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A FLORISTIC INVENTORY OF TWO BOULDER COUNTY OPEN SPACE PARCELS:
HEIL VALLEY RANCH AND HALL RANCH, COLORADO, U.S.A

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ABSTRACT

An inventory of the vascular plants of Heil Valley Ranch and Hall Ranch in the north foothills of Boulder County was completed during 2017 and 2018, prior to a catastrophic forest fire that severely impacted this area in the fall of 2020. Heil Valley Ranch and Hall Ranch are keystone units of the Boulder County Parks and Open Space system. These large parcels (~10,000 acres/4047 ha) represent a significant portion of publicly accessible open space in the county and represent an exemplary legacy of land preservation in the region. The biologically diverse foothill landscapes represent the ecotone between the High Plains and the Southern Rocky Mountains. Vital transition zones in the area harbor globally vulnerable and critically imperiled plant associations, the most detailed categorization described by the US National Vegetation Classification (2021). A total of 607 botanical specimens were collected over the course of 39 separate visits. There are 381 species from 82 families of flowering plants represented at the study area, with the greatest diversity occurring in Poaceae and the Asteraceae. Of these, 319 are native, 62 are non-native, and 7 species are of conservation concern. The present study is the first floristic study of these parcels and provides baseline data for future work in the area, as well as information for comparison to floristic works in the broader Front Range foothills region. Together, these studies inform conservation policy at a time when biodiversity is threatened both globally and locally. As the Front Range megaregion rapidly expands in human population, biological inventories will provide critical data to promote the expansion of conservation areas in parallel with urban growth.

Key Words: Boulder County Parks and Open Space, floristics, forest fire, Hall Ranch, Heil Valley Ranch, Rocky Mountain foothills, xeric shrublands.

Natural history collections contribute critical data to many disciplines that address questions and challenges pertaining to biodiversity, but also to the identification and production of foods, medicines, and knowledge about diseases (Funk 2018). The material generated by floristic inventories specifically contributes to policy planning for the placement of conservation areas and for the protection of species of conservation concern (Nualart et al. 2017). Spatial and temporal data encapsulated in a museum specimen are exceptional resources that not only facilitate research in taxonomy and systematics, but also help to advance informal learning and scientific literacy (Monfils et al. 2017). The Front Range Urban Corridor is a populous region spanning the eastern edge of the Southern Rocky Mountains that is part of a fast-growing megaregion anchored by Denver (Lang et al. 2007). This study provides baseline data given the anthropogenic threats such as habitat fragmentation, development, and climate change. Floristic inventories have the potential to play a profound role in the necessary synthesis between urban planning and conservation in the foothills of the Southern Rockies. As cities in this

region merge, conservation areas will also require expanded networks to provide robust and contiguous habitat necessary to support functional and thriving populations of flora, fauna, and microbiota.

The emergence of the Rocky Mountain Chain approximately 70 million yr ago generated a landscape characterized by substantive relief. This mountain building event and the recession of the Western Interior Seaway apportioned a complex geology and diversity of life zones (Mutel and Emerick 1992; Bridge 2004). In Boulder County, the Southern Rockies extend to their eastern terminus, bringing the Continental Divide near the burgeoning Front Range Urban Corridor. Within the 742 square miles comprising Boulder County, most of Colorado's life zones are present, from alpine tundra to grassland. There are 3324 flowering plant taxa documented within Colorado (Ackerfield 2015), and remarkably, over half of these (1743 taxa) occur in Boulder County alone (Weber 1995).

Heil Valley Ranch and Hall Ranch are administered by Boulder County Parks and Open Space (BCPOS). At the time of their acquisition in the early 1990s (along with Trevarton Ranch), these two

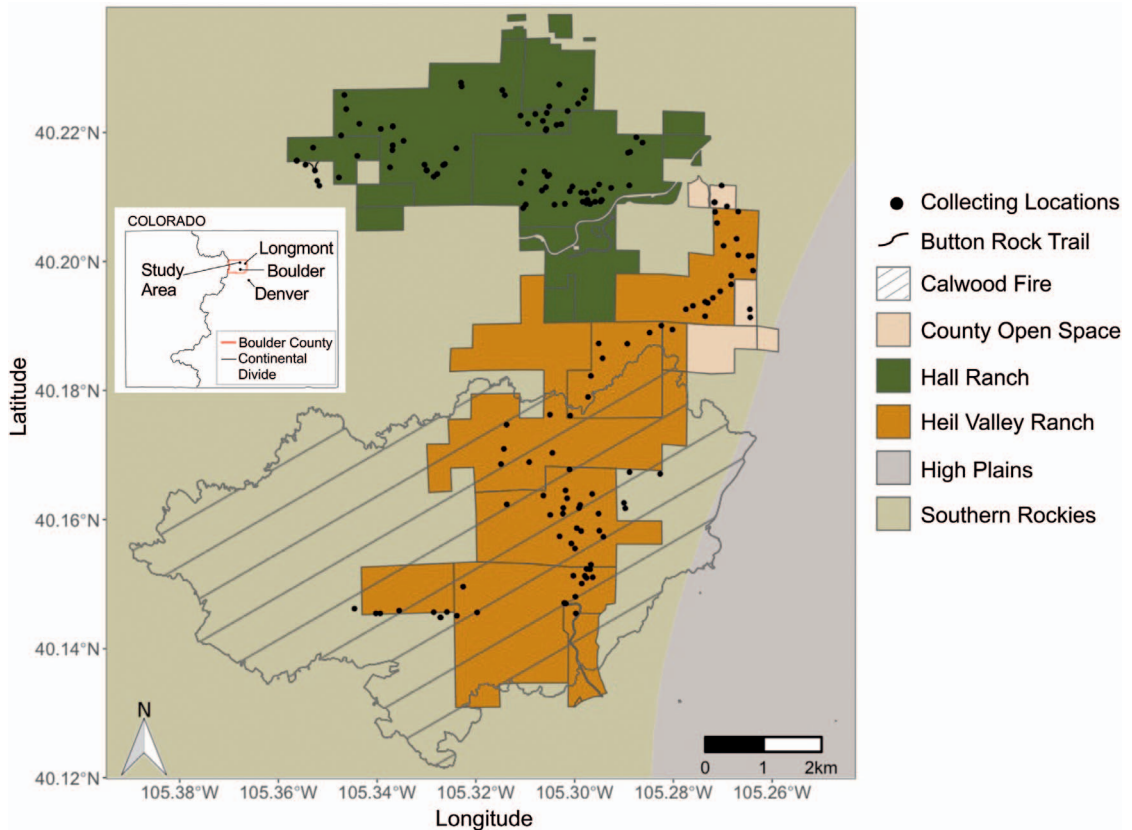


FIG. 1. This floristic inventory focused on Hall Ranch (the darker green parcel to the north) and Heil Valley Ranch (the orange parcel to the south). The dots indicate collecting localities from 2017 and 2018. The Calwood Fire is indicated by a hatched polygon overlay and Level III Ecoregions (U.S. EPA 2013) are indicated as background colors, with the sage green color indicating the Southern Rockies to the west, and grey-tan color indicating the High Plains to the east.

properties represented one of the largest land rescues in the county (BCPOS 1996). Heil Valley and Hall Ranches (Fig. 1) offer unique opportunities not only for recreation, but also for increasing awareness about the ecological, genetic, and aesthetic benefits of this unique intersection of grasslands and the mountain foothills (Bock and Bock 1998). Along with the City of Boulder Mountain Parks, the Arapaho and Roosevelt National Forests, Ron Stewart Preserve at Rabbit Mountain and other BCPOS parcels, Heil Valley Ranch and Hall Ranch provide a critical refuge for the flora and fauna of the northern foothills of Boulder County. The substantial size of these two parcels (6231 and 3899 acres respectively) makes them a significant addition to a long legacy of natural area conservation in the county.

