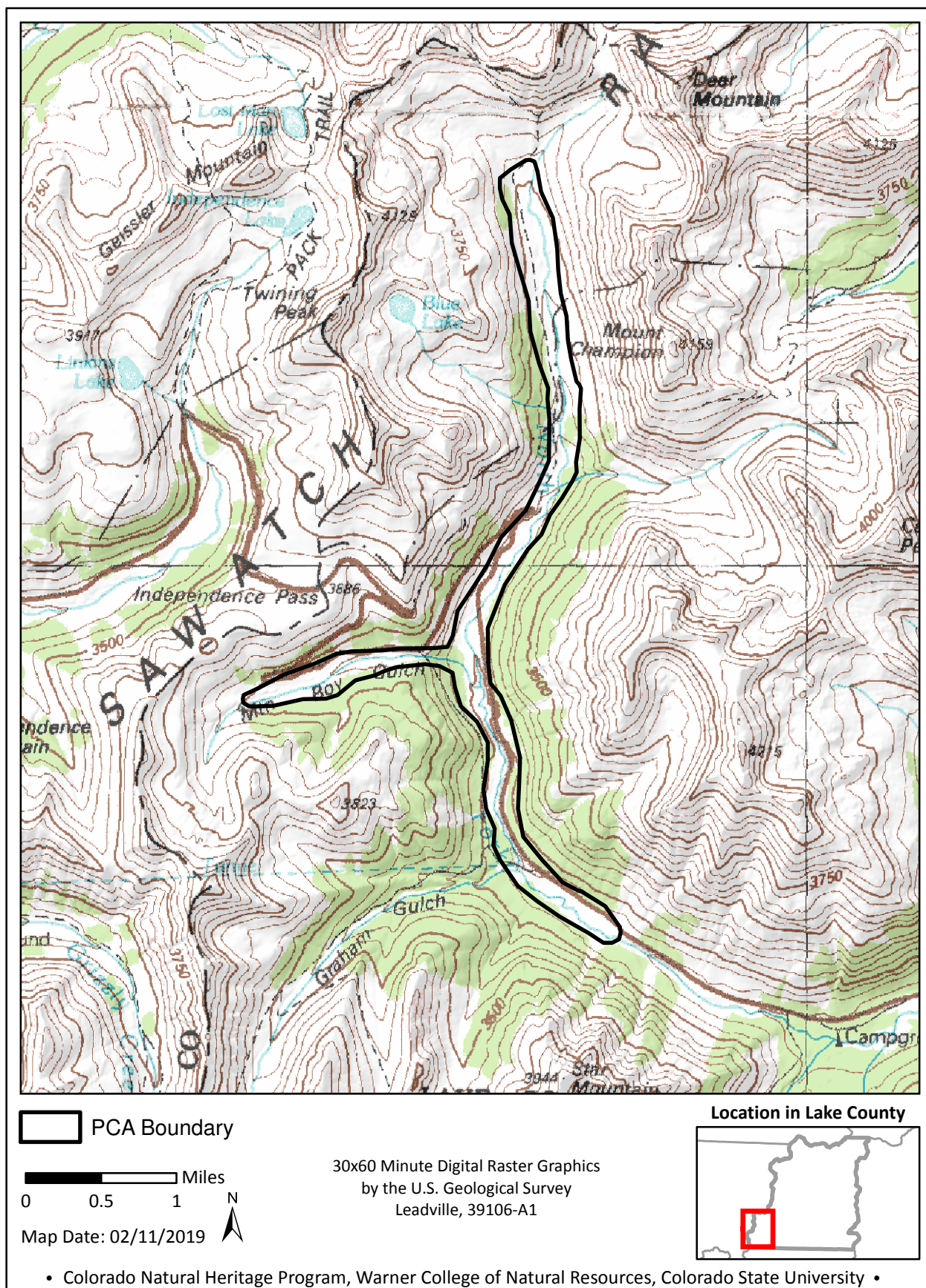
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**Version Author:** Culver, D.R.

**Version Date:** 01/04/2019



North Fork Lake Creek Potential Conservation Area, B2: Very High Biodiversity Significance

## Sawatch Range Fen Complex

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Mount Massive

**Size:** 2,700 acres (1,093 ha)

**Elevation:** 9,600 - 12,200 ft. (2,926 - 3,719 m)

**General Description:** The Sawatch Range Fen Complex is located within the glacial carved landscape along the eastern flank of the Sawatch Range. The wetlands are located between lateral moraines that were created during the Pinedale and Bull Lake glaciation (Tweto 1979). Windsor, Rainbow, Native, Swamp, and Hidden lakes are cirque lakes located at the terminal moraines and flow southeast to Rock Creek and eventually into the Arkansas River. The geology within the site created layers of granitic rocks that, along with permanent groundwater discharge, are indicative of fens. The site supports numerous fens, peat-accumulating wetlands, fed by groundwater discharge from mountain snowpack. A fen is a type of peatland that accumulates at least 40 cm (16 inches) of organic material in the upper 80 cm (32 inches) of the soil profile. Peat forms slowly over time where the production of organic matter is greater than the rate of decomposition due to saturation (Culver and Lemly 2013). The dominant plant association is water sedge (*Carex aquatilis*) fen, an uncommon wetland type limited to peat-accumulating wetlands fed by groundwater discharge. It is co-dominant with boreal bog sedge (*Carex magellanica* ssp. *irrigua*), tall cottongrass (*Eriophorum angustifolium*), and needle spikerush (*Eleocharis acicularis*). Numerous soil pits resulted in over 40 cm of fibric to peat with much of the wetland quaking. Associated forbs include elephanthead lousewort (*Pedicularis groenlandica*), marsh marigold (*Caltha leptosepala*), and heartleaf bittercress (*Cardamine cordifolia*). Other graminoids include black alpine sedge (*Carex nigricans*), mountain sedge (*C. scopulorum*), inland sedge (*C. interior*), Drummond rush (*Juncus drummondii*), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint (*Calamagrostis canadensis*). Aquatic plants documented include narrowleaf bur-reed (*Sparganium angustifolium*), vernal star-wort (*Callitriche palustris*), and Bolander's quillwort (*Isoetes bolanderi*). The fens are surrounded by short willows, e.g., planeleaf willow (*Salix planifolia*), shortfruited willow (*S. brachycarpa*), and bog birch (*Betula glandulosa*). Subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) subalpine forest surround the wetlands on drier mountain slopes. Lower in the site, along Rock Creek, is a bog birch (*Betula glandulosa*) / *Sphagnum* ssp. shrub fen that occurs on landslide deposits from the adjacent mountains.

**Key Environmental Factors:** Key environmental factors include undisturbed hydrology, in particular groundwater discharge from snowmelt in adjacent mountains. Beaver are also key to maintain groundwater levels sufficient for fens to thrive.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.



**Land Use History:** The lower portion of the site is owned by USFWS Leadville Hatchery that utilizes water from the site.

**Biodiversity Significance Rank Comments (B2):** The site is of very high biodiversity significance (B2) due to the concentration of several excellent (A-ranked) occurrences of globally rare plant associations. The globally imperiled (G2G3/S2S3) water sedge (*Carex aquatilis*)-*Sphagnum* spp. fen, was found in several locations in excellent (A-ranked) condition. A globally rare (G2/S2) bog birch (*Betula glandulosa*) / *Sphagnum* spp. shrub fen in excellent (A-ranked) condition was documented around lower portion of Rock Creek. In general, fens are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013).

Natural Heritage element occurrences at Sawatch Range Fen Complex.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Betula glandulosa</i> / <i>Sphagnum</i> spp. Shrub Fen	Dwarf Birch / sphagnum Shrubland	G2	S2				A	2017-07-09
Natural Communities	<i>Carex aquatilis</i> - <i>Sphagnum</i> spp. Fen		G2G3	S2S3				A	2017-07-22

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** *Lynx* (*Lynx canadensis*) has been documented and the site has potential habitat for amphibians.

**Boundary Justification:** Boundary is drawn to capture the immediate hydrological processes that support the fens and the immediate watershed to indicate importance of maintaining groundwater flow.

**Protection Urgency Rank Comments (P4):** The site falls within the ownership of either the U.S. Forest Service and the U.S. Fish and Wildlife Service. At the time of the study (2017) no known threats or developments are known.

**Management Urgency Rank Comments (M4):** Monitoring impacts from concentrated areas for backcountry sites is a minor concern.

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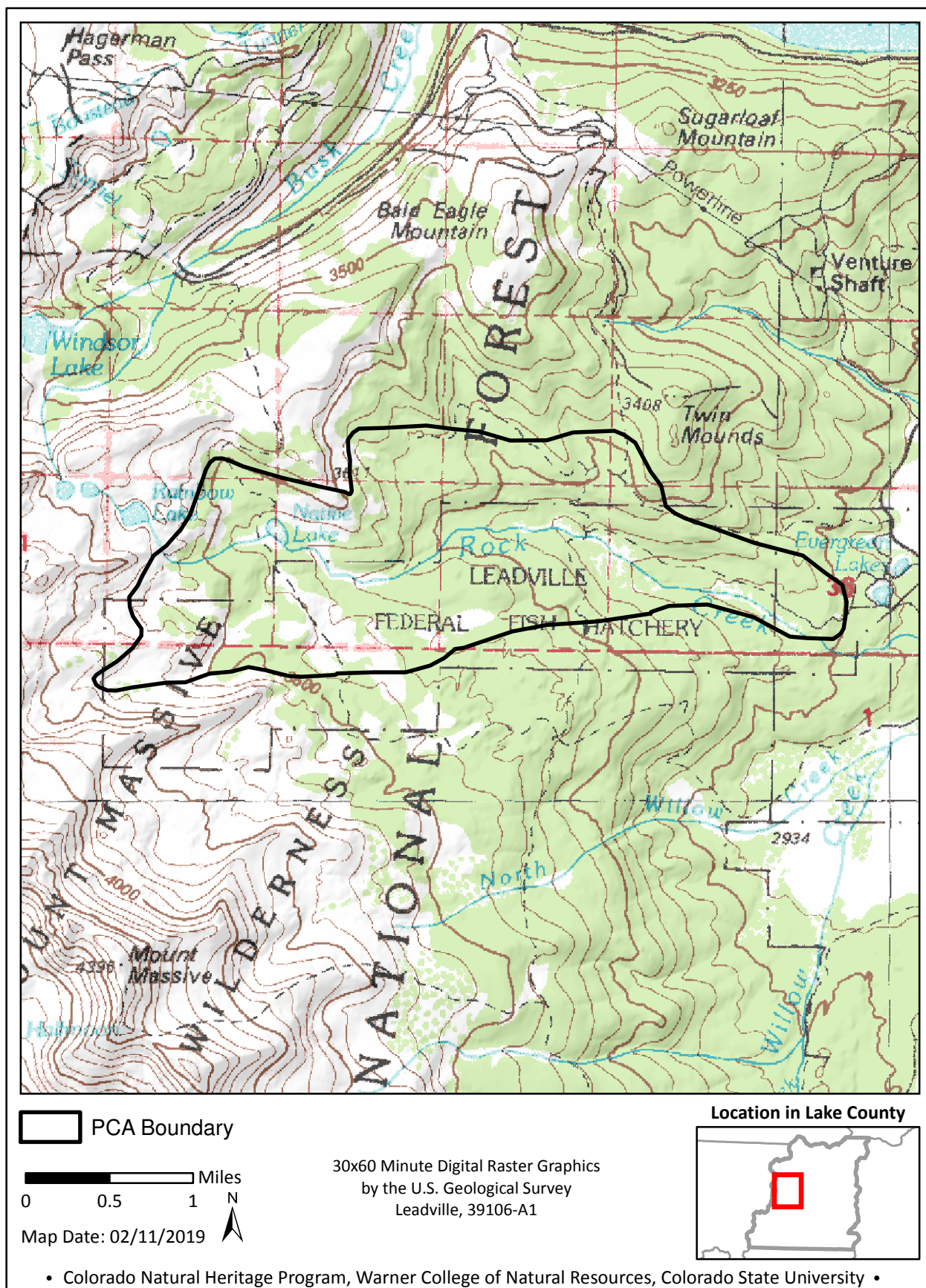
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**Version Author:** Culver, D.R.

**Version Date:** 01/04/2019



Sawatch Range Fen Complex Potential Conservation Area, B2: Very High Biodiversity Significance

## Twining Peak

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Champion, Independence Pass

**Size:** 1,517 acres (614 ha)

**Elevation:** 12,200 - 13,700 ft. (3,719 - 4,176 m)

**General Description:** Twining Peak rises to 13,700 feet and is crossed by the Continental Divide. The headwaters of the Roaring Fork River run along the western edge of the site. Dramatic views are afforded of Mt. Capitol, Mt. Sopris, and the Maroon Bells. Along the southern end there is a series of small ponds, willow patches, and marshy areas dominated by white marsh-marigold (*Caltha leptosepala*), as well as planeleaf willow (*Salix planifolia*). The slopes at the lower elevations are sparsely vegetated with dwarf clover (*Trifolium nanum*), yellow paintbrush (*Castilleja occidentalis*) and Ross's avens (*Geum rossii*). At the higher elevations, there are scree slopes, fell fields, rock gardens and large boulder outcrops interspersed. The western slopes of Twining Peak support diamondleaf willow - barren ground willow (*Salix planifolia* - *Salix brachycarpa*) shrublands with scattered Engelmann spruce (*Picea engelmannii*) that reach above treeline, and open wet and dry alpine meadows. The upper elevations are rocky with talus and boulder fields with scattered alpine meadows. There are some large patches with cryptogammic soil crusts.

**Key Environmental Factors:** Key factors include deep enough snowpack to support alpine system during the summer months.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Historically, mining was prevalent in the area; however, it is unknown if it occurred within the site boundaries.

**Biodiversity Significance Rank Comments (B2):** This site supports a globally imperiled (G2G3/S2S3) *Carex aquatilis* - *Sphagnum* spp. fen in excellent condition (A-ranked). Fens are an uncommon, irreplaceable wetland in the Southern Rockies. There are also good (B-ranked) and fair (C-ranked) occurrences of rare plants including the globally vulnerable (G3/S3) Colorado Divide whitlow-grass (*Draba streptobrachia*), the globally vulnerable (G3/S1) rockcress draba (*Draba globosa*), the globally vulnerable (G3/S3) Colorado wood-rush (*Luzula subcapitata*), and the state imperiled (G4G5/S2) northern rockcress (*Draba borealis*).



## Natural Heritage element occurrences at Twining Peak.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2017-07-22
Vascular Plants	Draba globosa	rockcress draba	G3	S1				C	2006-08-02
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				B	2006-08-02
Vascular Plants	Luzula subcapitata	Colorado wood - rush	G3	S3				BC	2017-07-23
Vascular Plants	Draba borealis	northern rockcress	G4G5	S2				C	2006-07-04

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** This site includes an excellent occurrence of the thick-leaf whitlow-grass (*Draba crassa*), a species on CNHP's watchlist, and the globally imperiled (G2/S2) Gray's Peak whitlow-grass (*Draba grayana*) is historically known from the site.

**Boundary Justification:** This boundary is drawn to 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time; and 3) include representation from each of the local alpine plant communities which may support a pollinator for one or more of the rare plant species. The upslope cliffs, rock outcrops, fell fields, and scree slopes were included to protect the occurrences from unnatural erosional disturbances. The downslope areas of suitable habitat were included to allow for the spread of the species over time.

**Protection Urgency Rank Comments (P4):** The site is publicly owned and managed by the U.S. Forest Service and is partially contained within the Hunter-Fryingpan and Mount Massive Wilderness Areas.

**Management Urgency Rank Comments (M3):** Recreation (mainly hiking) on this peak is currently minimal; however, if this activity increases, the construction of a trail will reduce the impact of trampling. There are no exotic species at this time. The Lost Man trail is adjacent to the creek and is commonly wet, causing hikers to create more new routes which widens the trail considerably. Trail maintenance might help prevent this widening.

**Natural Hazard Comments:** Talus slopes and boulder fields can be unstable.

**Off-Site Considerations:** The Lost Man trail is wet and causing hikers to create more and more new routes which is widening the trail considerably. Trail improvements may be considered.

**Information Needs:** Check with the Rocky Mountain Herbarium to verify the 1990 *Draba grayana* specimen at this location. Metal scraps of unknown purpose are scattered on the lower slopes of the mountain. If this material is for some future construction, the impacts

should be considered.

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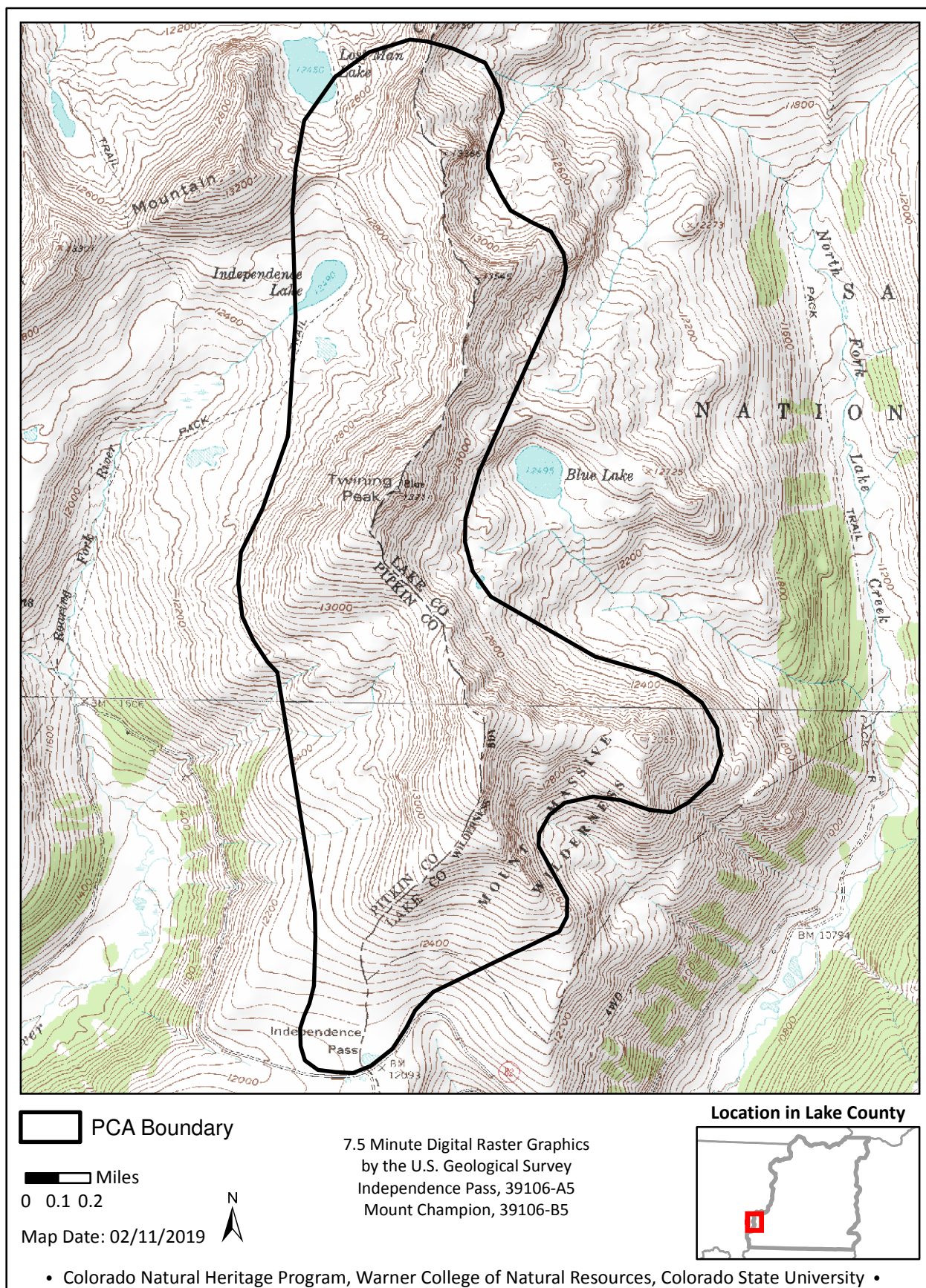
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**Version Author:** Culver, D.R.

**Version Date:** 02/05/2019



Twining Peak Potential Conservation Area, B2: Very High Biodiversity Significance

## Upper Lake Fork Fen Complex

Biodiversity Rank - B2: Very High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Homestake Reservoir

**Size:** 5,099 acres (2,063 ha)

**Elevation:** 10,400 - 11,200 ft. (3,170 - 3,414 m)

**General Description:** The Upper Lake Fork Fen Complex is located within the glacial carved landscape along the eastern flank of the Sawatch Range. The wetlands are located between lateral moraines that were created during the Pinedale and Bull Lake glaciation (Tweto 1979). Timberline, Virginia, Galena, and Bear lakes are cirque lakes located at the terminal moraines and flow south to Lake Creek and into Turquoise Lake. Glacier, Lake, Mill and Bear creeks are located within the site. The geology within the site created layer upon layer of glacial drift, that with permanent groundwater discharge are indicative of fens. The site supports numerous fens, peat-accumulating wetlands, fed by groundwater discharge from mountain snowpack. A fen is a type of peatland that accumulates at least 40 cm (16 inches) of organic material in the upper 80 cm (32 inches) of the soil profile. Peat forms slowly over time where the production of organic matter is greater than the rate of decomposition due to saturation (Culver and Lemly 2013). The dominant plant association is water sedge (*Carex aquatilis*) fen, an uncommon wetland type limited to peat-accumulating wetlands fed by groundwater discharge. It is co-dominant with boreal bog sedge (*Carex magellanica* ssp. *irrigua*), Buxbaum's sedge (*C. buxbaumii*), tall cottongrass (*Eriophorum angustifolium*), Chamisso's cottongrass (*Eriophorum chamissonis*), and needle spikerush (*Eleocharis acicularis*). Numerous soil pits resulted in over 40 cm of fibric to peat with much of the wetland quaking. Associated forbs include elephanthead lousewort (*Pedicularis groenlandica*), marsh marigold (*Caltha leptosepala*), heartleaf bittercress (*Cardamine cordifolia*). Other graminoids include tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), and inland sedge (*Carex interior*). The fens are surrounded by short willows, e.g., planeleaf willow (*Salix planifolia*), shortfruited willow (*S. brachycarpa*), and bog birch (*Betula glandulosa*). Subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) subalpine forest surround the wetlands on drier mountain slopes.

**Key Environmental Factors:** Key environmental factors include undisturbed hydrology, in particular groundwater discharge from snowmelt in adjacent mountains. Beaver are also key to maintain groundwater levels sufficient to fens to thrive.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** The Charles H. Boustead Tunnel or the Divide Tunnel is located within the site. It transports water from the Fryingpan River under the Continental Divide to Turquoise Reservoir as part of the Fryingpan—Arkansas Project or Fry-Ark. The Fry-Ark, is



a water diversion, storage, and delivery project that delivers water from the West Slope to southeastern Colorado for agriculture, hydroelectric power generation and to enhance recreation.

**Biodiversity Significance Rank Comments (B2):** The site is of very high biodiversity significance (B2) due to the concentration of fens and rare plants. There are numerous occurrences of globally vulnerable (G2G3/S2S3) fens, water sedge (*Carex aquatilis*) - *Sphagnum* spp. fen, that are in excellent (A-ranked) condition. An excellent occurrence (A-ranked) of the state significant (G4/S4) needle spikerush (*Eleocharis quinqueflora*) marsh was documented. New occurrences of the state vulnerable (G3/S3) Colorado woodrush (*Luzula subcapitata*) and an excellent occurrence of the state rare (G5/S1) Chamisso's cottongrass (*Eriophorum chamissonis*) were documented. In general, fens are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013).

Natural Heritage element occurrences at Upper Lake Fork Fen Complex.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Amphibians	Anaxyrus boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE	SWAP Tier 1/USFS	D	1998-99-99
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2018-08-21
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2017-07-23
Natural Communities	Carex aquatilis - Sphagnum spp. Fen		G2G3	S2S3				A	2017-07-22
Natural Communities	Eleocharis quinqueflora Fen	Alpine Wetlands	G4	S4				A	2018-08-13
Vascular Plants	Luzula subcapitata	Colorado wood - rush	G3	S3				BC	2017-07-24
Vascular Plants	Eriophorum altaicum var. neogaeum	Altai cottongrass	G4?T3T4	S3			USFS	C	2012-08-04
Vascular Plants	Eriophorum chamissonis		G5	S1			USFS	A	2018-08-13

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Two historical occurrences (1980s) of the Southern Rocky Mountain population of the boreal toad (*Anaxyrus boreas*) have been documented within this site as has lynx (*Lynx canadensis*).

**Boundary Justification:** Boundary is drawn to capture the immediate hydrological processes that support the fens and the immediate watershed to indicate importance of

maintaining groundwater flow.

**Protection Urgency Rank Comments (P4):** The majority of the site is located within the Mt Massive Wilderness/San Isabel National Forest. No threats are known at the time of the survey (2018).

**Management Urgency Rank Comments (M4):** Monitoring of dispersed backpacking is recommended as both the Continental Divide and Colorado trail bisect the site.

### References

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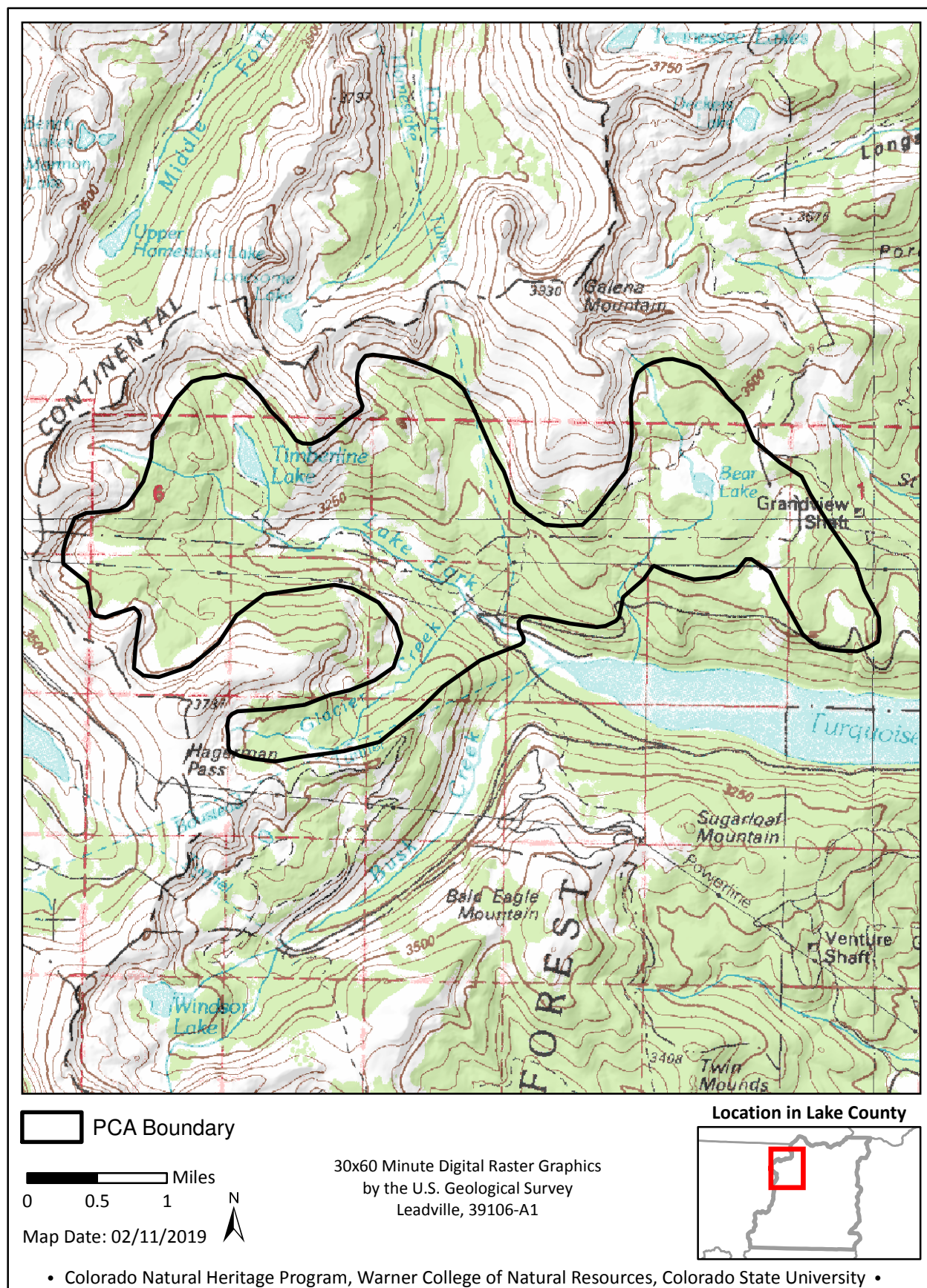
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**Version Author:** Culver, D.R.

**Version Date:** 01/04/2019



Upper Lake Fork Fen Complex Potential Conservation Area, B2: Very High Biodiversity Significance

## Arkansas River between Hayden and Balltown

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Leadville South, Granite, South Peak

**Size:** 6,957 acres (2,815 ha)

**Elevation:** 9,038 - 9,300 ft. (2,755 - 2,835 m)

**General Description:** The Arkansas River between Hayden and Balltown site is located in the Upper Arkansas River watershed. The Arkansas River drains this portion of Lake County, incorporating the following major tributaries: Big Union Creek, Spring Creek, and Low Pass Gulch on the eastern boundary. Box Creek and Lake Creek join the Arkansas River from the west. The underlying geology is representative of past glaciation from the side valleys that contributed several hundred feet of stream and lake deposits (Tweto 1979). The stream channel is straight with few meanders due to the gradient and topography. Soils contain the range of cobbles, rocks, and gravels. Mount Elbert and Mount Massive are located to the west and the Mosquito Range to the east. The riparian plant associations associated with this stretch of the Arkansas River include Geyer willow (*Salix geyeriana*) and Rocky Mountain willow (*S. monticola*) with shortfruited willow (*S. brachycarpa*) and coyote willow (*S. exigua*). The herbaceous layer is dominated by bog sedge (*Kobresia myosuroides*) which is the dominant graminoid on the upper bench with shrubby cinquefoil (*Dasiphora floribunda*). Other graminoids include beaked sedge (*Carex utriculata*), water sedge (*C. aquatilis*), woolly fruit sedge (*C. pellita*), field sedge (*C. praegracilis*) and baltic rush (*Juncus arcticus* ssp. *littoralis*). Songbirds observed in the area include Mountain Bluebird, Red-winged Blackbird, Barn Swallow, Western Meadowlark, Red-tailed Hawk, American Kestrel, and Vesper Sparrow. Signs of wildlife include coyote, elk, and mule deer. The uplands are dominated by mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and/or hay meadows. At the Hayden Ranch (operated by Colorado Mountain College) is a restored wetland from upper Box Creek as part of the mitigation for the City of Aurora's Box Creek Reservoir. Historically, before water development projects, this site likely was a very extensive wetland with peat-accumulating fens throughout the area.

**Key Environmental Factors:** Hydrology is the main environmental factor. The altered hydrology from past water delivery projects has lowered the groundwater table throughout the site.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Land use is mainly ranching and recreational access to fishing.

**Biodiversity Significance Rank Comments (B3):** The site encompasses several element occurrences of wetland-dependent species and plant associations. The rank is based on a



good (B-ranked) occurrence of the globally vulnerable (G3G4/S2) park milkvetch (*Astragalus leptaleus*). The site also supports a fair (C-ranked) occurrence of the globally vulnerable (G3/S3) plant community, Geyer's willow - Rocky Mountain willow / mesic forbs (*Salix geyeriana* - *Salix monticola* / mesic forbs) wet shrubland, and an introduced location for the globally rare (G2/S2) and Colorado endemic Porter's feathergrass (*Ptilagrostis porterii*) which is in fair-to-poor (CD-ranked) condition.

Natural Heritage element occurrences at Arkansas River between Hayden and Balltown.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> - <i>Salix monticola</i> / Mesic Forbs Wet Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				C	2018-07-25
Vascular Plants	<i>Ptilagrostis porterii</i>	Porter feathergrass	G2	S2			SWAP Tier 2/USFS	CD	2018-07-10
Vascular Plants	<i>Astragalus leptaleus</i>	Park milkvetch	G3G4	S2			USFS	B	2018-07-25

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** The restoration fen at Hayden Ranch is of interest for other mitigations involving fens. Townsend's Big-eared Bat (*Corynorhinus townsendii pallescens*) was documented in the late 1990s.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P3):** Most of the land is owned by the State or Bureau of Land Management. There are several private land parcels that have conservation easements held by the Central Colorado Conservancy.

**Management Urgency Rank Comments (M2):** Groundwater levels need to be monitored. The vegetation has changed, especially within the riparian zone, to graminoids that can tolerate drier soils. Non-native species present include scattered Canada thistle (*Cirsium arvense*) and wild chamomile (*Tripleurospermum perforatum*).

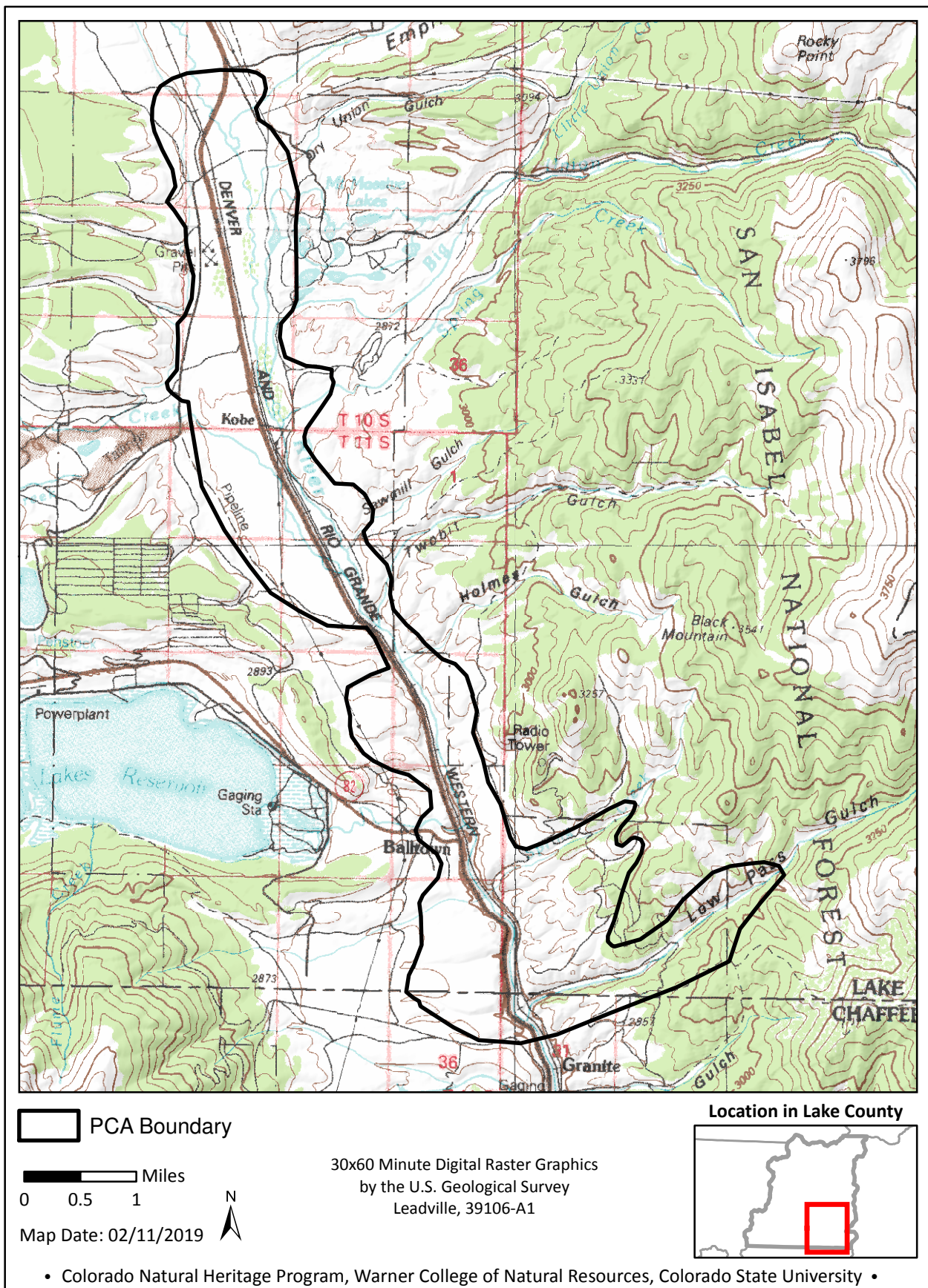
**Information Needs:** Groundwater level monitoring.