The objective of the present work is to provide the first repository of plant biodiversity data of an ecologically complex foothills ecotone, where there has never been a thorough floristic inventory. The lack of collecting in these foothill ecotones is notable in a county with an extensive (approximately 170 yr) history of botanical collecting. Important contribu-

tions to collecting in Boulder County have been made by Frances Ramaley, William A. Weber, Tim Hogan, and Dina Clark (SEINet) among many others. The parcels were privately owned up until their acquisition by BCPOS in the early 1990s. It is at this time that thorough inventories of the plant communities and biologically significant portions at the study area were conducted by the BCPOS (1996, 2016) and CNHP (Brune et al. 1996; Neid et al. 2008), but none have produced a comprehensive checklist of the flora. Neid et al. (2008) coalesced data (including private lands) that identified rare species, plant communities of concern and proposed habitat for conservation in Boulder County. Prior to 2017, 12 botanists had sampled plants from the study area, yielding 65 specimens.

The present study aims to comprehensively survey the plants of Heil Valley Ranch and Hall Ranch. This work has the potential to inform management decisions of BCPOS, especially after catastrophic wildfires that traversed the region in late 2020, devastating approximately 5000 acres of Heil Valley Ranch in particular (BCPOS 2021). The inventory can also be used towards comparative study regard-

ing inventories of adjacent natural areas in the county and beyond. These data have applications for comparison with the work of Hogan (1993, 2019) and Clark (2014). In addition, recent inventories of the Red Hill Study Area (an area of high biodiversity significance on Heil Valley Ranch and Trevarton Open Space) (Vickery 2019), as well as Ron Stewart Preserve at Rabbit Mountain (Vickery 2021) demonstrate increased attention to the biodiversity of the foothills, where species from the great plains reach the edge of their range. Going further, significant shrublands and grasslands at the study area offer grounds for wider comparison to adjacent foothill sites north and south, including Red Mountain and Soapstone Prairie Natural Area in Larimer County (Brune et al. 1996; McAleer 2014) and inventories of Golden and vicinity (Schweich 2020a, 2020b; CNHP 2021) in Jefferson County. Inventories of grasslands in eastern Colorado such as Pawnee National Grassland (Hazlett 1998), Mesa de Maya (Clark 1996), and Comanche National Grassland (Kuhn 2009) also aid in our understanding of these underrepresented landscapes.

The purpose of the study is to provide a checklist of the flora at each parcel that can be utilized by staff at BCPOS for conservation planning. This work contributes to the list of floras in the region that together provide a basis for reference ecosystems that can be used to inform restoration policy and the assessment of the level of degradation of an area (Nualart et al. 2017). In addition, this checklist can be used to support interpretation that increases scientific literacy and engages the public at these popular recreation destinations.

Description of the Study Area

Heil Valley Ranch and Hall Ranch together encompass approximately 10,000 acres (4047 ha) (Fig. 1). The elevation gradient spans nearly 609 meters at Hall Ranch (1643 to 2195 meters) and nearly 823 meters (~1646 to 2463 meters) at Heil Valley Ranch. On a north-south axis, the parcels are separated by South St. Vrain Drive (Colorado Route 7) and the South St. Vrain Creek. The eastern boundary consists of points that converge with U.S. Route 36; the town of Lyons, Colorado Route 7, and several BCPOS conservation easements and Left-hand Canyon. The Dakota Hogback, a series of north to south trending sandstone hills, occurs to the west of Route 36, marking the transition between the Great Plains and the Rocky Mountains (Waagé 1955). The Western boundary is predominately under jurisdiction of the United States Forest Service (i.e., Arapahoe and Roosevelt National Forests). The location of the study area positions it as critical buffer between the Front Range Urban Corridor and these adjacent national forests. Notably, the study area itself harbors significant populations of flora and fauna that rely on the wide assortment of habitats present in this ecotone. The occurrence of

shrublands, which are unique within Boulder County, offers resources for numerous mammals and birds. The study area also provides winter refuge for migrating mammals, and habitat for butterflies that prefer high quality tallgrass prairies (Neid et al. 2008). Hall Ranch is also home to the highest elevation prairie dog colonies in Boulder County (BCPOS 1996).

Heil Valley Ranch comprises approximately 6231 acres (2,522 ha). Large areas are set aside for habitat conservation (~5000 acres). Two-hundred forty-three acres are set aside for raptors as seasonal closures between December 15 and July 15. Recreation is not permitted in those areas. Most of the critical wildlife habitat is located on the west side of the parcel bordering Arapaho and Roosevelt National Forests. Significant features include secluded canyons, remnants of ranching settlements and quarries, a box canyon, and seasonal ponds.

Hall Ranch encompasses approximately 3899 acres (1578 ha) and is located west of the town of Lyons between the North and South St. Vrain Creeks. Approximately 1718 acres are designated, for habitat conservation where recreation is not permitted. The parcel consists of grasslands and shrublands to the east and woodlands and lower montane forest to the west. Two charismatic land formations occur at Hall Ranch: Indian Lookout Mountain and Hat Rock, which exist in close proximity to the primary parking area of Hall Ranch and the town of Lyons. To the northwest, Hall Ranch connects with the Button Rock Preserve (City of Longmont) via the Button Rock Trail.

Geology

The mountain building event of the Laramide orogeny (approximately 75 to 40 million yr ago) exposed a complex geology, consisting of igneous, sedimentary, and metamorphic rock units in the study area. Sandstone is the most common rock unit. The western portions of Hall Ranch include igneous rocks of Silver Plume Granite and sedimentary layers of the Fountain Formation, Ingleside Formation, and Lyons Sandstone. West of the town of Lyons, the peaks of Indian Lookout Mountain and Hat Rock are composed of the Ingleside formation (reddish-pink, fine-grained quartz sandstone). Surrounding the peaks is the Fountain Formation (arkosic conglomerate, sandstone, siltstone, shale and limestone). Sedimentary rock units prevail at Heil Valley Ranch. These include the Fountain Formation, Lyons Sandstone, and Lykins Formation. The northern area of Heil Valley Ranch is composed of Lyons Sandstone and Bergen Shale. The maroon east of Red Hill, in the eastern portion of the parcel is the result of siltstone and sandstone of the Lykins formation. Plumely Canyon and Geer Canyon, in the western portion of the parcel, are composed of the Fountain Formation (sandstone,

siltstone and shale) (Braddock et al. 1988; BCPOS 1996).

Land Use History

It is likely that the region has been occupied by humans since the late Pleistocene. Paleoindians were present between 11,300–7500 radiocarbon yr before present (Pitblado et al. 2007). The tribes of the eastern plains included the Apache, Comanche, Kiowa, Pawnee, and Shoshonee (Hughes 1987). Ute tribes inhabited the Central Rocky Mountains (Buchholtz 1983; Hughes 1987). Arapaho and Cheyenne tribes inhabited the area now known as Hall Ranch. Contact with Europeans began 275 yr before present. Evidence of tribal activity exists to this day, as four native American sites exist at Heil Valley Ranch (BCPOS 2022). Cultural sites include domestic structures, quarries, and rock art (BCPOS 1996).

The 1700s and 1800s were marked by exploration and fur trading by the Spanish and other European colonists. Beaver trappers worked in the surrounding rivers. The subsequent gold rush of the mid 19th century led to the pursuit of mining. Agriculture returned to prominence in the 19th century (Noel 2015). With expansion, builders sought new materials to replace wood and brick. Quarries in the study area produced the characteristic Lyons sandstone that has been used to build many local structures, including those of the University of Colorado Boulder campus. Throughout the 20th century, land use at both properties included homesteading, cattle ranching, and grazing of livestock. Harvest on these sites included crops, hay, and timber. Hunting occurred, primarily for deer and elk, mountain lion, black bear, and wild turkey. Moss rock collecting also took place (BCPOS 2022). The two properties were acquired in 1993 and 1994 by Boulder County and an additional 210 acres were added to Heil Valley Ranch in 2012 (BCPOS 1996, 2016).

Climate

The study area is located at the convergence of the High Plains and the Southern Rocky Mountains and features climatic elements of the high plains, mid-continental, and mountain ecoregions. The climate is semi-arid, with an increase in precipitation in the higher elevations towards the west (BCPOS 1996; Doesken 2003). Average precipitation for the nearby city of Longmont is 358.9 mm per yr. The average annual high temperature is 64.7°F and the low is 33.2°F. The warmest month of the year is July with average high temperatures of 89°F. January is the coolest month with average high temperatures of 42°F and low temperatures of 12°F (U.S. Climate Data 2019). The outer hogbacks of the study area receive more wind and sun exposure, allowing them to harbor higher concentrations of xerophytic plant associations, such as the characteristic *Cercocarpus*

montanus Raf. (Mountain Mahogany) shrublands (Neid et al. 2008).

METHODS

Field Work

To produce a first checklist of the flowering plants of Heil Valley Ranch and Hall Ranch and facilitate downstream conservation planning, 39 d were spent collecting plants in the field during the growing seasons of 2017 (June 14–August 15) and 2018 (April 30–September 30).

To facilitate the planning of fieldwork, the first author (SW) surveyed aerial maps and documentation of the study area prior to site visits. Sites were selected on the basis of diversity in topography, moisture, and aspect. While efforts were made to explore the majority of each parcel, subjective sampling was conducted in order to ensure the collection of as much diversity as possible (Peet 1981). Most species (229/381) were collected only once, in adherence to the guidelines set by BCPOS. Numerous species (152) were collected twice or more, when they belonged to larger plant families such as the Asteraceae, Cyperaceae, Fabaceae, and Poaceae, groups that were more challenging to key out in the field. Non-native species were also collected more than once in order to assess their impact on the landscape. Areas designated as critical wildlife habitat were visited only with permission from BCPOS and collecting in those areas was limited to late summer after the golden eagle nesting season. In addition, the following inventories were consulted: Clark (1996, 2014), Hogan (1993, 2019), Kuhn (2009), Sharples (2017), Tripp (2015), and Weber (1995).

At each collection site, a GPS waypoint was taken to record latitude, longitude, and elevation. Field notes were taken to record salient features pertaining to habitat, community vegetation type, and aspect. An approximate assessment of abundance was made for common species, while less common species were counted in the field prior to collecting. The following rankings used in the checklist are estimates: abundant (>1000), common (>500), scattered (~100), uncommon (<50), and rare (<25). In cases where there were less than 25 of a species, a photograph and coordinates were taken, and herbarium records were consulted prior to collecting.

Five collecting sites are outside of the boundary for either ranch. The species collected at these sites are included in the inventory because they are unique to study area. At two lower montane sites at Hall Ranch, several unique species were found including: *Arabis pycnocarpa* M.Hopkins, *Goodyera oblongifolia* Raf., *Heuchera bracteata* (Torr.) Ser., and *Turritis glabra* L. Two species were collected at Trevarton Open Space: *Oenothera howardii* (A.Nelson) M.E.Jones ex Prain and *Triodanis leptocarpa* (Nutt.) Nieuwl. Near the saddle of Geer Canyon, at Heil

TABLE 1. THE 10 MOST SPECIES-RICH GENERA IN THE STUDY AREA.

Genus	No. of species
<i>Carex</i> L.	8
<i>Poa</i> L.	7
<i>Astragalus</i> L.	6
<i>Muhlenbergia</i> Schreb.	5
<i>Bromus</i> L.	5
<i>Erigeron</i> L.	5
<i>Oenothera</i> L.	5
<i>Achnatherum</i> P.Beauv.	4
<i>Agrostis</i> L.	4
<i>Eriogonum</i> Michx.	4

Valley Ranch the first author collected *Castilleja miniata* Douglas ex Hook., *Orthocarpus luteus* Nutt., and *Oxytropis lambertii* Pursh.

A preliminary taxonomic identification was assigned in the field when possible. Plants were pressed in folded newspaper in a field press and later transferred into a wooden plant press between blotters and cardboard upon return from the study area. Within 24 hr, the plant presses were placed into the oven at University of Colorado Herbarium (COLO) and dried at 110°F for 2–3 d. The dried specimens were sorted by family and genus prior to final identification. After collection, specimens were identified, curated, and then deposited at COLO (Thiers 2022).

Identification

To identify collections, several references were used including the *Colorado Flora Eastern Slope Fourth Edition* (Weber and Wittmann 2012), *The Flora of Colorado* (Ackerfield 2015), and the *Flora of North America* (Flora of North America Editorial Committee 1993+). Plant taxonomy and nomenclature follow the Angiosperm Phylogeny Group III (2009). Each specimen identification was verified by utilizing the collection at COLO as a reference. Protologues and type specimens were also consulted in particularly difficult instances. Searches were conducted using SEINet (2022) to locate other specimens previously collected from the study area. Twelve botanists collected 65 specimens from the study area prior to this project. A map of the study area was generated with R (R, R Core Team, R Foundation for Statistical Computing, Vienna, Austria), using county open space, trail, and wildfire data from BCPOS (2022) and U.S. EPA Level III Ecoregions (U.S. EPA 2013).

RESULTS AND DISCUSSION

A total of 381 species in 285 genera (and 82 families) were identified for the study area. Of the 82 families, the most taxonomically diverse were Poaceae (65), Asteraceae (61), Fabaceae (20), Rosaceae (17), and Cyperaceae (16). The most taxonomically

TABLE 2. INTRODUCED SPECIES. Colorado noxious weed species are ranked in a hierarchy from A to C. B-list species are targeted by management plans designed to stop their spread. C-list species are targeted with management plans focused on education, research, and biological control. (Colorado Department of Agriculture 2019).

Scientific name	Rank
<i>Centaurea diffusa</i> Lam.	B
<i>Cirsium arvense</i> (L.) Scop.	B
<i>Cynoglossum officinale</i> L.	B
<i>Hesperis matronalis</i> L.	B
<i>Saponaria officinalis</i> L.	B
<i>Linaria dalmatICA</i> (L.) Mill.	B
<i>Aegilops cylindrica</i> Host	B
<i>Potentilla recta</i> L.	B
<i>Verbascum blattaria</i> Vell.	B
<i>Conium maculatum</i> L.	C
<i>Cichorium intybus</i> L.	C
<i>Convolvulus arvensis</i> L.	C
<i>Erodium cicutarium</i> (L.) L'Her. ex Aiton	C
<i>Hypericum perforatum</i> L.	C
<i>Bromus tectorum</i> L.	C
<i>Verbascum thapsus</i> L.	C

diverse genera were *Carex* L. (8), *Poa* L. (7), and *Astragalus* L. (6). Three genera in the Poaceae were represented in the ten most diverse genera in the study area: *Poa* (7), *Muhlenbergia* Schreb. (5), and *Bromus* L. (5) (Table 1). Within the ten most species rich genera in the study area (Table 1), five are grass genera. There were 62 introduced species in the study area, comprising 16% of the flora. Sixteen species ranked as noxious weeds occur at the study area (Table 2). There are 7 species on the BCPOS Species of Special Concern List and the Colorado Natural Heritage Program (CNHP) tracking list (Table 3). A visual representation of the collections organized by genera and species is shown in Fig. 2.

TABLE 3. THE FOLLOWING SPECIES OCCUR ON THE BOULDER COUNTY PARKS AND OPEN SPACE SPECIES OF SPECIAL CONCERN LIST (BCPOS 2013) AND THE COLORADO NATURAL HERITAGE PROGRAM (CNHP) TRACKING LIST (2019). The heritage network ranking system is utilized to target at species and habitats of conservation concern. Global (G) and State (S) levels are indicated here. 1 = Critically imperiled, 2 = Imperiled, 3 = Vulnerable to Extirpation, 4 = apparently secure, 5 = Demonstrably Widespread, Abundant and Secure.* Two-Range Rank: Roughly equal chance of G2 or G3, but other ranks much less likely. (Master et al. 2012)

Scientific name	Rank
<i>Aristida basiramea</i> Engelm. ex Vasey	G5 S1
<i>Claytonia rubra</i> (Howell) Tidestr.	G5 S1
<i>Crocianthemum bicknellii</i> (Fernald) Janch.	G5 S1
<i>Pediocactus simpsonii</i> (Engelm.) Britton & Rose	G4
<i>Physaria bellii</i> G.A.Mulligan	G2 G3 S2 S3*
<i>Potamogeton diversifolius</i> Raf.	G5 S1
<i>Viola pedatifida</i> G.Don	G5 S1