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**Version Author:** Culver, D.R.

**Version Date:** 01/03/2019



Arkansas River between Hayden and Balltown Potential Conservation Area, B3: High Biodiversity Significance

## Big Union Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Sherman

**Size:** 1,017 acres (412 ha)

**Elevation:** 10,600 - 12,000 ft. (3,231 - 3,658 m)

**General Description:** The site is located at the headwaters of Big Union Creek, a first order stream at the southwest slope of Ptarmigan Peak. This part of the county was not glaciated, therefore the underlying geology is derived from the Laramide Orogeny, consisting of granitic rocks (Tweto 1979). Several small drainages contribute to Big Union Creek, likely from groundwater discharge from snowpack via alluvium at the base of Weston Peak. The riparian area is dominated by wolf willow (*Salix wolfii*) with planeleaf willow (*S. planifolia*), shortfruited willow (*S. brachycarpa*), Rocky Mountain willow (*S. monticola*), and shrubby cinquefoil (*Dasiphora floridbunda*). Associated species include lambs-tongue ragwort (*Senecio integerrimus*), common yarrow (*Achillea millefolium*), alpine meadow-rue (*Thalictrum alpinum*), mountain bluebells (*Mertensia ciliata*), strawberry (*Fragaria virginiana*), felwort (*Swertia perennis*), large-leaved avens (*Geum macrophyllum*), Rocky Mountain hemlock (*Conioselinum scopulorum*), and queen's crown (*Rhodiola rhodantha*). Graminoids cover is approximately 10-20% and include chamisso sedge (*Carex pachystachya*), beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), water sedge (*C. aquatilis*), tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), and Baltic rush (*Juncus arcticus* ssp. *littoralis*). Soils are loamy with little mottling. The uplands are typical Engelmann spruce (*Picea engelmannii*) forests with lodgepole pine (*Pinus contorta*), scattered bristlecone pine (*Pinus aristata*) and mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) on south-facing slopes. There is evidence of beaver activity as well as mule deer and elk.

**Key Environmental Factors:** Key factors are beavers, to maintain groundwater level, unaltered seasonal flooding, and limited grazing pressure.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Remains of the Ruby Mine are above Big Union Creek and in the headwaters at Weston Pass.

**Cultural Features:** Weston Pass Road began as a toll road in 1878 for stagecoach and freight traffic going from Fairplay to Leadville.

**Biodiversity Significance Rank Comments (B3):** The site is of high biodiversity significance (B3) due to the good occurrence (B-ranked) of a globally vulnerable (G3/S3)



riparian shrubland, wolf willow / mesic forbs (*Salix wolfii* / mesic forb). Beaver evidence, a necessary component of highly functioning wetlands, especially riparian, was noted.

Natural Heritage element occurrences at Big Union Creek.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix wolfii</i> / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2018-07-18

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P4):** The majority of site is owned and managed by U.S. Forest Service. There are several mining claims above Big Union Creek that are privately held.

**Management Urgency Rank Comments (M3):** The presence of mesic forbs, instead of sedges or obligate wetland grasses, is indicative of a reduction of groundwater. The causes are numerous and can include climate change, improper grazing, or beaver removal. Management is urged to further monitor the groundwater levels.

### References

Carsey, K., D. Cooper, K. Decker, D. Culver, and G. Kittel. 2003. Statewide wetlands classification and characterization: Wetland plant associations of Colorado. Prepared for Colorado Department of Natural Resources, Denver, CO by Colorado Natural Heritage Program, Fort Collins, CO.

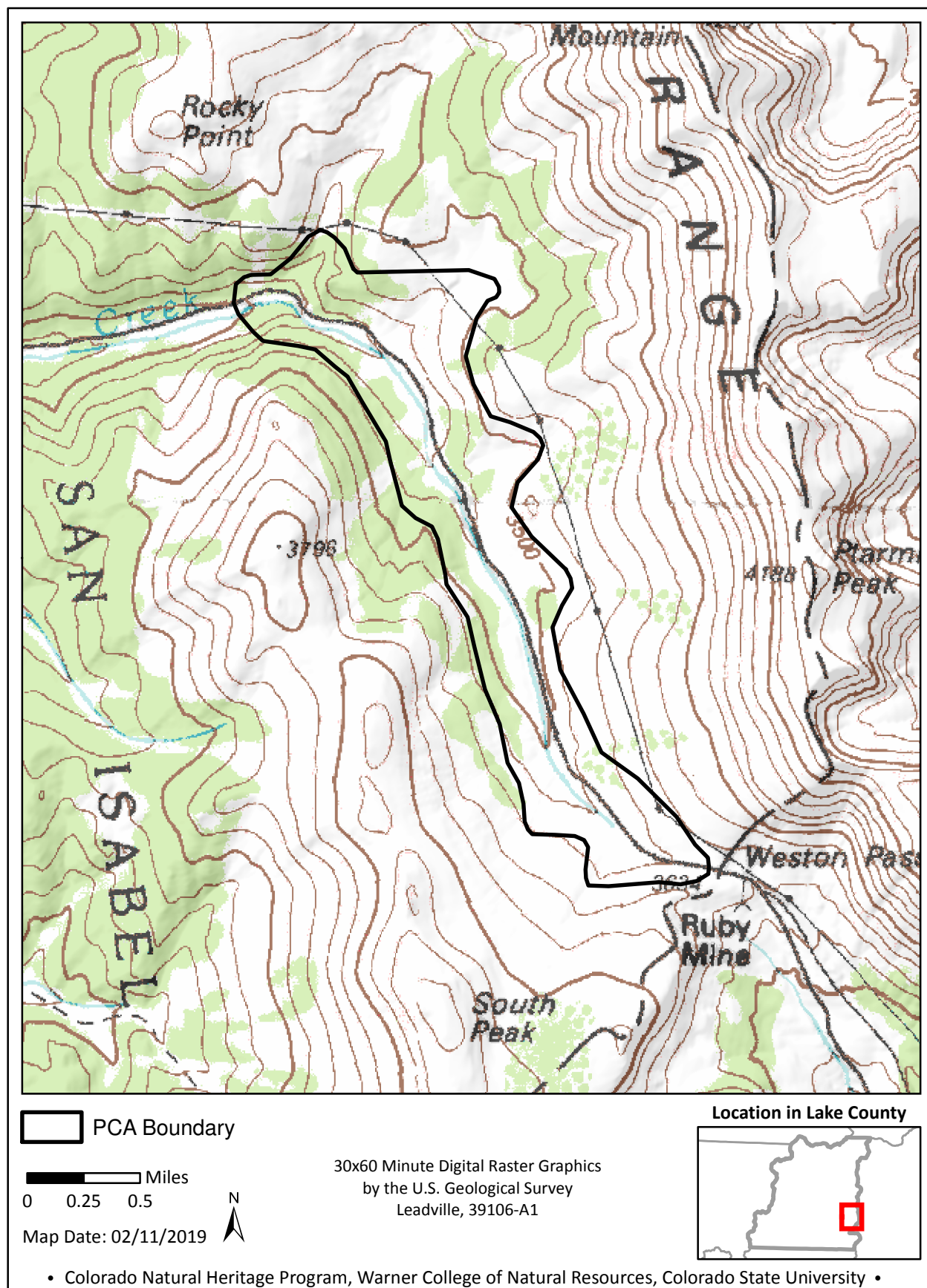
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Tweto, O. 1979. Geologic Map of Colorado, 1:500,000. United States Geological Survey, Department of Interior, and Geologic Survey of Colorado, Denver, CO.

**Version Author:** Culver, D. R.

**Version Date:** 01/07/2019



Big Union Creek Potential Conservation Area, B3: High Biodiversity Significance

## Buckeye Gulch

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Leadville North, Climax

**Size:** 267 acres (108 ha)

**Elevation:** 10,800 - 11,600 ft. (3,292 - 3,536 m)

**General Description:** The Buckeye Gulch site is located at the south slope of Buckeye Mountain in the Sawatch Range. Buckeye Gulch is minor tributary to the Upper Arkansas River. Buckeye Gulch is a first order stream that forms a moderately wide floodplain, that supports an extensive wolf willow (*Salix wolfii*) carr with planeleaf willow (*S. planifolia*), short-fruited willow (*S. brachycarpa*), and bog birch (*Betula glandulosa*). Forb species include elephanthead lousewort (*Pedicularis groenlandica*), heartleaf bittercress (*Cardamine cordifolia*), purple avens (*Geum rivale*), monkshood (*Aconitum columbianum*), arrowleaf ragwort (*Senecio triangularis*), common yarrow (*Achillea millefolium*), alpine meadow rue (*Thalictrum alpinum*), mountain bluebells (*Mertensia ciliata*), strawberry (*Fragaria virginiana*), and queen's crown (*Rhodiola rhodantha*). Graminoid cover is approximately 10-20% and includes tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), water sedge (*C. aquatilis*), and Baltic rush (*Juncus arcticus* ssp. *littoralis*). Soils are mucky peat with numerous depressions with open water. The surrounding uplands are Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) with buffaloberry (*Shepherdia canadensis*). Beaver evidence was documented with several dams, lodges, and beaver tracks. Signs of elk, deer, and moose were seen throughout the site.

**Key Environmental Factors:** Key factors include thriving beaver populations. Maintain current hydrology of seasonal flooding and high groundwater levels.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Biodiversity Significance Rank Comments (B3):** The Buckeye Gulch site is of high biodiversity significance (B3) due to the location of a good (B-rank) example of a globally vulnerable (G3/S3) wolf willow / mesic forb (*Salix wolfii* / mesic forb) wet shrubland. Hydrology is slightly altered in the lower portion of the site where there is evidence of mining, homesteading, and livestock grazing.

## Natural Heritage element occurrences at Buckeye Gulch.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Salix wolfii / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2017-08-26

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn with a 2 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. Private lands were respected and only properties with written permission were surveyed.

**Protection Urgency Rank Comments (P4):** The majority of the site is owned by the U.S. Forest Service with one inholding of private lands within the site.

**Management Urgency Rank Comments (M4):** Management recommendations are to maintain beaver populations and avoid hydrological modifications.

### References

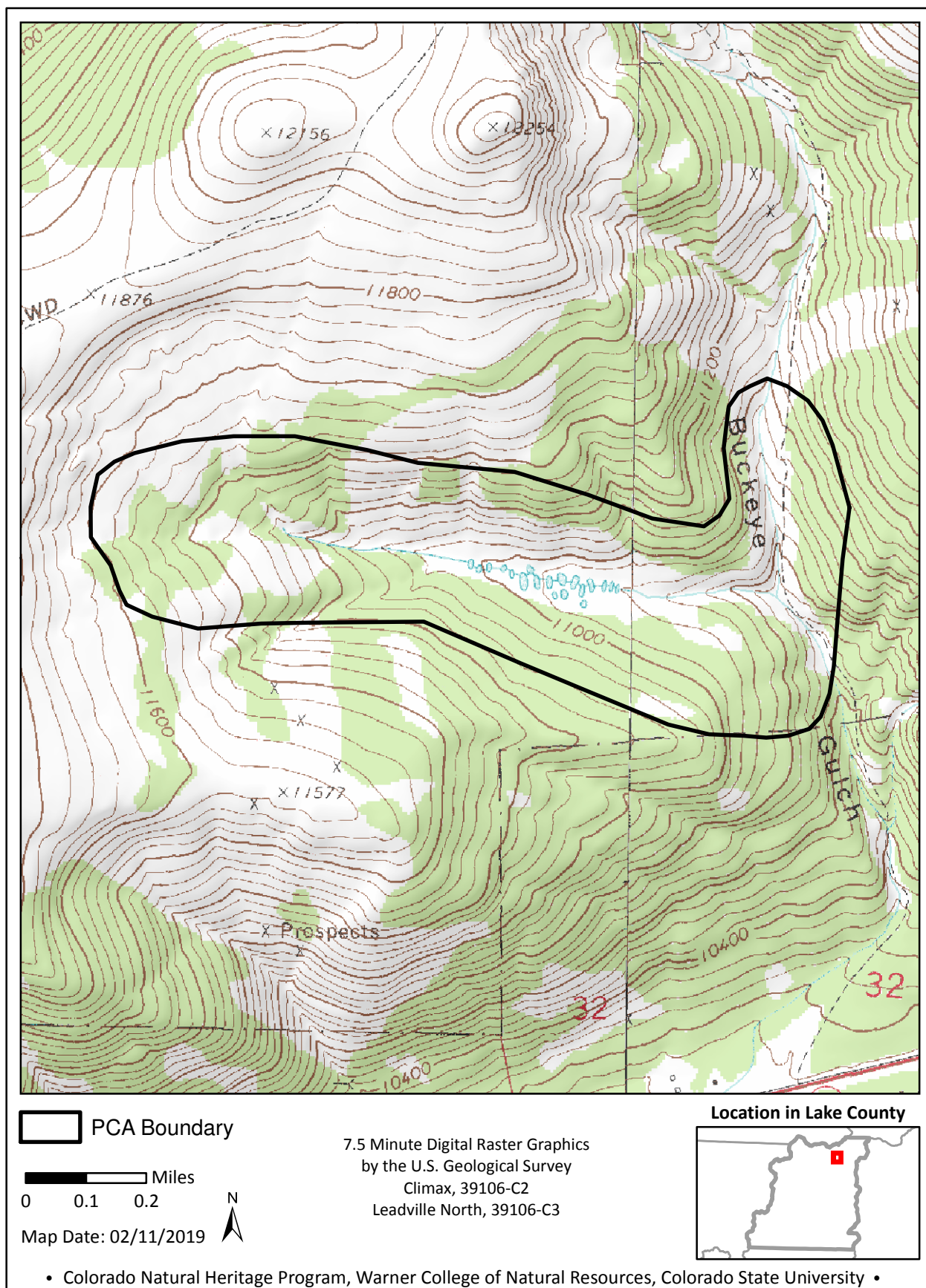
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**Version Author:** Culver, D.R.

**Version Date:** 01/25/2019





Buckeye Gulch Potential Conservation Area, B3: High Biodiversity Significance

## Corske Creek

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Elbert

**Size:** 327 acres (132 ha)

**Elevation:** 10,900 - 11,000 ft. (3,322 - 3,353 m)

**General Description:** The Corske Creek site is located at the southeastern toe slope of Mount Elbert. The wetlands are located on glacial and landslide deposits (Tweto 1979) that have been enhanced by beaver activity. Several areas of open water exist with aquatic vegetation such as narrowleaf bur-reed (*Sparganium angustifolium*) which shares dominance with water milfoil (*Myriophyllum sibiricum*) and pondweed (*Potamogeton praelongus*). The riparian shrubland supports an extensive wolf willow (*Salix wolfii*) carr with planeleaf willow (*S. planifolia*), short-fruited willow (*S. brachycarpa*), and shrubby cinquefoil (*Dasiphora floridbunda*). Forb species include lambs-tongue ragwort (*Senecio integerrimus*), common yarrow (*Achillea millefolium*), alpine meadow rue (*Thalictrum alpinum*), mountain bluebells (*Mertensia ciliata*), strawberry (*Fragaria virginiana*), felwort (*Swertia perennis*), large-leaved avens (*Geum macrophyllum*), Rocky Mountain hemlockparsley (*Conioselinum scopulorum*), and queen's crown (*Rhodiola rhodantha*). Graminoids cover approximately 10-20% and include chamisso sedge (*Carex pachystachya*), tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), water sedge (*C. aquatilis*), and Baltic rush (*Juncus arcticus* ssp. *littoralis*). Soils are loamy with some mottling, indicative of periodic episodes of flooding. The surrounding uplands are Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) with buffaloberry (*Shepherdia canadensis*). Beaver evidence was documented with several dams, lodges, and beaver tracks. Signs of elk, deer, and moose were seen throughout the site.

**Key Environmental Factors:** Key factors include thriving beaver populations. Maintain current hydrology of seasonal flooding and high groundwater levels.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Biodiversity Significance Rank Comments (B3):** The Corske Creek site is of high biodiversity significance (B3) due to an expansive wetland that supports an excellent (A-rank) example of a globally vulnerable (G3/S3) wolf willow / mesic forb (*Salix wolfii* / mesic forb) wet shrubland. A good (B-ranked) occurrence of the state rare (G4/S2) aquatic plant community, narrowleaf bur-reed (*Sparganium angustifolium*), is also within the site.

## Natural Heritage element occurrences at Corske Creek.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix wolfii</i> / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				A	2018-07-18
Natural Communities	<i>Sparganium angustifolium</i> Aquatic Vegetation	Montane Floating / submergent Palustrine Wetlands	G4	S2				B	2018-07-15

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Northern Goshawks (*Accipiter gentilis*) have been documented breeding within the site.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P2):** Site is owned by U.S. Forest Service, but the water is owned by City of Aurora. There are future plans to build a reservoir below the site. Impacts are unknown.

**Management Urgency Rank Comments (M3):** The Colorado and Continental Divide trails are located adjacent to the wetlands and the trailhead to summit Mount Elbert is located near the riparian corridor. Management recommendations are to keep dispersed camping to a minimum.

## References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

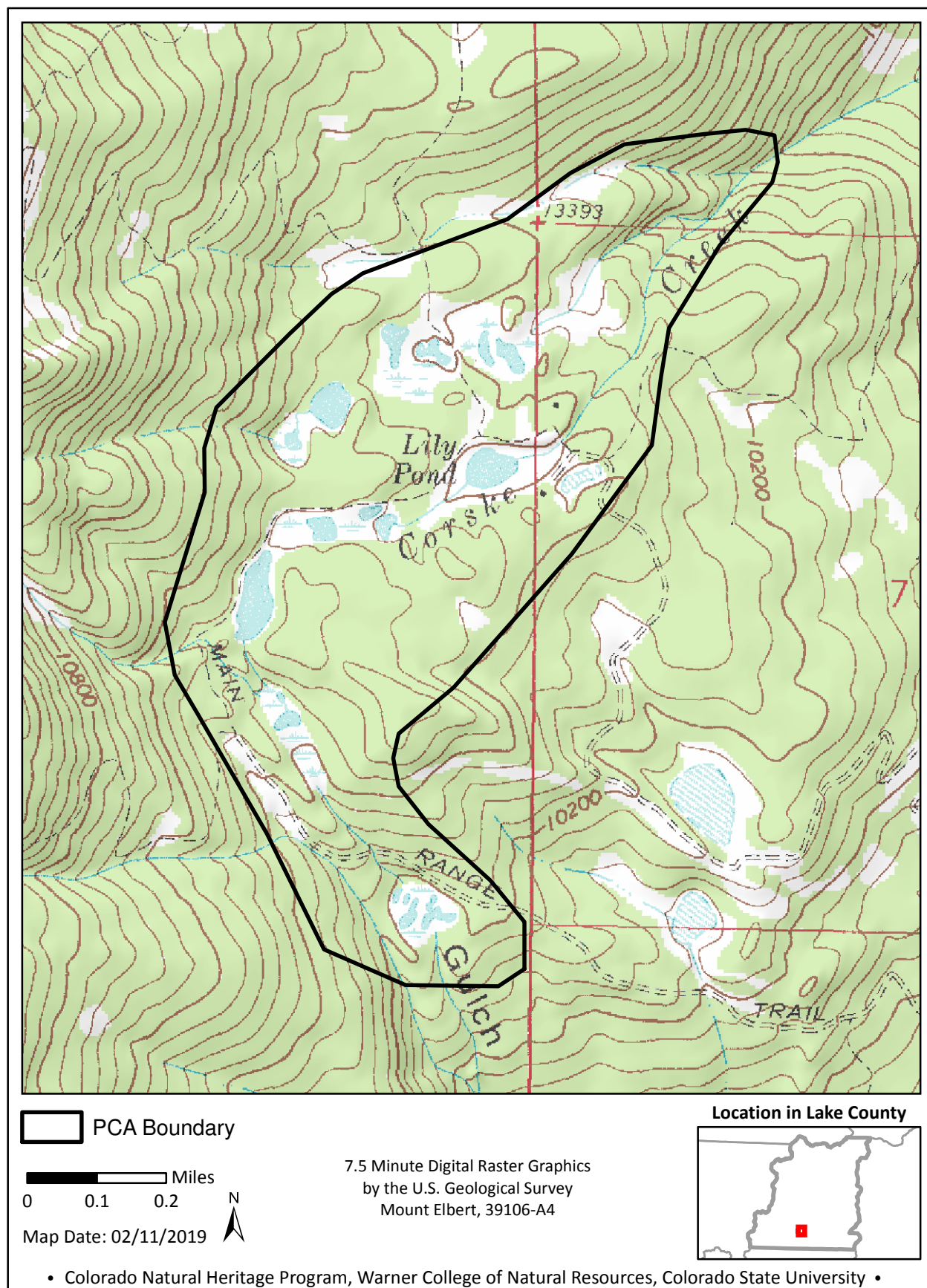
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**Version Author:** Culver, D.R.

**Version Date:** 01/28/2019



Corske Creek Potential Conservation Area, B3: High Biodiversity Significance



## East Fork Arkansas River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Leadville North, Climax

**Size:** 2,299 acres (930 ha)

**Elevation:** 9,996 - 12,000 ft. (3,047 - 3,658 m)

**General Description:** The East Fork Arkansas River site encompasses the headwaters of the Arkansas River. The East Fork begins in northeastern Lake County, within the cirque formed by Mount Arkansas, Mount Buckskin, and Mount Democrat. The first-order stream flows northwest atop glacial and landslide deposits. The East Fork is dominated by subalpine, low stature willows such as planeleaf willow (*Salix planifolia*), short-fruited willow (*S. brachycarpa*), marsh marigold (*Caltha leptosepala*), elephanthead lousewort (*Pedicularis groenlandica*), heartleaf bittercress (*Cardamine cordifolia*), yellow paintbrush (*Castilleja sulphurea*), tall fleabane (*Erigeron elatior*), streamside fleabane (*E. glabellus*), queen's crown (*Rhodiola rhodantha*), and mountain bluebell (*Mertensia ciliata*). Graminoid cover includes water sedge (*Carex aquatilis*), rock sedge (*C. saxatilis*), black sedge (*C. nova*), different-nerve sedge (*C. heteroneura*), tufted hairgrass (*Deschampsia cespitosa*), and alpine bluegrass (*Poa alpina*). Soils range from mesic loam to permanently saturated histosols along seeps on the west side of the riparian occurrence. No beaver activity was noted. There are several small fens scattered above the riparian zone dominated by water sedge (*Carex aquatilis*) with fibric peat to 40 cm deep. Once the East Fork starts to flow south, the riparian area widens and the shrub plant association transitions into wolf willow (*S. wolfii*) with Rocky Mountain willow (*S. monticola*), short-fruited willow (*S. brachycarpa*), bog birch (*Betula glandulosa*) and shrubby cinquefoil (*Dasiphora floribunda*). The graminoid cover is dominated by sedges, mainly water sedge (*Carex aquatilis*) with beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), bluejoint (*Calamagrostis canadensis*), and tufted hairgrass (*Deschampsia cespitosa*). Forbs include heartleaf bittercress (*Cardamine cordifolia*), valerian (*Valeriana edulis*), elephanthead lousewort (*Pedicularis groenlandica*), marsh marigold (*Caltha leptosepala*), monkshood (*Aconitum columbianum*), and large-leaved avens (*Geum macrophyllum*). Uplands are dominated by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*).

**Key Environmental Factors:** Key environmental factors are uninterrupted stream flows from mountains and beaver to maintain the groundwater level.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Historical mining claims are scattered throughout the upper slopes of the site.

**Biodiversity Significance Rank Comments (B3):** This site is of high biodiversity significance due to a good (B-ranked) occurrence of a globally vulnerable (G3/S3) strap-leaf willow (*Salix ligulifolia*) wet shrubland. It also supports an excellent (A-ranked) occurrence of a common (G5/S5) planeleaf willow / water sedge (*Salix planifolia* / *Carex aquatilis*) wet shrubland and a fair (C-ranked) occurrence of a state rare (G4/S3) wolf willow / water sedge (*Salix wolfii* / *Carex aquatilis*) wet shrubland.

Natural Heritage element occurrences at East Fork Arkansas River.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix ligulifolia</i> Wet Shrubland	Montane Willow Carr	G2G3	S3				B	1995-08-04
Natural Communities	<i>Salix wolfii</i> / <i>Carex aquatilis</i> Wet Shrubland	Subalpine Riparian Willow Carr	G4	S3				C	2018-07-08
Natural Communities	<i>Salix planifolia</i> / <i>Carex aquatilis</i> Wet Shrubland	Subalpine Riparian Willow Carr	G5	S5				A	2018-07-06

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** An historical occurrence of moonwort (*Botrychium simplex*) (G5S2) was searched for during 2017, but was not relocated. Several watchlisted plants, *Botrychium hesperium*, *Botrychium echo*, and *Botrychium minganense*, are known from the area.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P2):** Ownership for the site is shared by numerous owners. U.S. Forest Service owns the upper reaches, BLM owns parcels adjacent to Highway 93, and private owners, some with conservation easements, own properties closer to Leadville.

**Management Urgency Rank Comments (M2):** Monitor impacts from mining upstream, road maintenance within the floodplain, and expansion of non-native plants in 4 WD and trailhead parking areas.

## References

Carsey, K., D. Cooper, K. Decker, D. Culver, and G. Kittel. 2003. Statewide wetlands classification and characterization: Wetland plant associations of Colorado. Prepared for Colorado Department of Natural Resources, Denver, CO by Colorado Natural Heritage Program, Fort Collins, CO.

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**Version Author:** Culver, D.R.

**Version Date:** 01/07/2019



East Fork Arkansas River Potential Conservation Area, B3: High Biodiversity Significance



## Empire Gulch

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Leadville South, Mount Sherman

**Size:** 461 acres (186 ha)

**Elevation:** 10,500 - 12,000 ft. (3,200 - 3,658 m)

**General Description:** The Empire Gulch site is located at the base of Peerless Mountain and Mount Sheridan in the Mosquito Range in eastern Lake County. Empire Gulch sits atop glacial deposits of Pinedale and Bull Lake Glaciations (Tweto 1979) and meanders throughout the site, shifting direction due to beaver activity. The numerous side channels are hummocky with small ponds from beaver activity. The riparian area is dominated by Rocky Mountain willow (*Salix monticola*) / mesic graminoid shrubland. The willow carr is a tall, deciduous shrubland, with an open to closed canopy of willow located on the broad, low gradient floodplain supported by the meandering Empire Gulch. Associated shrubs include short-fruited willow (*S. brachycarpa*) and bog birch (*Betula glandulosa*). The graminoid layer is dominated by sedges and grasses that include bluejoint (*Calamagrostis canadensis*), tufted hairgrass (*Deschampsia cespitosa*), water sedge (*Carex aquatilis*), and beaked sedge (*C. utriculata*). A small pocket of analogue sedge (*C. simulata*), an indicator of a peat-accumulating wetland, was noted. The depth of peat was 10 cm, not sufficient to be classified as a fen. The forb layer consisted of elephanthead lousewort (*Pedicularis groenlandica*), pussy toes (*Antennaria* spp.), streamside fleabane (*Erigeron glabellus*), and heartleaf bittercress (*Cardamine cordifolia*). Soils are loamy with indications of mottling, indicating episodes of seasonal flooding. Evidence of past and current beaver activity as well as elk and deer were documented. The uplands are lodgepole pine (*Pinus contorta*) with Douglas-fir (*Pseudotsuga menziesii*) forests.

**Key Environmental Factors:** Key factors are beavers to maintain groundwater level, unaltered seasonal flooding, and limited grazing pressure.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** A private residential area is located above Empire Gulch.

**Biodiversity Significance Rank Comments (B3):** The Empire Gulch is of high biodiversity significance (B3) due to the presence of a good (B-ranked) occurrence of a globally vulnerable (G3/S3) Rocky Mountain willow / mesic graminoids (*Salix monticola* / mesic graminoid) wet shrubland. An occurrence of an aquatic plant, lesser bladderwort (*Utricularia minor*) (G5/S2) was documented in one of the beaver ponds. Bladderworts are an indicator of high water quality and perennial water. Bladderworts are carnivorous plants that trap small prey e.g., water fleas and mosquito larvae, in specialized "bladders".

#### Natural Heritage element occurrences at Empire Gulch.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Salix monticola / Mesic Graminoids Wet Shrubland	Montane Riparian Willow Carr	G3	S3				B	2017-08-24
Vascular Plants	Utricularia minor	lesser bladderwort	G5	S2			USFS	B	2017-07-27

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P4):** The lower portion of the site is privately owned, mainly by summer residents, and there are conservation easements in place. The upper portion is mainly owned by Colorado State Land Board and the U.S. Forest Service. There are historical mines above the site, especially in Empire Amphitheater.

**Management Urgency Rank Comments (M4):** Management recommendations include encouragement of beavers to maintain groundwater table depths.

#### References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

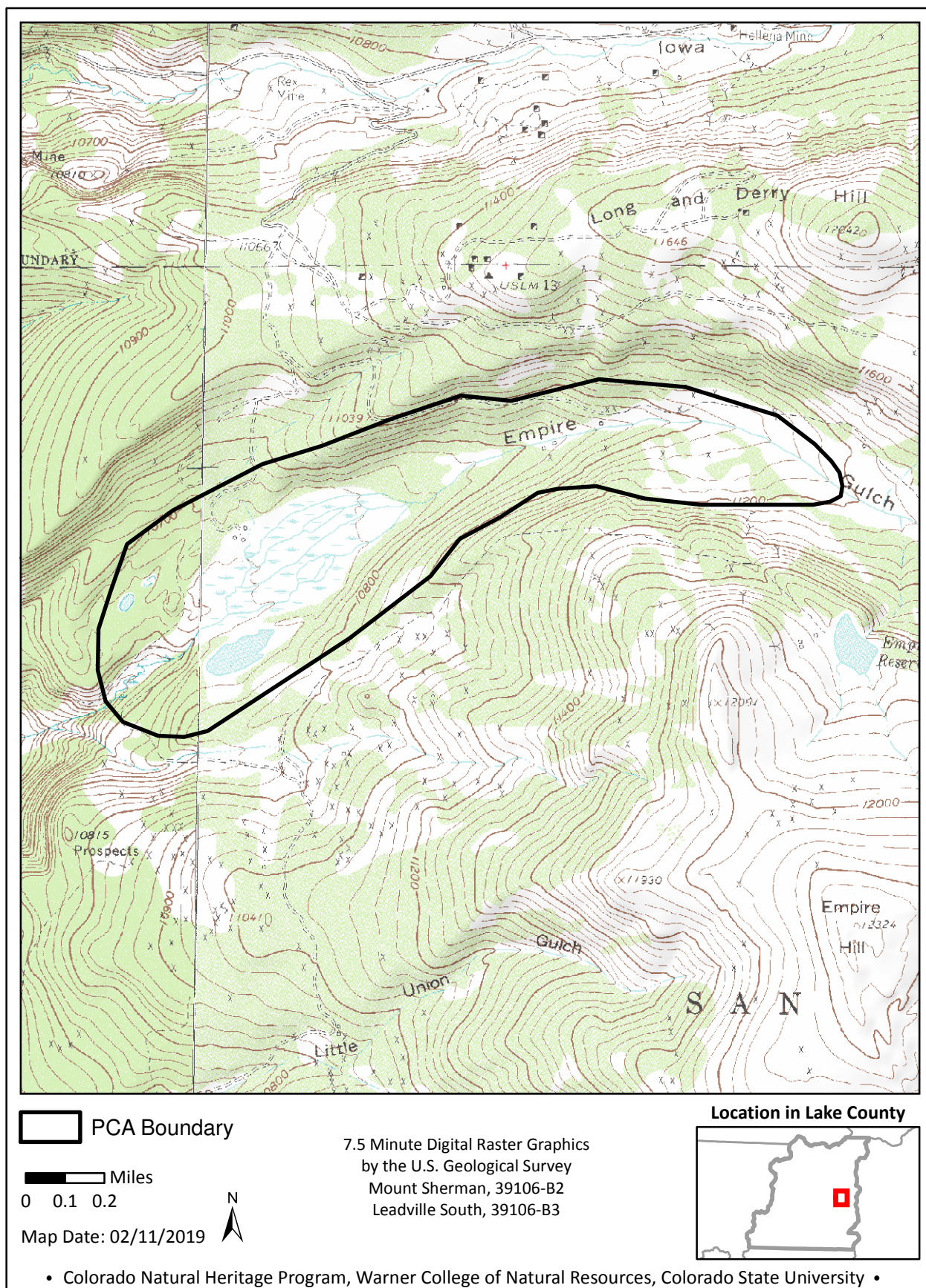
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**Version Author:** Culver, D.R.

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Empire Gulch Potential Conservation Area, B3: High Biodiversity Significance

## Longs Gulch

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Leadville North, Homestake Reservoir

**Size:** 881 acres (357 ha)

**Elevation:** 10,000 - 11,400 ft. (3,048 - 3,475 m)

**General Description:** The Longs Gulch site begins at the base of Galena Mountain in the Sawatch Range and flows southeast towards its confluence with Tennessee Creek. The site is between lateral moraines from the Pinedale and Bull Lake Glaciation (Tweto 1979) that have left glacial and landslide deposits. Longs Gulch is a first order stream that forms a moderately wide floodplain, that supports an extensive wolf willow (*Salix wolfii*) carr with planeleaf willow (*S. planifolia*), short-fruited willow (*S. brachycarpa*), and shrubby cinquefoil (*Dasiphora floridbunda*). Forb species include lambs-tongue ragwort (*Senecio integerrimus*), common yarrow (*Achillea millefolium*), alpine meadow rue (*Thalictrum alpinum*), mountain bluebells (*Mertensia ciliata*), strawberry (*Fragaria virginiana*), felwort (*Swertia perennis*), large-leaved avens (*Geum macrophyllum*), Rocky Mountain hemlockparsley (*Conioselinum scopulorum*), and queen's crown (*Rhodiola rhodantha*). Graminoids cover approximately 10-20% and include chamisso sedge (*Carex pachystachya*), tufted hairgrass (*Deschampsia cespitosa*), bluejoint (*Calamagrostis canadensis*), beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), water sedge (*C. aquatilis*), and Baltic rush (*Juncus arcticus* ssp. *littoralis*). Soils are loamy with some mottling, indicative of periodic episodes of flooding. The surrounding uplands are Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*) with buffaloberry (*Shepherdia canadensis*). Beaver evidence was documented with several dams, lodges, and beaver tracks. Signs of elk, deer, and moose were seen throughout the site.

**Key Environmental Factors:** Key factors include thriving beaver populations. Maintain current hydrology of seasonal flooding and high groundwater levels.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** The lower portion of the site is a residential area designed for fishing and hunting.

**Biodiversity Significance Rank Comments (B3):** The Longs Gulch site is of high biodiversity significance (B3) due to an expansive wetland that supports a good (B-ranked) example of a globally vulnerable (G3/S3) wolf willow / mesic forb (*Salix wolfii* / mesic forb) wet shrubland. Hydrology is slightly altered in the lower portion of the site. There is no evidence of mining, livestock grazing or flood controls. Boreal toad (*Anaxyrus boreas*) (G4T1Q/S1) was also documented within the site.



## Natural Heritage element occurrences at Longs Gulch.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Amphibians	Anaxyrus boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE	SWAP Tier 1/USFS	E	2018-08-17
Natural Communities	Salix wolfii / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2018-08-07

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn with at least a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P3):** The majority of the site is owned and managed by U.S. Forest Service. The lower portion is in private ownership.

**Management Urgency Rank Comments (M3):** Management recommendations are to maintain beaver population and avoid hydrological modifications.