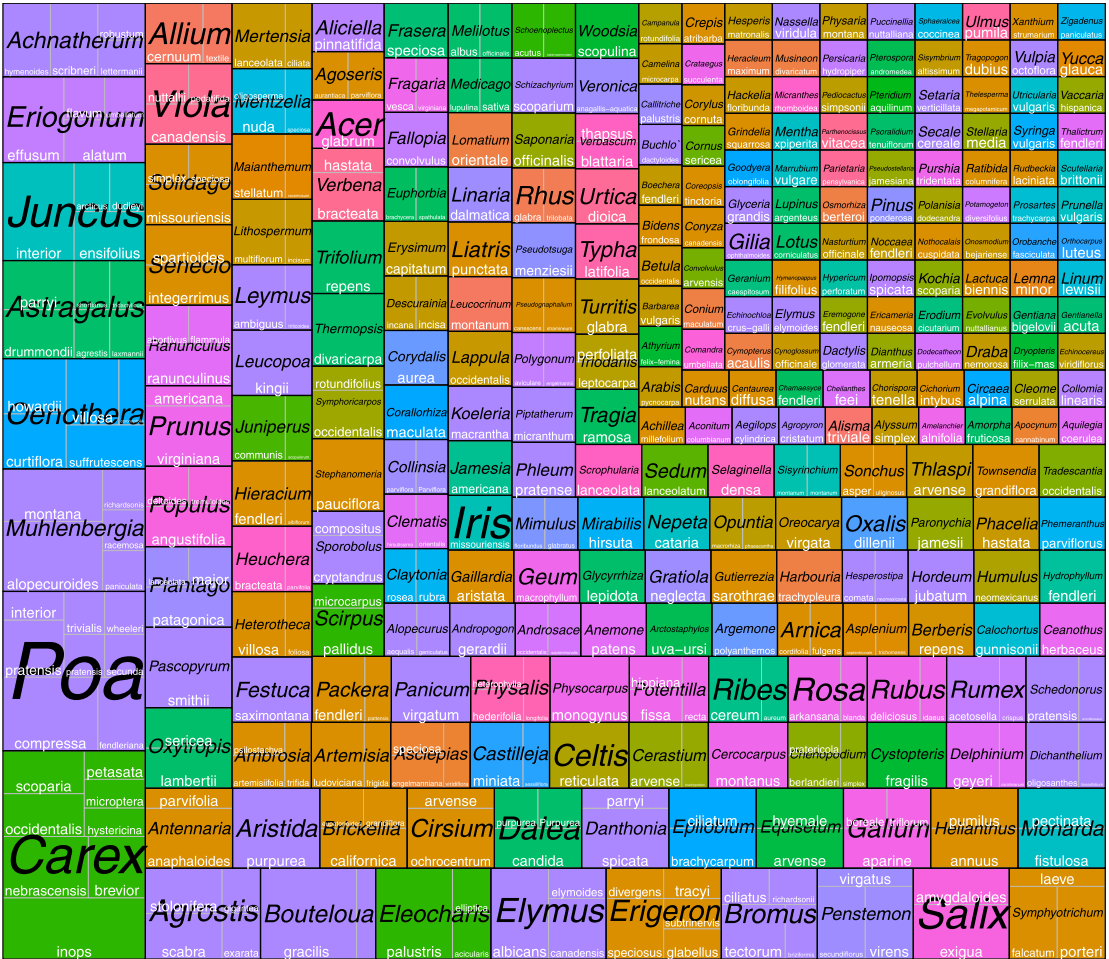


FIG. 2. Visual treemap representation of the 604 collections, organized by genus and species. The size of each box is proportional to the number of collections made. Genera indicated in black text and species indicated in white text. Colored boxes are only for visual distinction.

Plant Communities

Below, we present a description of the plant communities present at the study area, these roughly following NatureServe’s Terrestrial Ecological System descriptions (NatureServe 2013) based on observations made in the field. Here and elsewhere, vegetation classifications are useful in that they reflect synthesis between organisms and fundamental environmental factors, as well as ecological processes. Delimited units, for example, provide scientists the ability to communicate, conserve, and restore ecosystems. However, we caution that categorization of plant communities can undermine their complexity (Marr 1967; Peet 1981). For instance, species compositions within plant community types can fluctuate in response to environmental change, making simple classification schemes not entirely

comprehensive. Finally, floods, fire suppression, and invasion by non-native species have also impacted plant community types within the study area (Peet 1981).

Grasslands. Grassland ecosystems in North America have been drastically impacted by destruction of habitat, grazing, and lack of awareness (Bock and Bock 1998). Grasslands present at the study area specifically include lower elevation ecotonal grasslands, meadows, and openings of the lower montane woodlands and forests, as well as introduced grasses that infiltrate these areas. At the study area, grasslands that intergrade with woodlands have, notably, been altered due to the encroachment of *Pinus ponderosa* P.Lawson & C.Lawson woodlands as a result of fire suppression and grazing (Brune et al. 1996).

Western Great Plains Foothill Grassland. Components of tallgrass prairie and mixed-grass prairie communities occur on the lower slopes of the Dakota hogback. They also appear in open woodland and savanna communities. Tallgrass prairie associations dominated by *Andropogon gerardii* Vitman (Fig. 3F) and *Schizachyrium scoparium* (Michx.) Nash include assemblages of both prairie and montane species (Brune et al. 1996). The *Hesperostipa comata* Colorado Front Range Grassland (G1G2/S2) is dominant in these lower grasslands and shrubland communities where it occurs in large expanses of open grassland and also in association with *Cercocarpus montanus*. The *Hesperostipa neomexicana* Grassland (G3/S2) (Fig. 3C) is a significant natural community occurring on shale slopes and rocky substrates. It is a common association in the southwestern US that reaches its northern limits in Colorado and Wyoming (Brune et al. 1996).

Rocky Mountain Foothill Shrubland. The *Cercocarpus montanus* system occurs on dry rocky slopes, often in dense concentrations (Neid et al. 2008). Vestal (1919) acknowledged the prominence of *C. montanus* on the exposed outer hogbacks of the Northern foothills in Boulder County. Hogan (2019) listed *C. montanus* as infrequent in the City of Boulder Mountain Parks. *C. montanus* occurs with other shrubs and grasses, and occasionally trees.

Rocky Mountain Foothill Riparian Shrubland. The *Betula occidentalis* Hook. alliance occurs along Geer Canyon Creek and is codominant with *Acer glabrum* Torr. This narrow channel is surrounded by mixed conifer forest and, although uncommon in the study area, is notable for its high plant diversity. Geer Canyon Creek is the primary natural hydrologic system that flows through Heil Valley Ranch. These shrublands are sequestered along the western boundary of the parcel.

Southern Rocky Mountain Conifer Forest and Woodland. This dominant ecological system presents in great variation over the study area. *Pinus ponderosa* encroaches on grasslands and shrublands at lower elevations, mingling with *Cercocarpus montanus* and *Hesperostipa comata*. It then shifts to dry woodlands with a sparse understory of currant, grasses, forbs, and succulents. An example of these xeric woodlands occurs west of the Nelson Loop at Hall Ranch. Higher in elevation, Ponderosa Pine forest increases in density and intersperses with *Pseudotsuga menziesii* (Mirb.) Franco in north facing ravines. These cool, sheltered slopes offer a diverse understory in this transition to the montane life zone. The dense stands are mixed in age with many saplings. Montane plants occur at the lower limit of their range. *Populus tremuloides* Michx. appears in clonal patches. Dry montane woodland occurs on and around rocky outcroppings, and west facing cliffs and ledges. *Pseudotsuga menziesii* and *Pinus ponderosa* emerge from rocky fissures. *Asplenium*

septentrionale (L.) Hoffm. and *A. trichomanes* L. (Fig. 3B) are protected in horizontal crevices.