### References

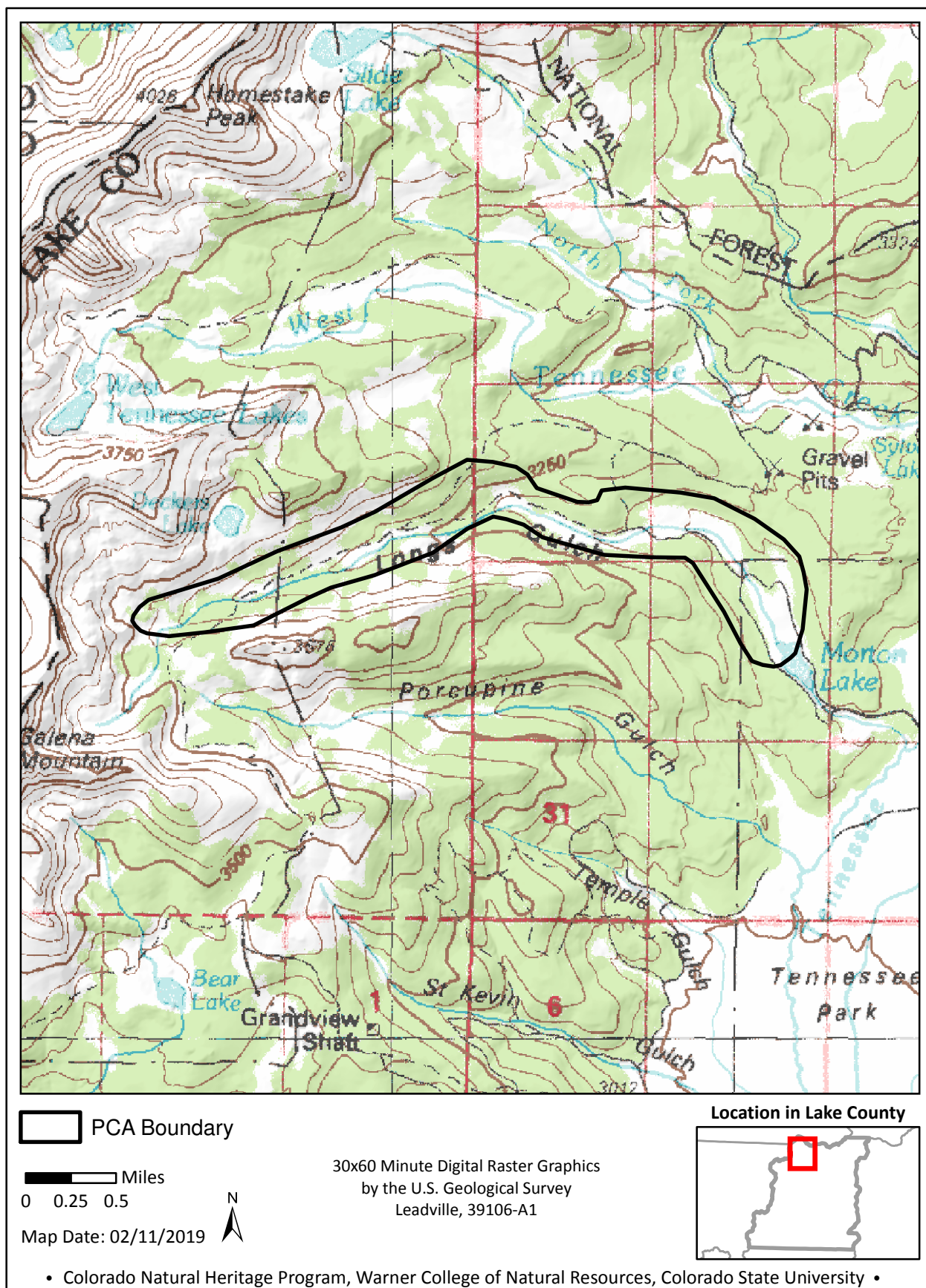
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**Version Author:** Culver, D.R.

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Longs Gulch Potential Conservation Area, B3: High Biodiversity Significance

## Lower Lake Fork

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future

**U.S.G.S. 7.5-minute quadrangles:** Leadville North, Leadville South, Homestake Reservoir, Mount Massive

**Size:** 1,451 acres (587 ha)

**Elevation:** 9,500 - 9,872 ft. (2,896 - 3,009 m)

**General Description:** The Lower Lake Fork site is located at the eastern toe slope of the Sawatch Range, on gravel and alluvial deposits from Bull Lake and Pinedale glaciation periods (Tweto 1979). Layer upon layer of glacially deposited rocks support several springs or upwellings through the site. Soda Springs, a capped alkaline spring is located within the site. Concentric rings spread out from the springs recognized by the changing vegetation and groundwater levels. Analogue sedge (*Carex simulata*), an indicator of permanently saturated soils, is located in the center ringed by beaked sedge (*C. utriculata*), water sedge (*C. aquatilis*), and Baltic rush (*Juncus articus* ssp. *littoralis*). Several halophytes or salt-loving plants were documented within this zone, such as seaside arrowgrass (*Triglochin maritima*), marsh arrowgrass (*T. palustris*), and seepweed (*Suaeda calceoliformis*). Beaked sedge (*C. utriculata*) wetland plant community occurs through the site and some portions "quake" due to floating vegetation. Other graminoids include analogue sedge (*C. simulata*), water sedge (*C. aquatilis*), fewflower spikerush (*Eleocharis quinqueflora*), common spikerush (*E. palustris*), Drummond's rush (*Juncus ensifolius*), and Baltic rush (*J. arcticus* ssp. *littoralis*). Forbs include elephanthead lousewort (*Pedicularis groenlandica*), shooting star (*Dodecatheon pulchellum*), blue-eyed grass (*Sisyrinchium idahoense* var. *occidentalis*), and moss gentian (*Gentiana fremontii*). Soils were fibric peat to a depth of 16 in deep before striking a clayey layer with small pebbles. There are a few scattered patches of planeleaf willow (*Salix planifolia*) and shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*). The riparian plant community that dominates Lake Fork is Geyer willow / mesic graminoid (*Salix geyeriana* / mesic graminoid) wet shrubland, a tall, deciduous shrubland that occurs within the moderately meandering Lake Fork, a Rosgen Stream Type C, a low gradient, meandering stream with point bars riffle/pools and a well-defined floodplain. Additional shrubs include planeleaf willow (*S. planifolia*), birch bog (*Betula glandulosa*), and shrubby cinquefoil. The herbaceous layer is dominated by beaked sedge, water sedge, silvery sedge (*C. canescens*), meadow sedge (*C. praegracilis*), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint (*Calamagrostis canadensis*). The forb layer was sparse with fringed willow herb (*Epilobium ciliatum*), large-leaved avens (*Geum macrophyllum*), western dock (*Rumex aquaticus*), yellow monkey flower (*Mimulus guttatus*), brightblue speedwell (*Veronica serpyllifolia* ssp. *humifusa*), American alpine speedwell (*V. anagallis-aquatica*), heartleaf bittercress (*Cardamine cordifolia*), and bluebells (*Mertensia ciliata*). Soils within the riparian zone are sandy loam with moderate mottling.

**Key Environmental Factors:** Key factors include unaltered hydrology and a viable beaver population to maintain high groundwater levels.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Ranching and haying have and still are main land uses.

**Biodiversity Significance Rank Comments (B3):** The Lower Lake Fork site is of high biodiversity significance (B3) due to its concentration of significant wetland elements. Along Lake Fork, an excellent (A-rank) occurrence of globally vulnerable (G3?/S2) Geyer willow (*Salix geyeriana*) / mesic graminoids wet shrubland was documented. Two fens were also documented, an excellent (A-rank) occurrence of a common (G5/S5) beaked sedge (*Carex utriculata*) wet meadow and a good (B-rank) occurrence of a common (G4/S3) analogue sedge (*Carex simulata*) fen. Fens, in general, are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the National Forest (Culver and Lemly 2013).

Natural Heritage element occurrences at Lower Lake Fork.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> / Mesic Graminoids Wet Shrubland	Geyer's Willow / Mesic Graminoid	G3?	S2				A	2017-06-17
Natural Communities	<i>Carex simulata</i> Fen	Wet Meadow	G4	S3				B	2017-07-06
Natural Communities	<i>Carex utriculata</i> Wet Meadow	Beaked Sedge Montane Wet Meadows	G5	S5				C	2017-07-06

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Northern Goshawks (*Accipiter gentilis*) have been documented breeding within the site.

**Boundary Justification:** The boundary is drawn with at least a 1 km buffer of the riparian corridor and the known fen occurrences to encompass surrounding ridge tops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P4):** Site is entirely privately owned with a conservation easement in place.

**Management Urgency Rank Comments (M4):** Monitor non-native plants along drier areas of the site.



## References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

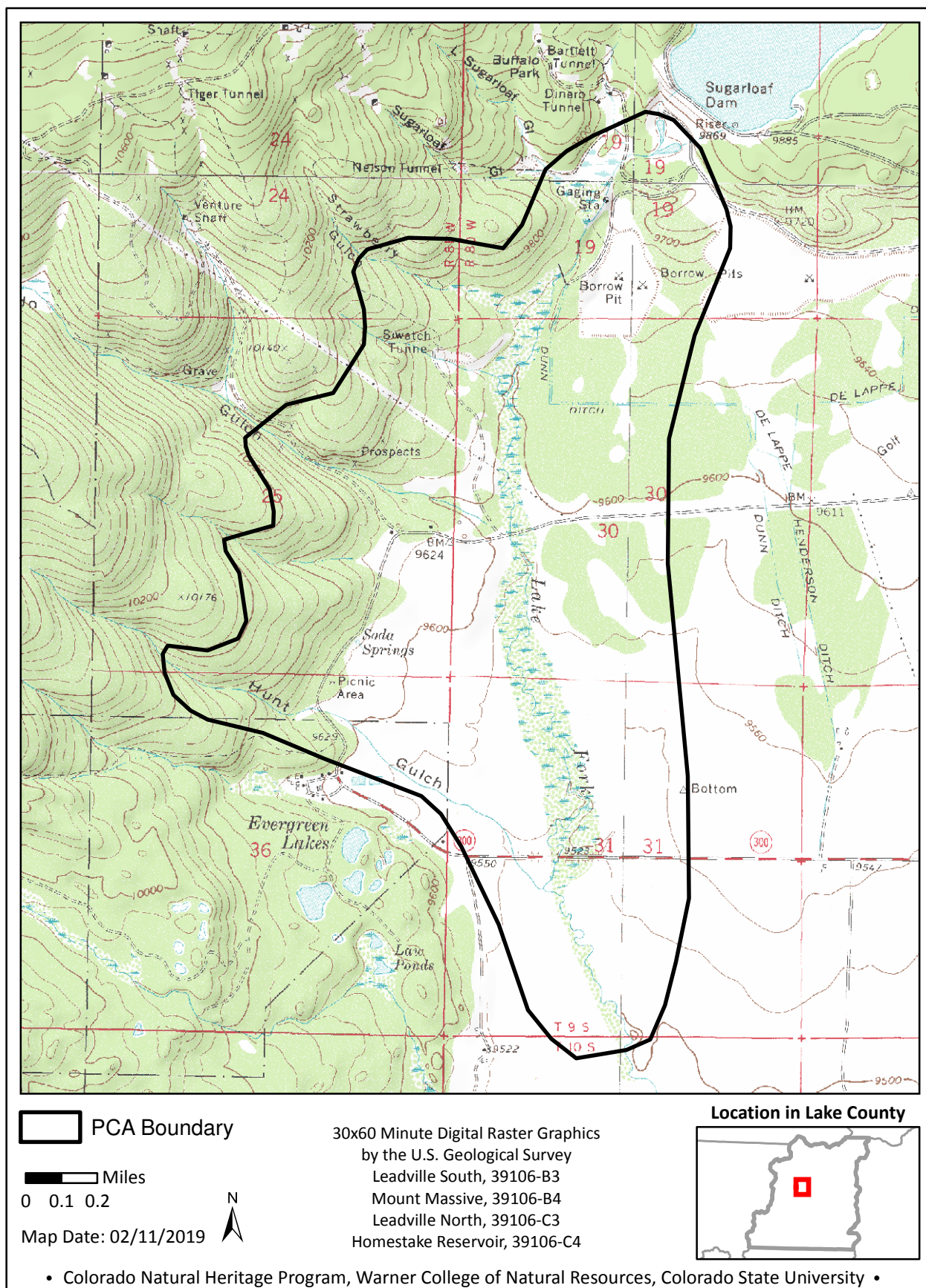
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**Version Author:** Culver, D.R.

**Version Date:** 01/17/2019



Lower Lake Fork Potential Conservation Area, B3: High Biodiversity Significance

## Mount Massive

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P5: No Action to be Taken on this Site

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

### U.S.G.S. 7.5-minute quadrangles: Mount Massive

**Size:** 400 acres (162 ha)

**Elevation:** 12,920 - 14,428 ft. (3,938 - 4,398 m)

**General Description:** The Mount Massive site is located within the Sawatch Range, south of Mount Elbert. Mount Massive is the second highest peak in the Rocky Mountains. The headwaters of Halfmoon and Willow creeks are located at the eastern and southern slopes of Mount Massive. There are numerous alpine tarn lakes throughout the site. The site topology is characterized with steep to moderate slopes and talus slopes, where the soil has become relatively stabilized and the water supply is more or less constant. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season. The alpine plant community system is characterized by a dense cover of low-growing, perennial graminoids and forbs. Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate, mat-forming plants with thick rootstocks or taproots characterize the forbs. Dominant species include: boreal sagebrush (*Artemisia arctica*), blackroot sedge (*Carex elynoides*), dry sedge (*Carex siccata*), spikenard sedge (*Carex nardina*), needleleaf sedge (*Carex duriuscula*), blackroot sedge (*Carex elynoides*), Hayden's sedge (*Carex haydeniana*), curly sedge (*Carex rupestris*), sheep fescue (*Festuca brachyphylla*), Idaho fescue (*Festuca idahoensis*), alpine avens (*Geum rossii*), Bellardi's bog sedge (*Kobresia myosuroides*), cushion phlox (*Phlox pulvinata*), and alpine clover (*Trifolium dasyphyllum*). Many other graminoids, forbs, and prostrate shrubs can also be found, including purple reedgrass (*Calamagrostis purpurascens*), alpine stichwort (*Minuartia obtusiloba*), tufted hairgrass (*Deschampsia cespitosa*), mountain avens (*Dryas octopetala*), cinquefoils (*Potentilla* spp.), Arctic bluegrass (*Poa arctica*), saxifrages (*Saxifraga* spp.), Rocky Mountain spike-moss (*Selaginella densa*), creeping sibbaldia (*Sibbaldia procumbens*), moss campion (*Silene acaulis*), golden rods (*Solidago* spp.), and Parry's clover (*Trifolium parryi*).

**Key Environmental Factors:** Key factors include sufficient snow pack to ensure longevity of alpine turf ecological system.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Cultural Features:** Mount Massive was first surveyed and climbed in 1873 during the Hayden Survey of the American West. Survey member Henry Gannett is credited with the first ascent. The highest peak in Wyoming, 13,809 feet, is named in honor of Gannett.

**Biodiversity Significance Rank Comments (B3):** The site supports a good (B-ranked) occurrence of the globally vulnerable (G3/S1) tundra draba (*Draba ventosa*) and a fair

(C-ranked) occurrence of the globally imperiled (G2/S2) Gray's Peak whitlow-grass (*Draba grayana*). Gray's Peak whitlow-grass, a Colorado endemic species, with a global distribution of central and northcentral Colorado and is restricted to high peaks at elevations above 11,500 to 14,000 ft. There are only 22 known occurrences in Colorado with four in Lake County; one near the summit of Mt. Massive, one near Independence pass and two from the east side both along the continental divide with the largest population near Mosquito Pass.

Natural Heritage element occurrences at Mount Massive.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	<i>Draba grayana</i>	Gray's Peak whitlow - grass	G2	S2			SWAP Tier 2/USFS	C	2006-07-19
Vascular Plants	<i>Draba ventosa</i>	tundra draba	G3	S1				B	2006-07-19

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Thick-leaf whitlow-grass (*Draba crassa*) and arctic draba (*Draba fladnizensis*), plants on CNHP's watchlist, have been documented within the site.

**Boundary Justification:** The site is drawn to protect the rare plant occurrences from direct impacts such as trampling or other surface disturbances. A buffer is drawn to provide suitable habitat where additional individuals can become established over time.

**Protection Urgency Rank Comments (P5):** Site is within a Wilderness Area and land managers are aware of the occurrences.

**Management Urgency Rank Comments (M3):** A trail through the rocky areas could threaten some individuals. Trail designation and signs requesting that people stay on the trail through the rare plant habitat are recommended. There is very high recreational use in this area.

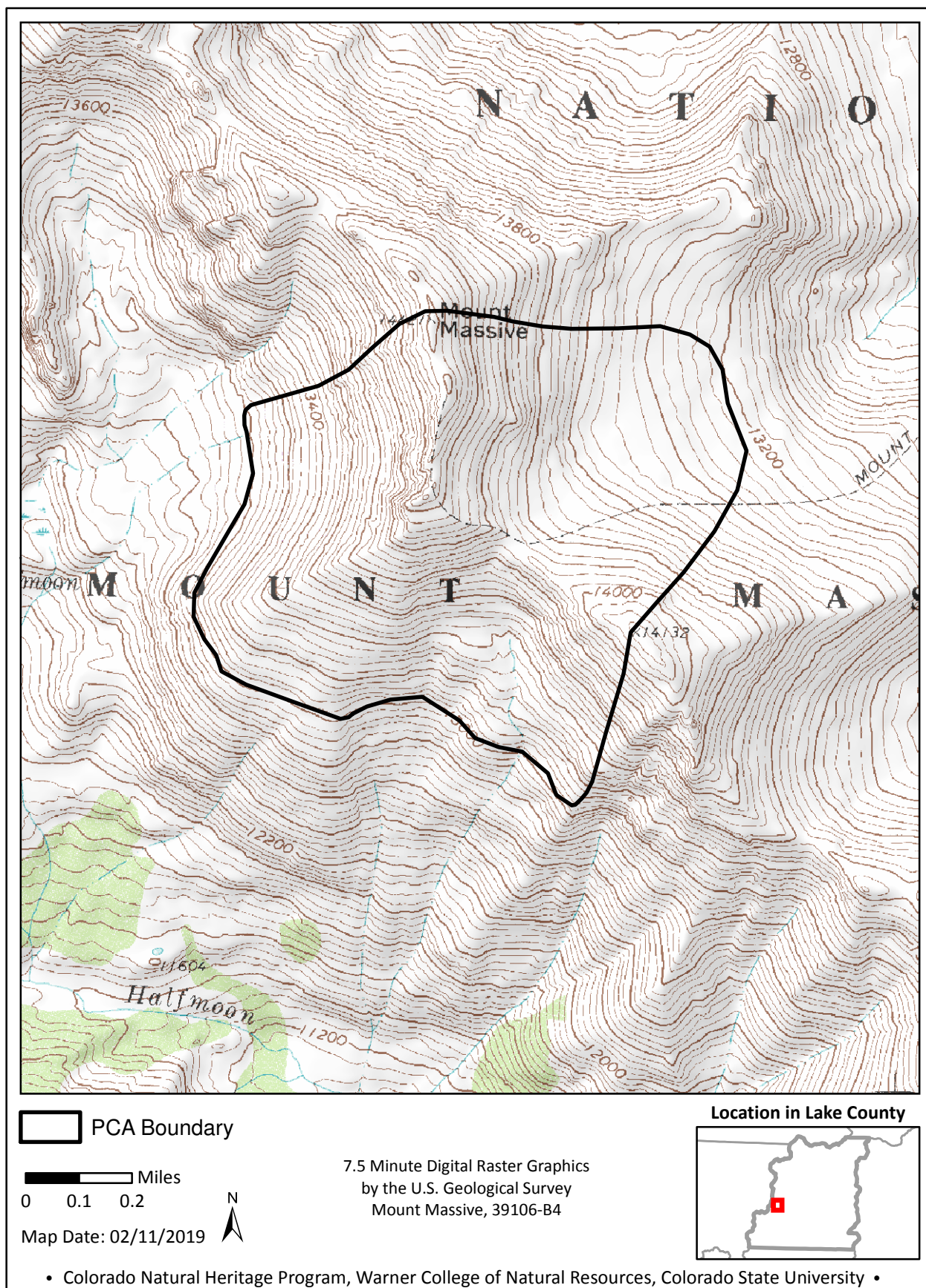
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**Version Author:** Spackman, S.C. and K.K. Fayette

**Version Date:** 02/11/2019





Mount Massive Potential Conservation Area, B3: High Biodiversity Significance

## Mountain Boy Park

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Independence Pass

**Size:** 772 acres (313 ha)

**Elevation:** 11,600 - 13,000 ft. (3,536 - 3,962 m)

**General Description:** The Mountain Boy Park site ranges in elevation between 11,600 and 13,000 feet along the Continental Divide. This site is a north-south running ridge, southwest of Independence Pass, which affords spectacular views of Mount Sopris and the Maroon Bells. To the east is a steep cliff which drops into Mountain Boy Gulch, and looks across to La Plata Peak. To the west, the slopes are more gradual and support a mosaic of alpine plant communities including rock gardens. The western slopes drop into Independence Creek and the Roaring Fork River. A heavily used trail follows the Continental Divide to a 13,198 foot peak.

**Biodiversity Significance Rank Comments (B3):** This site supports two globally significant plant species. Colorado Divide whitlow-grass (*Draba streptobrachia*) is globally vulnerable (G3/S3) and found in good condition. The globally imperiled (G2G3/S2S3) Rothrock townsend-daisy has also been documented within the site.

Natural Heritage element occurrences at Mountain Boy Park.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Vascular Plants	Townsendia rothrockii	Rothrock townsend - daisy	G2G3	S2S3			SWAP Tier 2	E	2012-07-14
Vascular Plants	Draba streptobrachia	Colorado Divide whitlow - grass	G3	S3				B	1997-07-21

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** This boundary is drawn to: 1) protect the occurrences from direct impacts such as trampling or other surface disturbances; 2) provide suitable habitat where additional individuals can become established over time; and 3) include representation from each of the local alpine plant communities which may support a pollinator for one or more of the rare plant species.

**Protection Urgency Rank Comments (P4):** This site is publicly owned and managed by the U.S. Forest Service within the Collegiate Peaks Wilderness Area.

**Management Urgency Rank Comments (M2):** The habitat is pristine and management is

adequate except for the area adjacent to the trail. A trail runs directly adjacent to the rare plant occurrences and bisects the site down the middle. Trampling from hikers is an immediate threat to these plants. Educational signs along the trail expressing the importance of preserving the rare plant habitat may be useful. If this is not effective, the trail should be closed or re-routed.

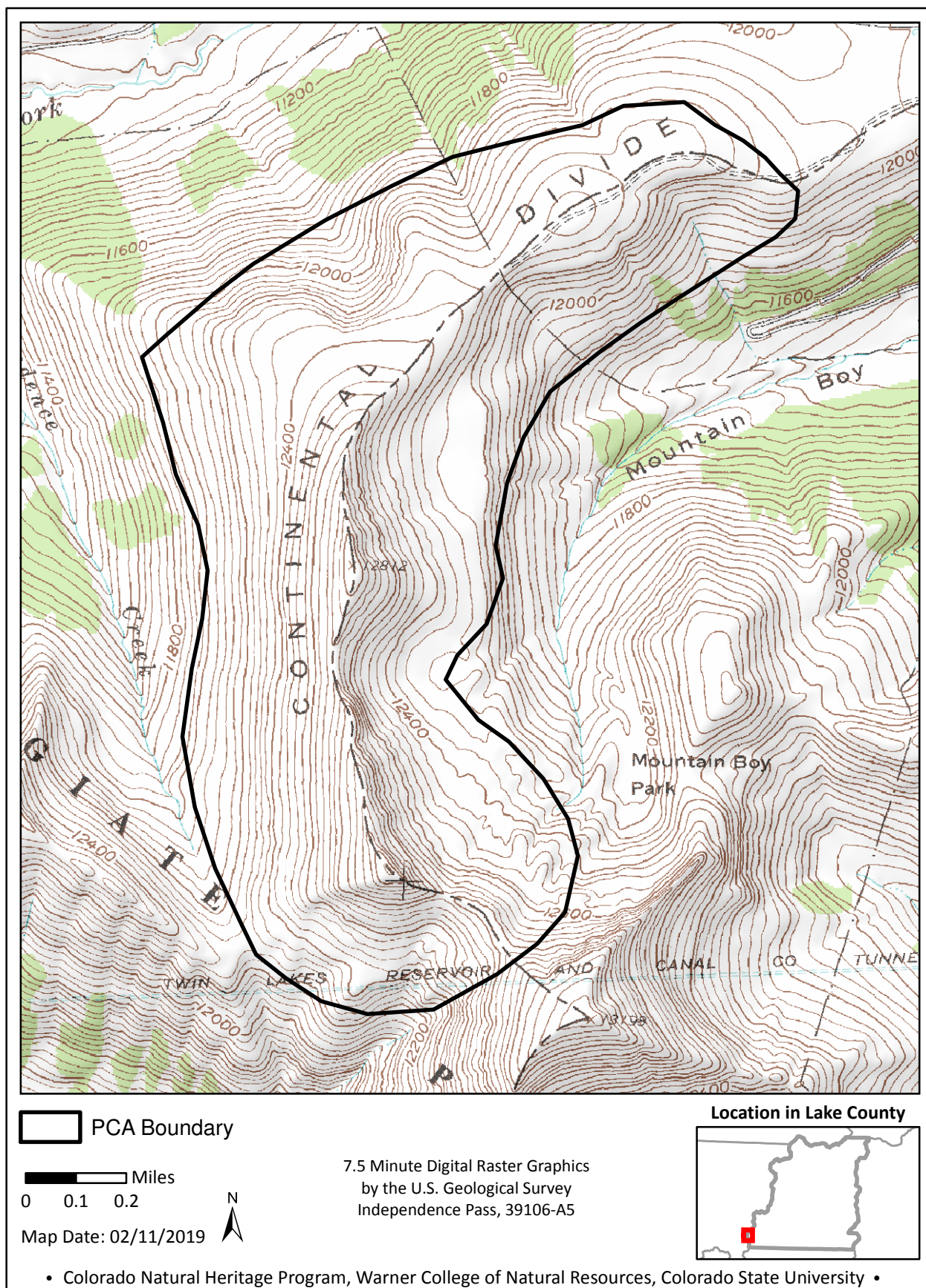
### **References**

Culver, D.R. and P. Smith. 2019. CNHP Final Report: Survey of Critical Biological Resources in Lake County, CO. Colorado Natural Heritage Program, Fort Collins, CO.

**Version Author:** Spackman, S.C.

**Version Date:** 05/05/1999





Mountain Boy Park Potential Conservation Area, B3: High Biodiversity Significance



## Tennessee Creek at East Fork Arkansas River

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Leadville South, Leadville North

**Size:** 5,444 acres (2,203 ha)

**Elevation:** 9,600 - 10,200 ft. (2,926 - 3,109 m)

**General Description:** The Tennessee Creek at East Fork Arkansas River site occurs in central Lake County on glacial and modern alluvium (Tweto 1979). The site supports large areas of wet to dry meadows and riparian shrublands along Tennessee Creek and its floodplain. Tennessee Creek is a Rosgen Stream Type C, a low gradient, meandering stream with point bars riffle/pools and a well-defined floodplain. The riparian area and its floodplain are dominated by Geyer willow (*Salix geyeriana*) and Rocky Mountain willow (*S. monticola*) with a mesic forb herbaceous layer. This plant community is an indicator of a drop in groundwater levels. Typically this plant association has an herbaceous layer with sedges and grasses that tolerate saturated conditions. Beaver and their dams are essential for the longevity of this riparian plant community. Geyer willow is most stable where the water table does not drop below 3 feet. Soils are silty loams. Wolf willow (*S. wolfii*) and planeleaf willow (*S. planifolia*) are scattered throughout the site. The herbaceous layer now has only relict wet meadows with sedges. There were numerous non-native plants and hay grasses encroaching on the wetland. Uplands are dominated by mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and Idaho and Arizona fescue grass (*Festuca idahoensis* and *F. arizonica*).

**Key Environmental Factors:** The key factor is to maintain groundwater levels and to promote beaver activity.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Ranching and water development projects.

**Biodiversity Significance Rank Comments (B3):** The site is one of high biodiversity significance (B3) due to the location of good (B-ranked) and fair (C-ranked) occurrences of a globally vulnerable (G3/S3) plant community, Geyer willow - Rocky Mountain willow / mesic forb (*Salix geyeriana* - *Salix monticola* / mesic forb), and an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Colorado tansy-aster (*Machaeranthera coloradoensis*). There is also an extant occurrence of the state imperiled (G5/S1) Richardson needlegrass (*Stipa richardsonii*).

## Natural Heritage element occurrences at Tennessee Creek at East Fork Arkansas River.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Salix geyeriana - Salix monticola / Mesic Forbs Wet Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				B	2018-07-25
Natural Communities	Salix geyeriana - Salix monticola / Mesic Forbs Wet Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				C	2018-08-16
Vascular Plants	Machaeranthera coloradoensis	Colorado tansy - aster	G3	S3			USFS	A	2018-08-22
Vascular Plants	Stipa richardsonii	Richardson needlegrass	G5	S1				E	2005-07-30

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Boreal toad and Mountain draba are known from the site.

**Boundary Justification:** Boundaries are drawn to capture the riparian zone as well as the adjacent tributaries that support the willow shrubland. Only private properties with written access were surveyed.

**Protection Urgency Rank Comments (P3):** The majority of the site is privately owned with a few acres of BLM properties.

**Management Urgency Rank Comments (M3):** Monitoring groundwater level is recommended. Uplands are fragmented by recreational access roads, especially near Leadville and Turquoise Lake. Toilets and designated camp sites could prevent further degradation.

## References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

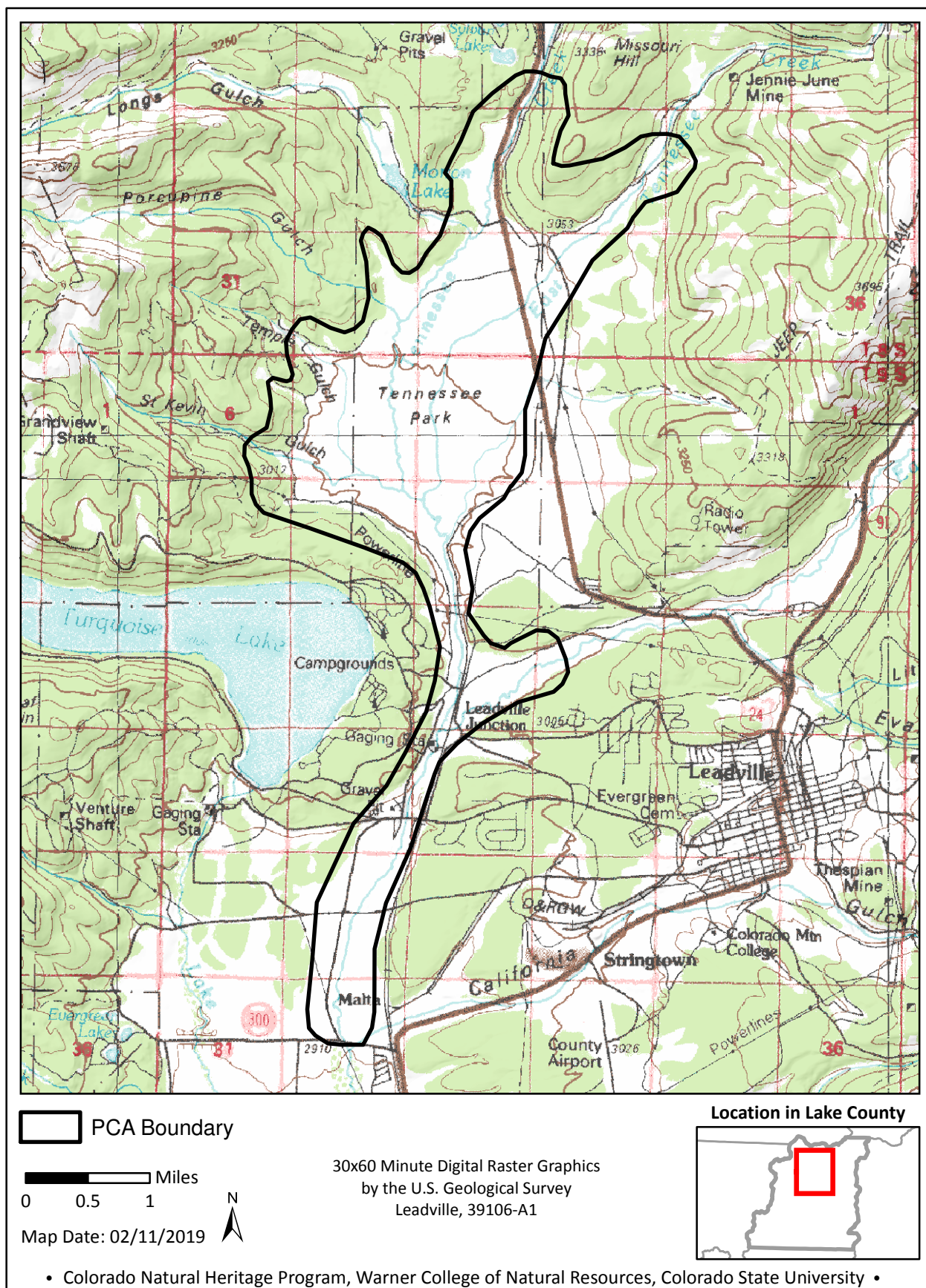
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**Version Author:** Culver, D.R.

**Version Date:** 01/10/2019



Tennessee Creek at East Fork Arkansas River Potential Conservation Area, B3: High Biodiversity Significance



## Twin Lakes

Biodiversity Rank - B3: High Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Elbert, Granite

**Size:** 2,501 acres (1,012 ha)

**Elevation:** 9,200 - 11,800 ft. (2,804 - 3,597 m)

**General Description:** The Twin Lakes site is located at the southeastern slope of Mount Elbert. Mount Elbert, the highest point in Colorado and the Southern Rocky Mountains, is located in the Sawatch Range. Mount Elbert and Mount Massive are massifs formed during the Laramide Orogeny (Tweto 1979). The underlying geology of the site is composed of glacial drift materials as well as landslide deposits. The site captures the lower reaches of Bartlett, Dayton, Gordon, and Smith gulches as the northern shore of Twin Lakes. The uplands are lodgepole pine (*Pinus contorta*) forests with aspen (*Populus tremuloides*). The understory is sparse with buffaloberry (*Shepherdia canadensis*), mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) with ragworts (*Senecio* spp.), rockcresses (*Arabis/Boechera* spp.), and brome grasses (*Bromus* spp.). The wetlands that surround Twin Lakes are dominated by Rocky Mountain willow (*Salix monticola*), Drummond willow (*S. drummondiana*), and planeleaf willow (*S. planifolia*). The site supports numerous small fens, peat-accumulating wetlands, fed by groundwater discharge from adjacent mountains. A fen is a type of peatland that accumulates at least 40 cm (16 inches) of organic material in the upper 80 cm (32 inches) of the soil profile. Peat forms slowly over time where the production of organic matter is greater than the rate of decomposition due to saturation (Culver and Lemly 2013). Vegetation within the fens are dominated by graminoids, chiefly water sedge (*Carex aquatilis*) with needle spikerush (*Eleocharis acicularis*). Other graminoids include analogue sedge (*C. simulata*), common spikerush (*E. palustris*), Drummond's rush (*Juncus ensifolius*), and Baltic rush (*J. arcticus* ssp. *littoralis*). Forbs include elephanthead lousewort (*Pedicularis groenlandica*) and shooting star (*Dodecatheon pulchellum*). Soils were fibric peat to a depth of 16 in deep before striking a clayey layer with small pebbles. There are a few scattered patches of planeleaf willow (*Salix planifolia*) and shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*). The riparian plant community that dominates this portion of Lake Creek is a narrowleaf cottonwood with mixed willows (*Populus angustifolia* / *Salix monticola, drummondiana*) riparian forest. This riparian forest occurs within the moderately meandering Lake Creek, a Rosgen Stream Type C, a low gradient, meandering stream with point bars riffle/pools and a well-defined floodplain. Additional shrubs include planeleaf willow (*S. planifolia*), birch bog (*Betula glandulosa*), and shrubby cinquefoil. The herbaceous layer is dominated by beaked sedge, water sedge, silvery sedge (*C. canescens*), meadow sedge (*C. praegracilis*), tufted hairgrass (*Deschampsia cespitosa*), and bluejoint (*Calamagrostis canadensis*). The forb layer was sparse with fringed willow herb (*Epilobium ciliatum*), large-leaved avens (*Geum macrophyllum*), western dock (*Rumex aquaticus*), yellow monkey flower (*Mimulus guttatus*), brightblue speedwell (*Veronica serpyllifolia* ssp. *humifusa*), American alpine speedwell (*V. anagallis-aquatica*), heartleaf bittercress (*Cardamine cordifolia*), and bluebells (*Mertensia ciliata*). Soils within

the riparian zone are sandy loam with moderate mottling.

**Key Environmental Factors:** The key factor for riparian forests and fens is unaltered hydrology to maintain high groundwater tables.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Twin Lakes is a popular destination for camping, hiking, and fishing.