The present study represents the first floristic inventory of Heil Valley Ranch and Hall Ranch—two keystone units of conservation within Boulder County—as administered by Boulder County Parks and Open Space. Thorough inventories of the plant communities and biologically significant portions at the study area have been conducted by the BCPOS (1996, 2016) and CNHP (Brune et al. 1996; Neid et al. 2008), but none have produced a comprehensive checklist of the flora. The number of species reflects the diversity of habitats as well as land use history. Notably, the presence of semi-arid shrublands and extensive grasslands represents a departure from the forested foothills of Boulder Mountain Park. The present contribution provides data for comparison with relevant floristic work in the region, in particular to the concentrations of shrublands and high plains species in the county and along the Front Range. Within the study area there are 46 species with a high plains distribution. William Weber's 1995 checklist of Boulder County vascular plants provides a valuable overview of the rich flora found in the county (1538 taxa), a result of the steep topographical gradient in which the continental divide reaches its eastern expression. Floristic work by collection managers at COLO (Tim Hogan and Dina Clark) provide additional focus within the county.

Hogan's most recent work (2019) documents 698 species of vascular plants in Boulder Open Space and Mountain Parks, a neighboring area comparable in size (7000 acres) and provides a revised checklist that encompasses over 30 yr of collection in the area. Mountain Parks has differences in land use history, dominant plant communities, and lesser elevational gradient. In addition, it has benefitted from preservation measures enacted by the City of Boulder at the end of the 19th century, while the study area was acquired by BCPOS only in 1993 and 1994 (with ongoing expansions). Mountain Parks includes larger montane area and higher peaks. The terrain and geology at each location support different plant communities and concentrations of flora. Notable at Mountain Parks is the presence of 75 plant species with eastern North American affinities including *Agrimonia striata* Michx., *Aralia nudicaulis* L., *Betula papyrifera* Marshall, and *Lilium philadelphicum* L. In contrast, fewer of these eastern relics are present at the study area. Mountain Parks, for example, lacks large assemblage of foothills shrubland communities dominated by *Cercocarpus montanus*. These are supported by the rocky substrates and aspect provided by the Dakota Hogback. Twenty-one percent of the flora of the Boulder Mountain Park is composed of introduced species (Hogan 2019). Visual assessment coupled with the different land use histories of each site indicates that the impact of introduced species is more widespread and deleterious at the study area where semi-natural assemblages



FIG. 3. Examples of the flora at Heil Valley Ranch and Hall Ranch. A. *Viola pedatifida*, a violet common to the Great Plains that is uncommon in the study area. B. *Asplenium trichomanes*, a fern rare to the study area, found in rock crevices. C. *Hesperostipa neomexicana*, a southwestern grass near the northern limits of its range. D. *Pediocactus simpsonii* (Engelm.) Britton & Rose, a spherical southwestern cactus. E. *Physaria bellii*, a mustard endemic to Colorado. F. *Andropogon gerardii*, a tallgrass prairie grass that is a component of many plant associations in the study area.

of introduced species dominate many of the grassland and woodland habitats.

Clark made 421 (of 898 retrieved from SEINet) collections at White Rocks Open Space (City of Boulder Open Space and Mountain Parks). This rare high plains habitat (~100 acres) features Laramie and Fox Hills sandstone at the eastern edge of the county (Weber 1995; Tripp 2015). Plant communities include Mixed Grass Prairie, Sand Sage Shrubland, and *Rhus trilobata* (*R. aromatica*)/*Yucca glauca*/*Hesperostipa comata* shrublands. Clark's work (2001, 2014) at this unique site documents rare plants such as *Asplenium adiantum-nigrum* L. (G5S1), *Apios americana* Medik. (G5S1), and *Aristida basiramea* Engelm. ex Vasey (G5S2). Within the study area there are 46 species with a Great Plains distribution. Great plains species that occur at both White Rocks and the study area include *Allium textile* A.Nelson & J.F.Macbr., *Asclepias engelmanniana* Woodson, *Asplenium trichomanes*, *Aristida basiramea*, *Buchloë dactyloides* (Nutt.) Engelm., *Delphinium carolinianum* Walter, *Eriogonum effusum* Nutt., *Mentzelia nuda* (Pursh) Torr. & A.Gray, and *Rosa arkansana* Porter. Several shrubs appear at both sites, but *Cercocarpus montanus* characteristic of the hogbacks of the study area are absent from White Rocks. White Rocks includes populations of *Prunus pumila* L., absent at the study area.

Recent inventories of the Red Hill Study Area, (Heil Valley Ranch and Trevarton Open Space) (Vickery 2021), as well as Ron Stewart Preserve at Rabbit Mountain (Vickery 2021), both BCPOS parcels, demonstrate increased attention to the biodiversity of the neighboring foothills. Both parcels have a BI ranking (outstanding biodiversity) from CNHP. The inventory of the Red Hill Study Area (320 acres) resulted in the documentation of 391 species. This parcel includes a portion of the 740-acre Trevarton property acquired by BCPOS in 2017. Infrequent or rare species documented by both the first author (who briefly explored the boundaries of this area) and Vickery include *Claytonia rubra* (Howell) Tidestr., *Crepis atribarba* A.Heller, *Linaria canadensis* (L.) Dum.deCours, *Physaria bellii* G.A.Mulligan, and *Vicia Ludoviciana* Nutt. ex Torr. & A.Gray. In addition, Vickery documented *Asclepias stenophylla* A.Gray, *Carex oreocharis* Holm, *Lactuca ludoviciana* (Nutt.) Riddell, and *Orobanche multiflora* Nutt. Vickery also documents local endemic *Physaria vitulifera* Rydb. at the site. Ron Stewart Preserve at Rabbit Mountain is located NW of the Study area, north of highway 66 in Longmont. His study documents 494 species (538 have been documented in total). This approximately 7000-acre parcel includes the southern extent of the hogbacks common in Larimer County to the north (Neid et al. 2008). Notable species present at both Rabbit Mountain and the study area are *Aristida basiramea*, *Ceanothus herbaceus* Raf., and Colorado endemics, *Physaria bellii* and *Mentzelia speciosa* Osterh.

There has been significant floristic work conducted north of the study area in Larimer County (Brune et al. 1996). In 2014 McAleer inventoried two parcels, Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA), adding granular data to the 1996 and 2004 inventories by CNHP that delimited the significant biodiversity of Larimer County. These two parcels along the Wyoming border, were open to the public in 2009. SPNA is 18,728 acres, and was previously privately owned ranch land. West of SPNA is RMOS (14,980 acres), an ecotone between the foothills and the plains. Four-hundred-thirty-eight taxa were identified at these two parcels, compared to the study area where 381 species were documented. McAleer classifies 108 species with shortgrass prairie distributions, although species are often designated multiple affinities. *Mentzelia speciosa* (G3S3) was documented at SPNA and is also found at the study area. *Cercocarpus montanus* shrublands occur at RMOS, as well as occurrences of *Hesperostipa neomexicana* (Thurb.) Barkworth, for which there are only five records in Larimer County (SEINet 2022). There are also five records for this species in two counties of Wyoming, the northern extent of its range.

Significant remnant grasslands and shrublands occur in the vicinity of Golden, CO in Jefferson County. This foothills transition zone south of the study area includes 556 acres of parkland. In 2020 CNHP surveyed 115 acres (Sovell et al. 2021) and documented 114 plant taxa. Rare species documented are: *Physaria* x1 (GNA/S1), *Smilax lasioneura* Hook. (G5/S3S4), *Spiranthes diluvialis* Sheviak (G2G3/S2). Tom Schweich has conducted ongoing botanical inventories of the area, making 835 collections as of 2020. Lorraine Yeatts has also contributed 334 collections. Significant parcels included in these inventories are North and South Table Mountain, Lookout Mountain, and North Washington Open Space. *Cercocarpus montanus* shrublands occur on North Table Mountain Park (1873 acres) which is owned and managed by Jefferson County Open Space. One-hundred-twenty-two species were documented at North Washington Open Space (4 acres) which includes a small remnant mixed grass prairie. Many taxa of interest are more common in the mountains and foothills and rare in the plains.

Disturbance: Floods

The September 2013 flood event impacted both parcels. This multi-state event was caused by a protracted period of heavy rainfall (September 11–12) and flooding (September 13–16). Water from flooded canyons traveled to the South Platte River in NE Colorado and Nebraska. Boulder and Larimer Counties were the most severely impacted. (Gochis et al. 2015) At Heil Valley Ranch, Geer Canyon Creek overflowed, causing flooding to Geer Canyon Drive. Riparian vegetation was damaged, in addition to

roads and structures. (BCPOS 2016) At Hall Ranch, the flooded South St. Vrain Creek damaged the flood plain and Old South Saint Vrain Road (BCPOS 2022).

Disturbance: Wildfires

Before Euro-American settlement, many Ponderosa Pine ecosystems took the form of savannas which supported diverse understories (Matonis 2021). Subsequent changes in climate and human populations led to an increase in fire suppression and grazing. At lower elevations, Ponderosa Pine forests encroached on grasslands. These denser forests have a higher potential for high-severity fires leading to tree mortality, habitat loss for some plant species, and higher potential for an increase in non-native species. The last several decades have produced wildfires of an unprecedented size and scope. There have been six fires on Heil Valley Ranch between 1988–2020 (Addington et al. 2018; Matonis 2021). On October 17, 2020, the Calwood Fire burned a total of 10,106 acres, making it the biggest fire in the history of Boulder County. Approximately 4400 acres burned on Heil Valley Ranch. Sustained winds of 40 miles per hr caused high intensity fire for which much of the forest was unprepared. Many *Pinus ponderosa* 300–400 yr in age were lost (BCPOS 2021a; BCPOS 2021b).

Regeneration of Ponderosa Pine forest can be limited after severe fire and the success of post burn seedlings is dependent on climatic conditions (Addington et al. 2018). Affected portions of the study area may remain unforested for many years and it is possible that there will be a conversion of some areas from forest to grassland or shrubland. This change in habitat can also increase diversity and in turn create different patterns in the fire regime. Prescribed burns on the site have demonstrated potential to aid in the restoration of the Ponderosa Pine ecosystem (Matonis 2021).

Regional research indicates that increased richness and cover of exotic species is a risk following high severity fires (Fornwalt 2010; Matonis 2021). However, recent studies at Heil Valley Ranch have demonstrated that non-native species have so far not appeared in greater numbers than native species after the Calwood fire (Stevens-Rumann and Fornwalt 2021). In terms of other effects of high severity fires on the structure of plant communities, research following the Calwood Fire has shown burned sites to have higher proportions of forbs and lower proportions of graminoids and shrubs relative to unburned sites (Matonis 2021; Stevens-Rumann and Fornwalt 2021). Native grasses that declined at the site included *Agrostis scabra* Willd. and *Muhlenbergia montana* (Nutt.) Hitchc. New native forbs that appeared are *Triodanis perfoliata* (L.) Nieuwl. and *Phacelia hastata* Douglas ex Lehm. (Matonis 2021). There are only 20 herbarium records for *Triodanis perfoliata* in Boulder County (SEINet). These data

considered variables, including management practices by BCPOS, such as thinning and prescribed burns, along with the variables of the fire itself. Long term monitoring supported by BCPOS enabled this research to take place. While these papers provide a short-term overview of the immediate effects of wildfire on local grassland and forest communities, continued research and monitoring is needed to determine the longer-term effects of wildfire.

CONCLUSIONS

This study provides comprehensive data on the flora of the North foothills of Boulder County. The purpose of this inventory is to provide a checklist of the flora of these substantial parcels that can be utilized by staff at BCPOS for conservation planning. Floristic inventories help to promote policy dedicated to the protection and restoration of natural resources and ecosystem services, which is especially relevant in an era of environmental change including forest fires that impacted this very area 2 yr after the inventory (in 2020). Floristic inventories have the potential to mitigate the biodiversity crisis by informing land management, conservation, and restoration. The legacy of land conservation by BCPOS and their continued efforts to understand and manage these landscapes, provides a model for other open space programs and conservation organizations.

ANNOTATED CHECKLIST

The checklist is organized alphabetically by family, genus, and specific epithet. All collections made by the first author are deposited at the herbarium of the University of Colorado Museum (COLO). Nomenclature follows the Angiosperm Phylogeny Group III (2009). A total of 607 botanical specimens were collected. Bracketed entries include the collection numbers made by the first author. Sixty-five specimens were collected at the site prior to this study and are indicated by bracketed entries that include collector names and collection numbers. These collectors are Berta Anderson, Dina Clark, Tim Hogan, William Jennings, Judy King, Patrick Murphy, Richard Scully, Linda Senser, Stanley Smookler, William A. Weber, and Ron C. Wittmann. The most significant contribution was made by Dina Clark who added 32 specimens to the checklist. Seventeen of these specimens are the sole representatives of the checklist and the remainder add depth to the data presented.

Biogeographical affinities of plants from Heil Valley Ranch and Hall Ranch are parsed into the following categories: Africa (AFR), Circumboreal, Cosmopolitan, Eastern North America (ENA), Eurasia (EA), Europe (EU), Great Plains (GP), North America (NA), South America (SA), Southern Rockies (SORO), Southwest North America (SWNA), United States (US), Western North Amer-

ica (WNA), Western United States (WUS). We provide comments on the habitat and abundance of each species at the study area using the following rankings: abundant (>1000), common (>500), scattered (~100), uncommon (<50), and rare (<25).

Alismataceae

Alisma triviale Pursh

Uncommon in seasonal ponds. NA. [522]

Amaranthaceae

Chenopodium berlandieri Moq.

Uncommon in dry and disturbed areas. NA. [597]

Chenopodium pratericola Rydb.

Scattered in shrublands. NA. [190]

Chenopodium simplex (Torr.) Raf.

Uncommon in forested canyons. NA. [557]

Kochia scoparia (L.) Schrad.

Uncommon in disturbed grasslands. EA. [260]

Amaryllidaceae

Allium cernuum Roth

Common in Ponderosa Pine woodlands. NA. [249, 620]

Allium textile A.Nelson & J.F.Macbr.

Scattered in shrublands. GP. [331]

Anacardiaceae

Rhus glabra L.

Scattered in open canyons and along road sides. NA. [649]

Rhus trilobata Nutt.

Abundant, a dominant component of shrublands. WNA. [148]

Toxicodendron rydbergii (Small ex Rydb.) Greene

Common on rocky slopes and canyon floors. NA.

Apiaceae

Conium maculatum L.

Common in riparian areas. EU. [529]

Cymopterus acaulis Raf.

Scattered in forest openings. WNA. [370]

Harbouria trachypleura J.M.Coult. & Rose

Common in woodlands and forests. SORO. [126, 283], [Clark 4354]

Heracleum maximum W.Bartram

Uncommon. Found along montane canyon streams. NA. [530]

Lomatium orientale J.M.Coult & Rose

Common in grasslands and shrublands. GP. [285, 346]

Musineon divaricatum (Pursh) Nutt.

Scattered in shrublands. GP. [304]

Osmorhiza berteroi DC.

Uncommon, found in a cool montane ravine. NA (and South America). [386]

Apocynaceae

Apocynum androsaemifolium L.

Scattered in shrublands and grasslands. NA. [Clark 4355]

Apocynum cannabinum L.

Common in shrublands and open woods. NA. [176]

Asclepias engelmanniana Woodson

Uncommon on grassland slopes. GP. [586]

Asclepias speciosa Torr.

Common in riparian areas. WNA. [204]

Asclepias viridiflora Raf.

Uncommon in dry grasslands. NA. [499]

Araceae

Lemna minor L.

Scattered in streams. Cosmopolitan. [213]

Asparagaceae

Leucocrinum montanum Nutt. ex A.Gray

Scattered in grasslands. WUS. [274, 343]

Maianthemum racemosum (L.) Link

Uncommon in forests. NA. [392]

Maianthemum stellatum (L.) Link

Uncommon in forests. NA. [383, 548]

Yucca glauca Nutt.

Scattered on dry slopes. GP. [133]

Aspleniaceae

Asplenium septentrionale (L.) Hoffm.

Rare. Found in rock crevices. WNA and EA. [235]

Asplenium trichomanes L.

Rare. Found in rock crevices. Cosmopolitan. [234]

Asteraceae

Achillea millefolium L.

Common in woodlands and forest openings. NA and EA. [461]

Agoseris aurantiaca (Hook.) Greene

Uncommon, meadows and forest openings. WNA (and Quebec). [575]

Agoseris parviflora (Nutt.) D.Dietr.