**Biodiversity Significance Rank Comments (B3):** The Twin Lakes site is ranked with a high biodiversity significance (B3) due to the concentration of significant plants and plant communities; however, the elements have all been impacted by either habitat alteration from residential homes or the Frying Pan-Arkansas Project. The narrowleaf cottonwood with mixed willows (*Populus angustifolia* / *Salix monticola*, *drummondiana*, *lucida*), a globally vulnerable (G3/S2) plant community, is in fair condition (C-ranked) due to the significant, irreversible hydrological alterations of Lake Creek. CNHP also documented a globally vulnerable (G3G4/S2) park milkvetch (*Astragalus leptaleus*), the state rare (G5/S2) southwestern waterwort (*Elatine rubella*) in good (B-ranked) condition, and a fair (C-ranked) occurrence of the state rare (G5/S2) hoary willow (*Salix candida*). In the lodgepole pine forest, a fair (C-ranked) occurrence of the globally imperiled (G2/S2) Crandall's rock-cress (*Boechnera crandallii*) was documented.

Natural Heritage element occurrences at Twin Lakes.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Populus angustifolia</i> / <i>Salix</i> ( <i>monticola</i> , <i>drummondiana</i> , <i>lucida</i> ) Riparian Woodland	Narrowleaf Cottonwood / Mixed Willows Montane Riparian Forest	G3	S2				C	2017-09-11
Vascular Plants	<i>Boechnera crandallii</i>	Crandall's rock - cress	G2	S2			BLM/S WAP Tier 2	C	2005-07-01
Vascular Plants	<i>Astragalus leptaleus</i>	Park milkvetch	G3G4	S2			USFS	E	2018-07-24
Vascular Plants	<i>Elatine rubella</i>	southwestern waterwort	G5	S2				B	2018-08-02
Vascular Plants	<i>Salix candida</i>	hoary or silver willow	G5	S2			USFS	C	2018-07-17

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** There are historic occurrences (greater than 20 years since last observation) for the following: boreal toad (*Anaxyrus boreas*) (G4T1/QS1), Glenwood Springs rockcress (*Boechnera oxylobula*) (G3/S3), Rocky Mountain gayfeather (*Liatris ligulistylis*) (G5?/S2), marsh felwort (*Lomatogonum rotatum*) (G5/S2) and Porters feathergrass (*Ptilagrostis*

*porteri*) (G2/S2). In addition, Northern Goshawk (*Accipiter gentilis*) was documented breeding and a Mountain draba (*Draba rectifructa*) observation, a plant on CNHP's watch list, is present.

**Boundary Justification:** The boundary is drawn to include the known occurrences, additional potential habitat, and the local mosaic of plant communities and to capture the immediate hydrological processes that support the fens and the immediate watershed to indicate importance of maintaining groundwater flow. Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** This site contains a mix of private lands and lands managed by the Pike-San Isabel National Forest. There is no special designation for these lands.

**Management Urgency Rank Comments (M3):** The Continental Divide and Colorado trails may run near or through this site. Monitoring to assure the continued or improved viability of the occurrences is recommended.

### References

Carsey, K., G. Kittel, K. Decker, D. Cooper, and D. Culver. 2003. Field guide to the wetland and riparian plant associations of Colorado. Prepared for the Colorado Department of Natural Resources, Denver, CO by the Colorado Natural Heritage Program, Fort Collins, CO.

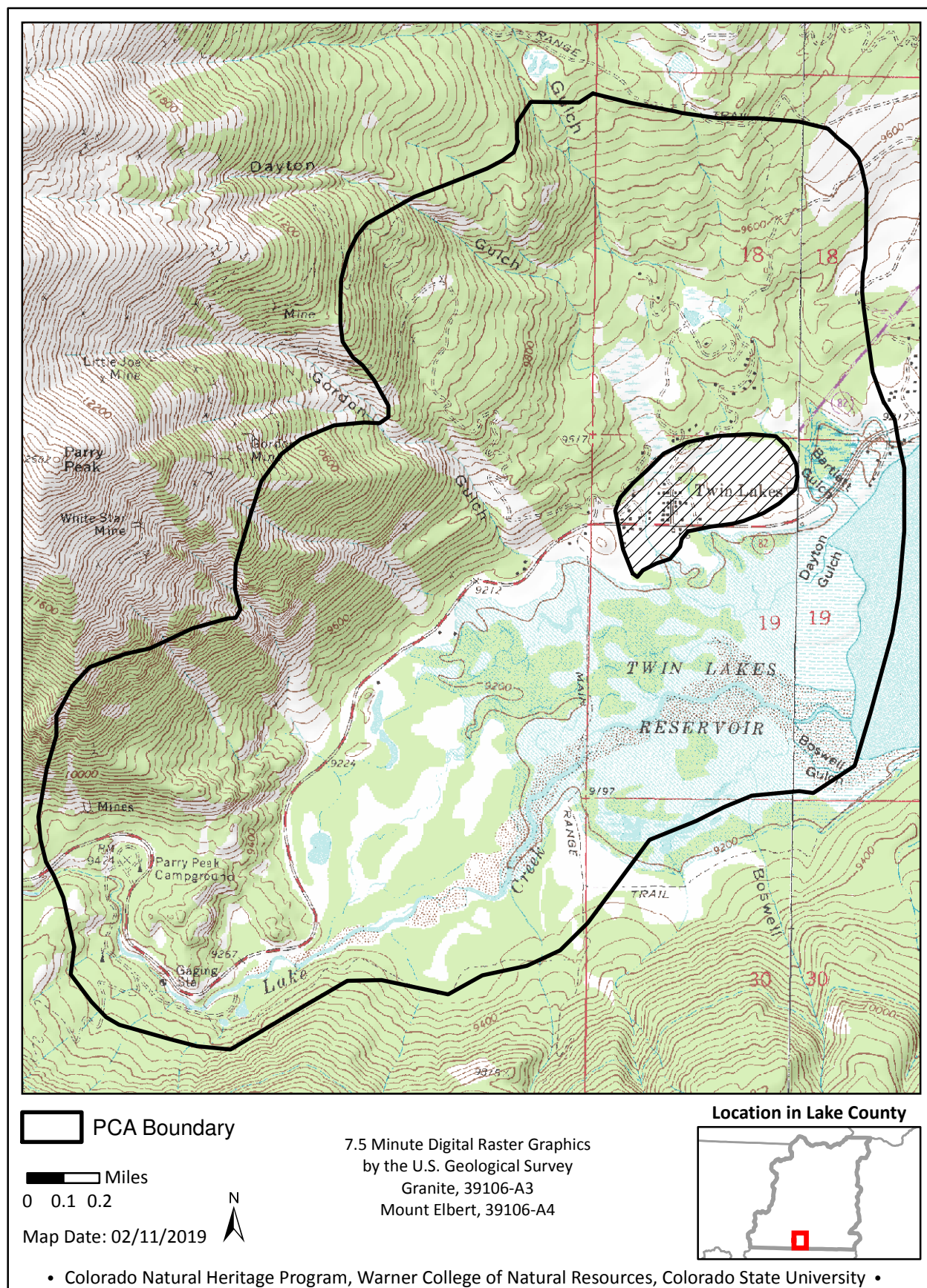
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**Version Author:** Culver, D.R.

**Version Date:** 01/28/2019



Twin Lakes Potential Conservation Area, B3: High Biodiversity Significance



## Birdseye Gulch

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P1: Immediately Threatened/Outstanding Opportunity

Management Urgency Rank - M1: Essential within 1 Year to Prevent Loss

**U.S.G.S. 7.5-minute quadrangles:** Climax

**Size:** 524 acres (212 ha)

**Elevation:** 10,200 - 11,400 ft. (3,109 - 3,475 m)

**General Description:** The Birds Eye Gulch site is located along the west slope of Mosquito Peak and Mosquito Pass. It is one of several first order streams that confluence with the main stem of the Arkansas, north of Leadville. The gulch is a steep, narrow canyon with a very narrow floodplain that has cut down through glacial drift from Pinedale and Bull Lake Glaciation (Tweto 1979) as well as recent landslide deposits. The riparian corridor is dominated by Drummond willow (*Salix drummondiana*) with planeleaf willow (*S. planifolia*), Rocky Mountain willow (*S. monticola*), and thinleaf alder (*Alnus incana*), with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) in the tree stratum. This plant association is indicative of an early colonizer of first-order, boulder strewn, steep streams, such as Birdseye Gulch. The soils are rocky with pockets of deep loam. A popular 4 wheel drive road is located adjacent, and sometimes within the stream bed, with the destination of Mosquito Pass.

**Key Environmental Factors:** Key environmental factors are maintaining the stream channel and floodplain.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Historical mining claims exist throughout the upper slopes of the site.

**Biodiversity Significance Rank Comments (B4):** The site is of moderate biodiversity significance (B4) due to the good (B-ranked) occurrence of a state significant (G4/S4) riparian shrubland, Drummond's willow / mesic forbs (*Salix drummondiana* / mesic forb). A boreal toad southern Rocky Mountain population (*Anaxyrus boreas*) (G4T1QS1) occurrence was also documented within the site.

## Natural Heritage element occurrences at Birdseye Gulch.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Amphibians	Anaxyrus boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE	SWAP Tier 1/USFS	E	2017-09-02
Natural Communities	Salix drummondiana / Mesic Forbs Wet Shrubland	Drummonds Willow / Mesic Forb	G4	S4				B	2018-07-08

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P1):** The majority of the site is owned and managed by BLM Royal Gorge Field Office. However, Lake County has the initial permitting (permit will expire in 2022) to build a reservoir at Birdseye Gulch.

**Management Urgency Rank Comments (M1):** The two track crosses the gulch numerous times causing excessive erosion. Additionally, there is evidence of 4 WD going off road in the subalpine and alpine vegetation in the upper reaches of Birdseye Gulch.

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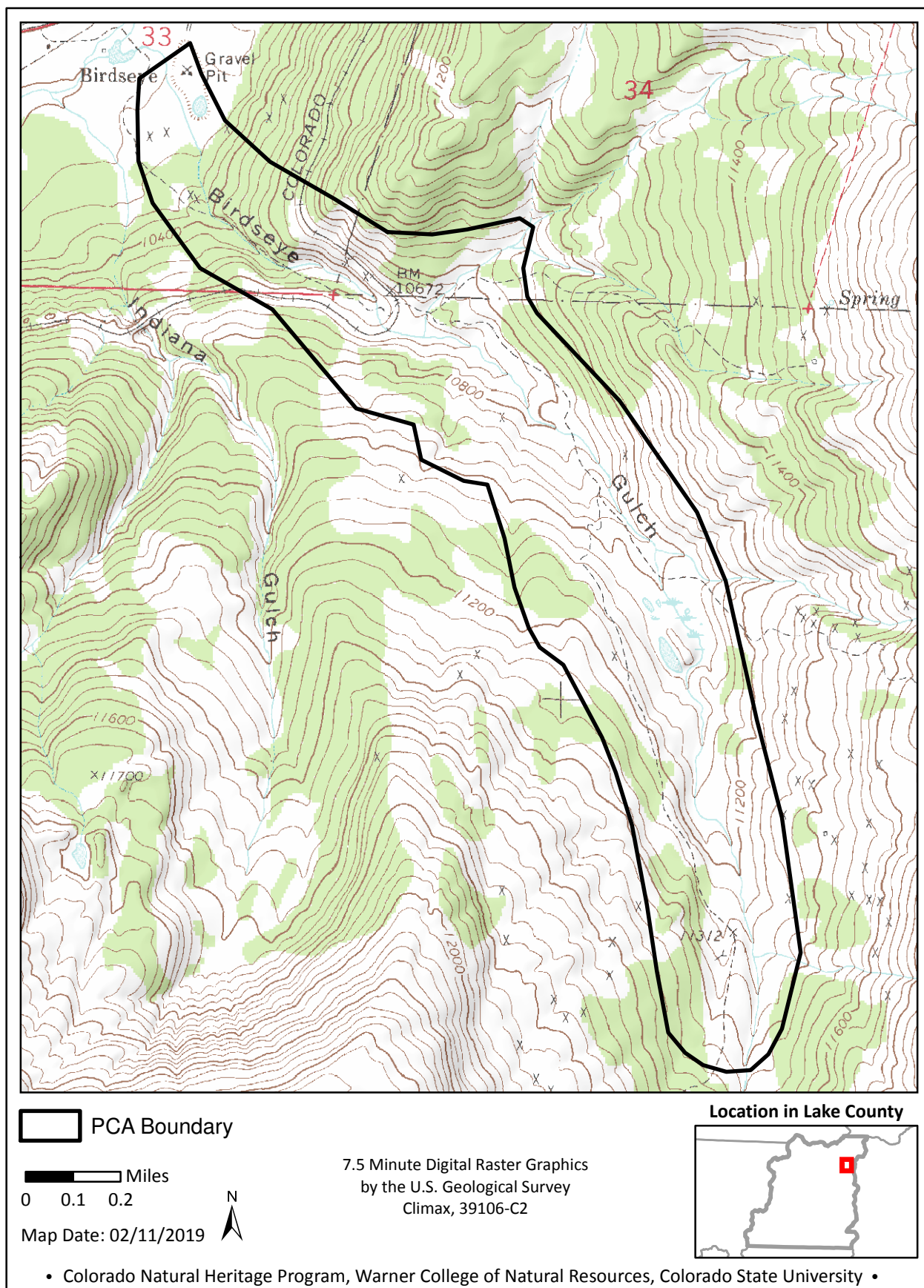
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Birdseye Gulch Potential Conservation Area, B4: Moderate Biodiversity Significance

## Dyer Amphitheater at Iowa Gulch

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Sherman

**Size:** 951 acres (385 ha)

**Elevation:** 10,800 - 12,800 ft. (3,292 - 3,901 m)

**General Description:** The Dyer Amphitheater at Iowa Gulch site is representative of the subalpine and alpine wetlands in Lake County. Dyer Amphitheater is located on glacial alluvium (Tweto 1979) within a cirque formed with East Ball Mountain and West Dyer Mountain to the northwest, and Geminin Peak and Mount Sherman to the east. The alpine wetland plant association within the amphitheater, planeleaf willow (*Salix planifolia*), commonly occurs in glaciated valleys. Associated species include short-fruited willow (*S. brachycarpa*), marsh marigold (*Caltha leptosepala*), elephanthead lousewort (*Pedicularis groenlandica*), heartleaf bittercress (*Cardamine cordifolia*), yellow paintbrush (*Castilleja sulphurea*), tall fleabane (*Erigeron elatior*), streamside fleabane (*E. glabellus*), queen's crown (*Rhodiola rhodantha*), and mountain bluebell (*Mertensia ciliata*). Graminoid cover is < 25%, and includes water sedge (*Carex aquatilis*), rock sedge (*C. saxatilis*), black sedge (*C. nova*), different-nerve sedge (*C. heteroneura*), tufted hairgrass (*Deschampsia cespitosa*), and alpine bluegrass (*Poa alpina*). Soils range from mesic loam to permanently saturated histosols along seeps on the west side of the riparian occurrence. There is an old beaver lodge in the lower pond, but no recent beaver activity was noted. There are several small fens scattered above the riparian zone dominated by water sedge (*Carex aquatilis*) with fibric peat to 40 cm deep. The upper slopes are typical alpine turf with gray leaf willow (*S. glauca*). Iowa Gulch, located below Dyer Amphitheatre, is a first order stream located at the southwest base of Mount Sherman. Iowa Gulch supports a dense shrub layer of mainly wolf willow (*Salix wolfii*) with planeleaf willow (*Salix planifolia*). The wolf willow / mesic forb is a plant association that occurs along the moderately wide floodplain of Iowa Gulch and is an indicator of groundwater alterations, usually a drop in groundwater levels. Soils are loamy with little mottling, meaning the soils are never saturated long enough to become anaerobic. In 1995, CNHP ecologists classified the plant association as *Salix wolfii* / *Carex aquatilis*, which is indicative of saturated soils, with surface water.

**Key Environmental Factors:** The key factor is hydrology. Stream flow from surrounding mountains and snowpack is essential.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Sherman Mine, located below Mount Sherman at the base of Iowa Gulch, is an historical mining operation for silver and lead.



**Cultural Features:** Dyer Amphitheater is named for Reverend John L. Dyer who was a Methodist minister and was known to cross Mosquito Pass several times a week in all weather conditions.

**Biodiversity Significance Rank Comments (B4):** The site is of moderate biodiversity significance (B4) due to the presence of an excellent (A-ranked) occurrence of a globally common, but state significant (G4/S4) wetland plant association, planeleaf willow / marsh marigold (*Salix planifolia* / *Caltha leptosepala*) wet shrubland, and a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) riparian shrubland, wolf willow / mesic forbs (*Salix wolfii* / mesic forb).

Natural Heritage element occurrences at Dyer Amphitheater at Iowa Gulch.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	<i>Salix wolfii</i> / Mesic Forbs Wet Shrubland	Subalpine Riparian Willow Carr	G3	S3				C	2018-08-07
Natural Communities	<i>Salix planifolia</i> / <i>Caltha leptosepala</i> Wet Shrubland	Subalpine Riparian Willow Carr	G4	S4				A	2018-08-08

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Leadville milkvetch (*Astragalus molybdenus*) is found in good condition and expands beyond the site.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P3):** The majority of the site is owned and managed by BLM, Royal Gorge Field Office. There are scattered privately held mining claims in the upper slopes above the site.

**Management Urgency Rank Comments (M3):** Monitor hiking and 4WD impacts.

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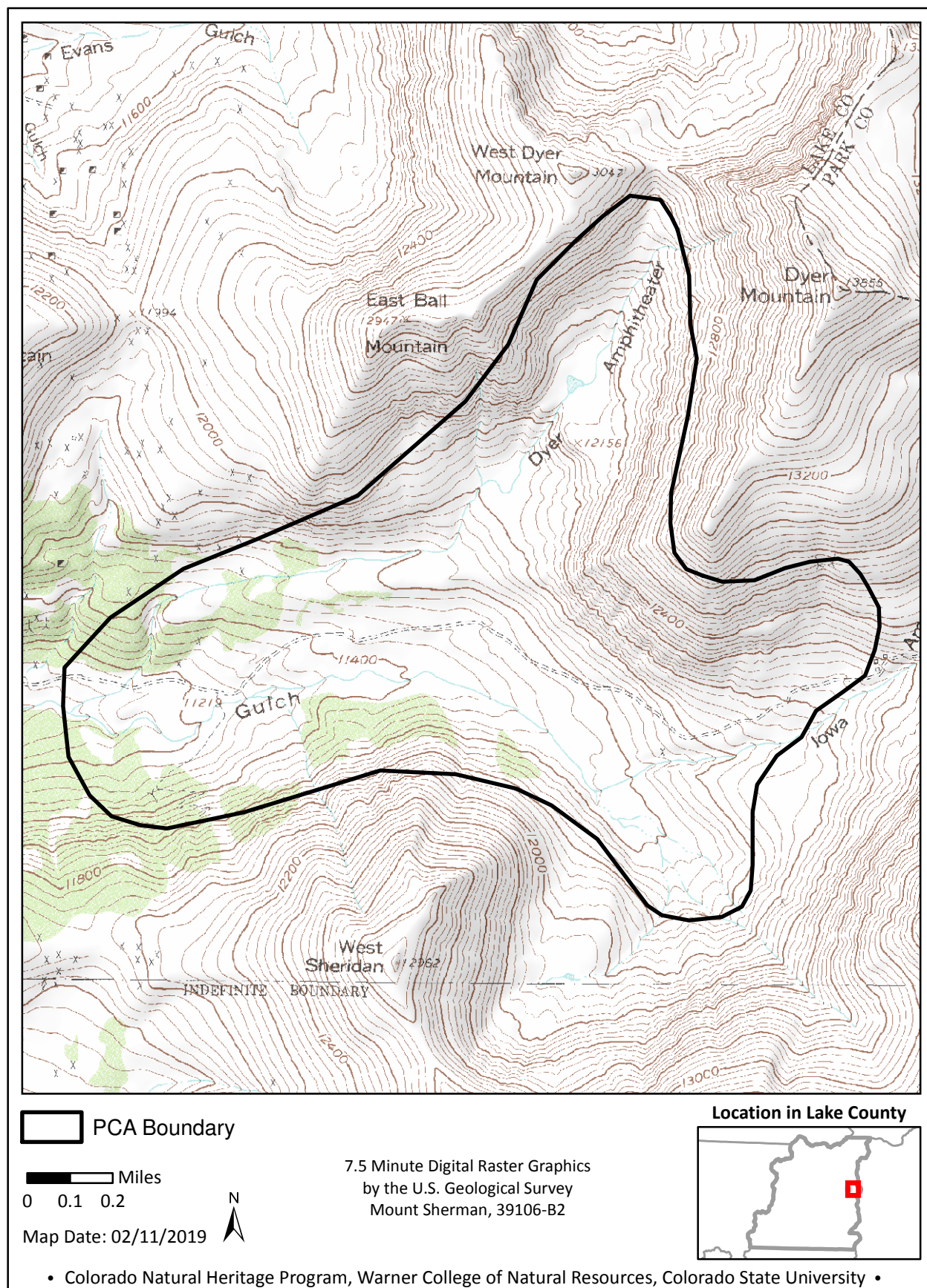
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Dyer Amphitheater at Iowa Gulch Potential Conservation Area, B4: Moderate Biodiversity Significance

## Halfmoon Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P4: No Threat or Special Opportunity

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Mount Massive, Mount Champion

**Size:** 1,240 acres (502 ha)

**Elevation:** 10,100 - 11,800 ft. (3,078 - 3,597 m)

**General Description:** Halfmoon Creek begins at the southeastern base of Mount Champion flowing along a steep gradient with few meanders and a narrow floodplain. A narrow band of subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) dominate the tree layer with scattered lodgepole pine (*Pinus contorta*). The shrub layer is dominated by Drummond willow (*Salix drummondiana*) and scattered thinleaf alder (*Alnus incana*). This common riparian association is found throughout Colorado's mountains, especially along first order streams, such as Half Moon Creek. The herbaceous layer contains typical upper montane vegetation, cowparsnip (*Heracleum maximum*), grouse whortleberry (*Vaccinium cespitosum*), brook saxifrage (*Saxifraga odontoloma*), twin flower (*Linnea borealis*), Gray's angelica (*Angelica grayi*), and cowbane (*Oxypolis fendleri*). As the creek widens, wolf willow (*Salix wolfii*) with sedges dominate floodplain. Scattered bog birch (*Betula glandulosa*) and planeleaf willow (*Salix planifolia*) also occur on the floodplain. The herbaceous layer is dominated by beaked sedge (*Carex utriculata*) with bluejoint (*Calamagrostis canadensis*) and tufted hairgrass (*Deschampsia cespitosa*). Forbs are scattered and include elephanthead lousewort (*Pedicularis groenlandica*), heartleaf bittercress (*Cardamine cordifolia*), purple avens (*Geum rivale*), western polemonium (*Polemonium caeruleum*), and water ragwort (*Senecio hydrophilus*). Soils are mucky peat with numerous depressions with open water. The adjacent slopes are dominated by Engelmann spruce and lodgepole pine forests. Numerous mines dot the upper mountain slopes, especially in the headwaters region.

**Key Environmental Factors:** Key factors are adequate snowpack to maintain water table levels and the presence of beavers.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** Historically, the Champion Mine, established in 1890s, mined gold and silver for the smelters in Leadville. A 6,100 foot tramway was constructed to deliver the ore down to trucks. Dilapidated buildings and tramway still remain along a very primitive two-track road.

**Biodiversity Significance Rank Comments (B4):** The Halfmoon Creek site supports a good (B-ranked) occurrence of subalpine fir - Engelmann spruce / Drummond willow (*Abies lasiocarpa* - *Picea engelmannii* / *Salix drummondiana*) swamp forest (G5/S4) and an excellent (A-ranked) occurrence of wolf willow / beaked sedge (*Salix wolfii* / *Carex*



*utriculata*) (G4/S1) wet shrubland. There are also occurrences of White-tailed Ptarmigan (*Lagopus leucura*) and a historical occurrence of a state rare plant (G4/S2) northern twayblade (*Listera borealis*). This is a small occurrence (previously B-ranked), but is within a wilderness area and likely still viable.

#### Natural Heritage element occurrences at Halfmoon Creek.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Birds	<i>Lagopus leucura</i>	White - tailed Ptarmigan	G5	S4			SWAP Tier 1/USFS	E	2017-02-15
Birds	<i>Lagopus leucura</i>	White - tailed Ptarmigan	G5	S4			SWAP Tier 1/USFS	E	2005-02-24
Natural Communities	<i>Salix wolfii</i> / <i>Carex utriculata</i> Wet Shrubland	Subalpine Riparian Willow Carr	G4	S1				A	2017-07-08
Natural Communities	<i>Abies lasiocarpa</i> - <i>Picea engelmannii</i> / <i>Salix drummondiana</i> Swamp Forest	Montane Riparian Forest	G5	S4				B	2017-07-08
Vascular Plants	<i>Listera borealis</i>	northern twayblade	G4	S2				H	1990-07-16

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Other Values:** Lynx (*Lynx canadensis*) have been documented in the area, as well as variegated scouringrush (*Hippochaete variegata*), a plant formerly tracked by CNHP. Northern Goshawks (*Accipiter gentilis*) have been documented breeding within the site.

**Boundary Justification:** The boundary is drawn with a 1 km buffer of the riparian corridor to encompass adjacent gulches and surrounding ridgetops for immediate watershed protection. On private lands, only those sites with written permission from the landowner were accessed.

**Protection Urgency Rank Comments (P4):** Majority of the site lies within the San Isabel National Forest, except for the scattered private mining claims.

**Management Urgency Rank Comments (M3):** Dispersed camping impacts are very high throughout the site. There are not many level sites due to the topography, so the flat areas are overrun with vehicles. It is advised to designate a few sites to camp and restore the sites closest to the creek.

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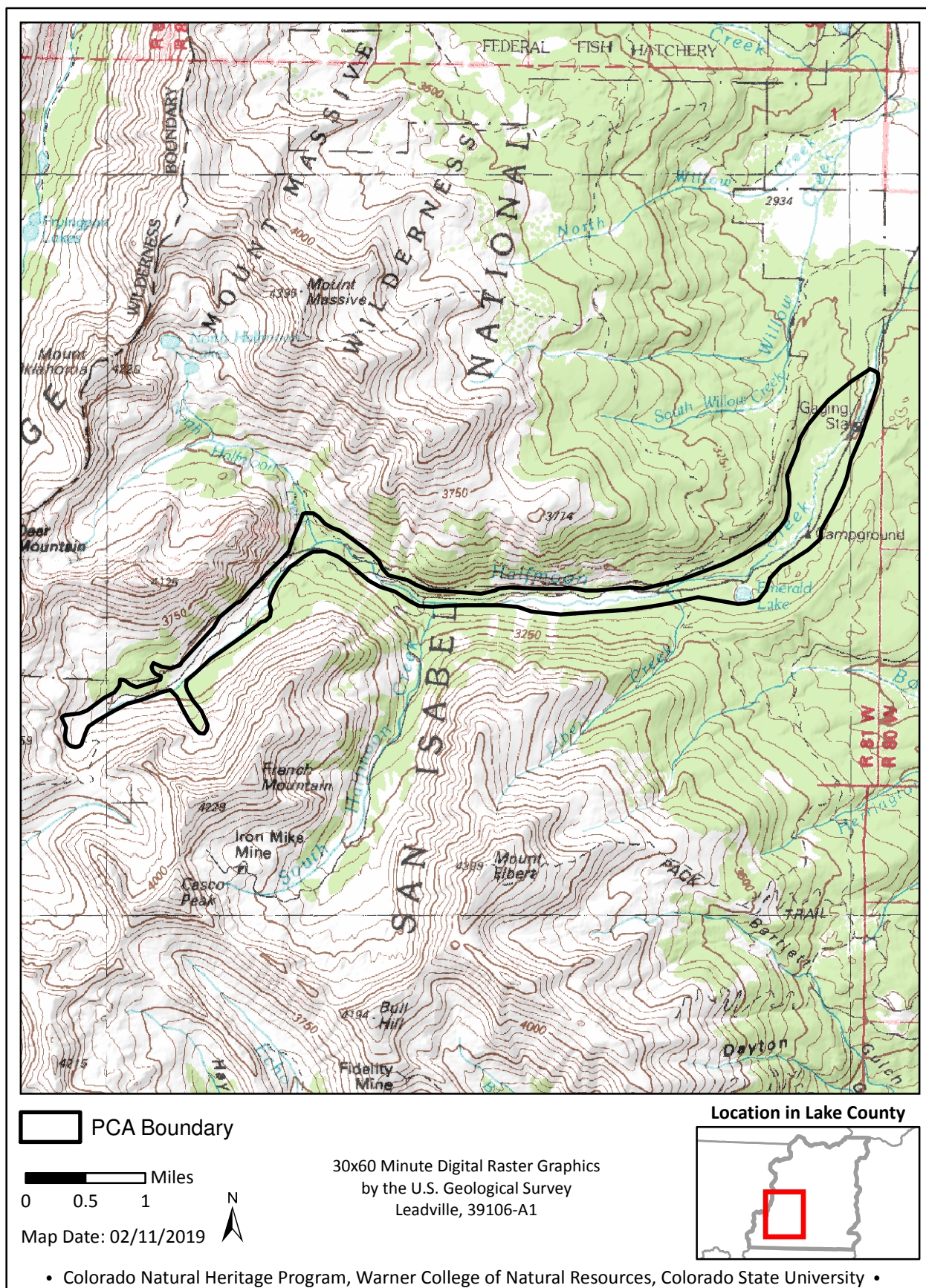
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Halfmoon Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

## Upper Chalk Creek

Biodiversity Rank - B4: Moderate Biodiversity Significance

Protection Urgency Rank - P2: Threat/Opportunity within 5 Years

Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality

**U.S.G.S. 7.5-minute quadrangles:** Climax, Copper Mountain

**Size:** 195 acres (79 ha)

**Elevation:** 11,400 - 11,600 ft. (3,475 - 3,536 m)

**General Description:** The Upper Chalk Creek site is located along the Continental Divide and the border with Eagle County. The underlying geology consists of sedimentary rocks from the Minturn Formation (Tweto 1979). The site is located between Buckeye Peak and Chalk Mountain, southeast of the Continental Divide, where the snow accumulates faster and deeper than the western side. The site contains fens, a unique groundwater supported wetland type. The fens are located at the start of the small tributaries that flow into Chalk Creek and eventually into the Arkansas River. The fens are dominated by analogue sedge (*Carex simulata*), a fen-obligate plant. The associated plants include water sedge (*Carex aquatilis*), boreal bog sedge (*Carex magellanica* ssp. *irrigua*), few-flowered spikerush (*Eleocharis quinqueflora*), and tall cottongrass (*Eriophorum angustifolium*). Other graminoids include tufted hairgrass (*Deschampsia cespitosa*) and Drummond rush (*Juncus drummondii*). There are no trees or shrubs within the fen, but the drier edges support shrubs, e.g., planeleaf willow (*Salix planifolia*), short-fruited willow (*S. brachycarpa*), and grayleaf willow (*S. glauca*). The forb layer is sparse and includes elephanthead lousewort (*Pedicularis groenlandica*), saffron ragwort (*Packera crocata*), queen's crown (*Rhodiola rhodantha*), and Oregon saxifrage (*Saxifraga oregano*). Soils are spongy, with accumulation of at least 40 cm of fibric to hemic peat in several soil pits. Uplands are dominated by alpine plants like dry sedge (*Carex siccata*) and Bellardi's bog sedge (*Kobresia myosuroides*), moss campion (*Silene acaulis*), alpine stichwort (*Minuartia obtusiloba*), dwarf clover (*Trifolium nanus*), alpine parsley (*Oreoxis alpina*), and alpine avens (*Geum rossii*).

**Key Environmental Factors:** Key factors are mainly undisturbed groundwater discharge and adequate snowmelt from mountains.

**Climate Description:** Climate is continental and varied, with moderately warm summers and typically very cold winters. Precipitation falls primarily as snow during the winter and spring, although summer convective showers make a significant contribution to the total.

**Land Use History:** There is evidence of water diversions within the Chalk Creek watershed.

**Biodiversity Significance Rank Comments (B4):** The Upper Chalk Creek site is of moderate biodiversity significance (B4) due to the presence of an excellent (A-ranked) occurrence of a globally secure (G4/S3) analogue sedge (*Carex simulata*) fen. Fens are an uncommon, irreplaceable wetland in the Southern Rockies. The peat accumulates at an extremely slow rate, 20 cm (8 inches) per 1,000 years. Fens are considered a Resource Category 1 within the U.S. Fish and Wildlife Service and an irreplaceable resource within the



National Forest (Culver and Lemly 2013).

#### Natural Heritage element occurrences at Upper Chalk Creek.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Other Status	EO Rank	Last Obs Date
Natural Communities	Carex simulata Fen	Wet Meadow	G4	S3				A	2018-07-07

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundary is drawn to capture the immediate hydrological processes that support the fen and peat accumulation. Only private lands with written permission were accessed.

**Protection Urgency Rank Comments (P2):** Approximately half of the site is under private ownership. A conservation easement would assist in the protection of the wetlands.

**Management Urgency Rank Comments (M3):** Monitor the impacts from off road vehicles.

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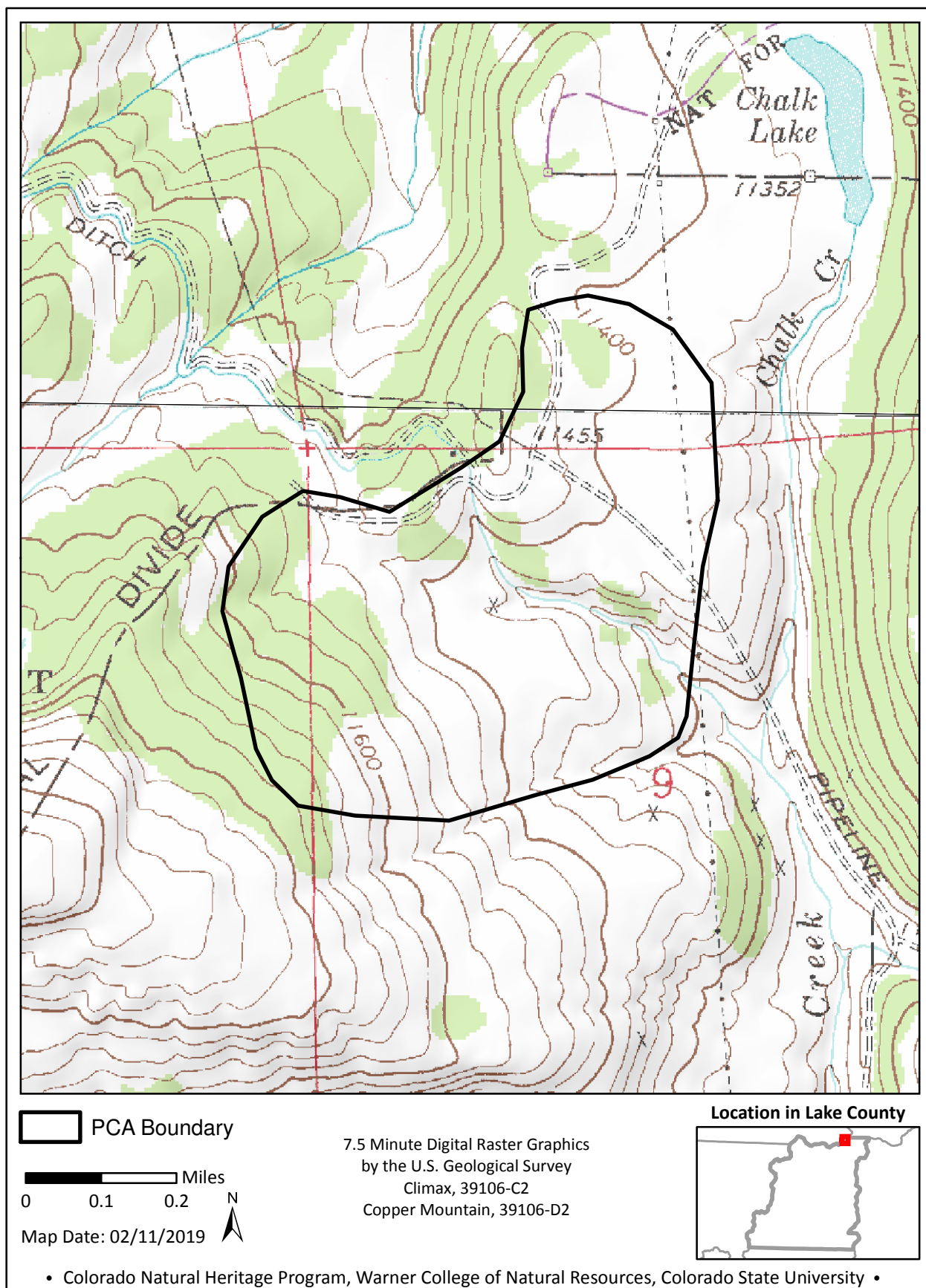
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Upper Chalk Creek Potential Conservation Area, B4: Moderate Biodiversity Significance

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