Uncommon, woodlands. WUS. [407]

Ambrosia artemisiifolia L.

Scattered in disturbed areas and meadows. NA (and SA). [640]

Ambrosia psilostachya DC.

Common in disturbed areas and meadows. NA. [246]

Ambrosia trifida L.

Uncommon in disturbed mesic habitats. NA. 688

Antennaria anaphaloides Rydb.

Common in woodlands and forests. WNA. [366, 367, 418]

Antennaria parvifolia Nutt.

Scattered in woodlands and forests. WNA (and GP). [309]

- Arnica cordifolia* Hook.**
Common in forests and along streams. WNA. [374]
- Arnica fulgens* Pursh**
Scattered in meadows and rocky slopes. WNA. [321]
- Artemisia frigida* Willd.**
Abundant in dry locations. NA (and EA). [611]
- Artemisia ludoviciana* Nutt.**
Abundant in dry locations. NA. [243, 644]
- Bidens frondosa* L.**
Uncommon, found in a stockpond. NA. [687]
- Brickellia californica* (Torr. & A.Gray) A.Gray**
Scattered on dry, rocky slopes. WNA. [594, 651]
- Brickellia eupatorioides* (L.) Shinnery**
Scattered in dry habitats. NA. [713]
- Brickellia grandiflora* (Hook.) Nutt.**
Scattered on rocky slopes. WNA (and GP). [593]
- Carduus nutans* L.**
Scattered in fields and disturbed habitat. EA (and AFR). [214]
- Centaurea diffusa* Lam.**
Scattered in disturbed areas, meadows and roadsides. EA (and Russia). [573]
- Cichorium intybus* L.**
Scattered along roads and in disturbed habitat. EU. [533]
- Cirsium arvense* (L.) Scop.**
Common in disturbed areas and fields. EA. [572]
- Cirsium ochrocentrum* A.Gray**
Common in dry places. WNA and GP. [145, 480, 562]
- Conyza canadensis* (L.) Cronquist**
Uncommon in disturbed fields. Cosmopolitan. [262]
- Coreopsis tinctoria* Nutt.**
Uncommon in seasonal ponds. NA. [517]
- Crepis atriobarba* A.Heller**
Uncommon on tops of hogbacks. WNA [419]
- Ericameria nauseosa* (Pall. ex Pursh) G.L.Nesom & G.I.Baird**
Common in dry, open areas. WNA [684]
- Erigeron divergens* Torr. & A.Gray**
Scattered in meadows and woodlands. WNA. [360]
- Erigeron glabellus* Nutt.**
Scattered in wet areas. WNA (North). [623]
- Erigeron speciosus* (Lindl.) DC.**
Scattered in ravines. WNA. [251, 709]
- Erigeron subtrinervis* Rydb. ex Porter & Britton**
Uncommon along streams. WUS. [580]
- Erigeron tracyi* Greene**
Common in meadows and woodlands. SWNA. [136]
- Gaillardia aristata* Pursh**
Common in meadows and woodlands. NA. [224, 569], [Clark 4367]
- Grindelia squarrosa* (Pursh) Dunal**
Common on dry slopes and ridges. NA. [610]
- Gutierrezia sarothrae* (Pursh) Britton & Rusby**
Abundant in dry places. WNA. [256, 670]
- Helianthus annuus* L.**
Common grasslands and fields. NA. [636, 658]
- Helianthus pumilus* Nutt.**
Common in grasslands and rocky slopes. SORO. [219, 245]
- Heterotheca foliosa* (Nutt.) Shinnery**
Common in grasslands. WNA. [628]
- Heterotheca villosa* (Pursh) Shinnery**
Common in grasslands. WNA and GP. [137, 676]
- Hieracium albiflorum* Hook.**
Scattered in open woodlands. WNA. [613]
- Hieracium fendleri* Sch. Bip.**
Scattered in forests and woodlands. SWNA (and Central America). [563, 579]
- Hymenopappus filifolius* Hook.**
Common in dry grasslands. WNA (and GP). [140]
- Lactuca biennis* (Moench) Fernald**
Uncommon in forests. NA (North). [541]
- Liatris punctata* Hook.**
Scattered in grasslands and meadows. NA (interior). [248, 639]
- Nothocalais cuspidata* (Pursh) Greene**
Uncommon on ridgetops. GP. [332]
- Packera fendleri* (A.Gray) W.A.Weber & Á.Löve**
Common in rocky slopes and forest openings. SORO. [406, 438]
- Packera plattensis* (Nutt.) W.A.Weber & Á.Löve**
Scattered on dry slopes and grasslands. GP. [410]
- Pseudognaphalium canescens* (DC.) Anderb.**
Scattered in grasslands and dry openings. WNA. [588]
- Pseudognaphalium stramineum* (Kunth) Anderb.**
Scattered along streams. NA. [494]
- Ratibida columnifera* (Nutt.) Wootton & Standl.**
Common in grasslands. NA. [177]
- Rudbeckia laciniata* L.**
Common along montane streams. NA. [528]
- Senecio integerrimus* Nutt.**
Scattered on open slopes. WNA and GP. [297, 411]
- Senecio spartioides* Torr. & A.Gray**
Scattered in woodlands. WNA. [681, 685]
- Solidago missouriensis* Nutt.**
Scattered in meadows and forests. NA. [598, 666]
- Solidago simplex* Kunth**
Scattered in meadows. NA. [227]
- Solidago speciosa* Nutt.**
Uncommon in riparian areas. ENA (and GP). [712]
- Sonchus asper* (L.) Hill**
Scattered in in drainages. EA and AFR. [457]
- Sonchus uliginosus* M.Bieb.**
Scattered in drainages. EA and AFR. [671]
- Stephanomeria pauciflora* (Torr.) A.Nelson**
Common in grasslands and dry openings. SWNA [587, 641, 691]
- Symphotrichum falcatum* (Lindl.) G.L.Nesom**
Common in meadows and on roadsides. NA. [675, 689]
- Symphotrichum laeve* (L.) Á. Löve & D.Löve**

- Common in meadows and forest openings. NA [622]
***Symphotrichum porteri* (A.Gray) G.L.Nesom**
 Common in meadows and woodlands. SORO. [642, 652]
***Thelesperma megapotamicum* (Spreng.) Kuntze**
 Common in grasslands and open areas. NA. [217]
***Townsendia grandiflora* Nutt.**
 Common in woodlands and shrubland openings. GP. [158, 463], [Clark 4371], [Weber & Wittman 19490]
***Tragopogon dubius* Scop.**
 Scattered along trails and grasslands. EA. [459]
***Xanthium strumarium* L.**
 Uncommon, found in stock pond. NA. [686]

Berberidaceae

- Berberis repens* Lindl.**
 Common in the understory of forests and woodlands. NA. [293, 396]

Betulaceae

- Betula occidentalis* Hook.**
 Dominant shrub along forested streams in Geer Canyon. WNA (North). [619]
***Corylus cornuta* Marshall**
 Common along forested streams in Geer Canyon. NA. [618]

Boraginaceae

- Cynoglossum officinale* L.**
 Uncommon introduced plant near drainages. EU. [428]
***Hackelia floribunda* (Lehm.) I.M.Johnst.**
 Common in woodlands and on dry slopes. WNA. [464]
***Lappula occidentalis* (S.Watson) Greene**
 Scattered in dry areas. NA. [201, 279]
***Lithospermum incisum* Lehm.**
 Common in grasslands and woodlands. NA. [365], [Clark 4365]
***Lithospermum multiflorum* Torr. ex A.Gray**
 Common in woodlands. NA (SORO and Mexico). [154, 233]
***Mertensia ciliata* (James ex Torr.) G.Don**
 Uncommon along streams in Geer Canyon. WUS. [551]
***Mertensia lanceolata* (Pursh) DC. ex A.DC.**
 Common in meadows and woodlands. WNA and GP. [122, 694]
***Onosmodium bejariense* DC.**
 Scattered in grasslands and dry woodlands. NA. [493]
***Oreocarya virgata* (Porter) Greene**
 Scattered in grasslands and forest openings. Endemic to CO and WY. [264, 362]
***Phacelia hastata* Douglas ex Lehm.**
 Common in grasslands and rocky slopes. WNA. [124, 416]

Brassicaceae

- Alyssum simplex* Rudolphi**
 Abundant in grasslands and low elevation slopes. EA and AFR [298]
***Arabis pycnocarpa* M.Hopkins**
 Scattered in meadows and forest openings. NA and E Asia. [436]
***Barbarea vulgaris* W.T.Aiton**
 Scattered in disturbed areas along drainages. EA and AFR. [310]
***Boechera fendleri* (S.Watson) W.A.Weber**
 Scattered in ponderosa pine woodlands. SWNA. [281]
***Camelina microcarpa* Andrz. ex DC.**
 Scattered along slopes of Dakota hogback. EA and AFR. [335]
***Chorispora tenella* (Pall.) DC.**
 Scattered along trails and slopes. EA. [271]
***Descurainia incana* (Bernh. ex Fisch. & C.A.Mey.) Dorn**
 Uncommon in forests. NA. [542]
***Descurainia incisa* (Engelm. ex A.Gray) Britton**
 Scattered in woodlands. NA [290]
***Descurainia pinnata* (Walter) Britton**
 Scattered in grasslands. NA. [Smookler 525]
***Draba nemorosa* L.**
 Uncommon in the understory of shrublands. NA and EA. [266]
***Erysimum capitatum* (Douglas ex Hook.) Greene**
 Common in understory of woodlands. NA. [284, 425]
***Hesperis matronalis* L.**
 Uncommon, found emerging from one drainage. EA and AFR. [352]
***Nasturtium officinale* W.T.Aiton**
 Common in drainages. Cosmopolitan. [448]
***Noccaea fendleri* (A.Gray) Holub**
 Uncommon on ridges. WNA. [317]
***Physaria bellii* G.A.Mulligan**
 Scattered on sandstone slopes. Endemic to Boulder and Larimer counties. SORO.
***Physaria montana* (A.Gray) Greene**
 Common in dry forest openings and rocky outcroppings. SORO. [278]
***Sisymbrium altissimum* L.**
 Scattered in grasslands. EU and AFR. [149]
***Thlaspi arvense* L.**
 Scattered in grasslands and disturbed areas. EA. [294, 695]
***Turritis glabra* L.**
 Common in forests and rocky slopes. Cosmopolitan. [334, 435], [Clark 4364]

Cactaceae

- Echinocereus viridiflorus* Engelm.**
 Scattered in grasslands and rocky outcroppings. GP and Mexico. [710]
***Opuntia macrorrhiza* Engelm.**
 Common in grasslands and understory of shrublands. NA (Great Plains, SWUS, Mexico). [612]

***Opuntia phaeacantha* Engelm.**

Common in grasslands and understory of shrublands. SWNA. [497]

***Pediocactus simpsonii* (Engelm.) Britton & Rose**

Scattered in woodland openings. SWUS. [277]

Campanulaceae

***Campanula rotundifolia* L.**

Scattered in forests and woodlands. Circumboreal. [180]

***Triodanis leptocarpa* (Nutt.) Nieuwl.**

Rare, one population found in grasslands. GP. [490]

***Triodanis perfoliata* (L.) Nieuwl.**

Rare, found in woodlands. NA and SA. [697]

Cannabaceae

***Celtis reticulata* Torr.**

Common on top of hogbacks and in box canyon. WNA. [164, 339, 692]

***Humulus neomexicanus* (A.Nelson & Cockerell) Rydb.**

Uncommon in canyons. WNA. [469, 668]

Caprifoliaceae

***Symphoricarpos occidentalis* Hook.**

Common in meadows and forests. NA. [207, 696]

***Symphoricarpos rotundifolius* A.Gray**

Scattered in grasslands and rocky hillsides. WNA. [426]

Caryophyllaceae

***Cerastium arvense* L.**

Common in forests and woodlands. Circumboreal. [125, 344]

***Cerastium brachypodum* (Engelm. ex A.Gray) B.L.Rob.**

Scattered in drainages. [268], [Senser 302]

***Dianthus armeria* L.**

Scattered in disturbed grasslands and woodlands. EA. [492]

***Eremogone fendleri* (A.Gray) Ikonn.**

Uncommon along cliff tops. SWNA. [401]

***Paronychia jamesii* Torr. & A.Gray**

Scattered on dry slopes and rocky outcroppings. SWNA. [240, 495], [Clark 4359]

***Pseudostellaria jamesiana* (Torr.) W.A.Weber & R.L.Hartm.**

Uncommon in forests. WNA. [393]

***Saponaria officinalis* L.**

Common in disturbed areas. EA. [196, 632]

***Stellaria media* (L.) Vill.**

Uncommon in canyon streams. EA. [545]

***Vaccaria hispanica* (Mill.) Rauschert**

Uncommon on dry grassland slopes. EA. [417]

Cistaceae

***Crocanthemum bicknellii* (Fernald) Janch.**

Uncommon, found on hogback west of Geer Canyon, previously burned by wildfire. ENA. [Scully 294]

Cleomaceae

***Cleome serrulata* Pursh**

Scattered along roadsides. NA. [647]

***Polanisia dodecandra* (L.) DC.**

Uncommon in sparse understory of grasslands. NA. [257]

Commelinaceae

***Tradescantia occidentalis* (Britton) Smyth**

Common on dry hillsides. GP and SWNA. [150, 539]

Convolvulaceae

***Convolvulus arvensis* L.**

Abundant in grasslands and disturbed areas EA. [635]

***Evolvulus nuttallianus* Schult.**

Scattered in old fields and dry grasslands. NA. (GP). [261] [Clark 4360]

Cornaceae

***Cornus sericea* L.**

Uncommon in streams. NA. [602]

Crassulaceae

***Sedum lanceolatum* Torr.**

Common in dry woodlands and rock crevices. WNA. [429, 472]

Cupressaceae

***Juniperus communis* L.**

Common forest shrub. Circumboreal. [308, 376]

***Juniperus scopulorum* Sarg.**

Common on hillsides and forests. WNA. [163]

Cyperaceae

***Carex brevior* (Dewey) Mack. ex Lunell**

Common along drainages. NA. [576, 167]

***Carex hystericina* Muhl. ex Willd.**

Uncommon in drainages. NA. [604]

***Carex inops* L.H.Bailey**

Abundant species of grasslands, dry woodlands, and forests. GP. [265, 316, 368, 521, 714]

***Carex microptera* Mack.**

Scattered in forests. WNA. [466]

***Carex nebrascensis* Dewey**

Common in drainages and depressions. WNA. [199, 441, 526]

***Carex occidentalis* L.H.Bailey**

Uncommon in canyons. SWUS. [377, 566]

***Carex petasata* Dewey**

Rare, found in seasonal pond. WNA. [520]

***Carex scoparia* Schkuhr ex Willd.**

Scattered in seasonal ponds and streams. NA. [209, 500]

Cyperus schweinitzii* Torr.**Uncommon in *Pinus ponderosa* savanna. ENA. [Clark 4461]Eleocharis acicularis* (L.) Roem. & Schult.**

Uncommon, found in seasonal pond. Cosmopolitan. [504]

***Eleocharis elliptica* Kunth**

Scattered in shrublands. NA (north of Mexico). [306]

***Eleocharis palustris* (L.) Roem. & Schult.**

Abundant in drainages and moist meadows. Cosmopolitan. [170, 322, 513, 706]

***Schoenoplectus acutus* (Muhl. ex Bigelow) Á.Löve & D.Löve**

Uncommon, found in seasonal pond. NA. [507]

***Scirpus microcarpus* J.Presl & C.Presl**

Uncommon, found in drainages. NA. [443]

***Scirpus pallidus* (Britton) Fernald**

Uncommon, in streams and wetlands. NA. [198, 606]

Dennstaedtiaceae

***Pteridium aquilinum* (L.) Kuhn**

Uncommon in forested canyons. Cosmopolitan. [558]

Dryopteridaceae

***Athyrium filix-femina* (L.) Roth.**

Uncommon along canyon streams. Circumboreal [536]

***Cystopteris fragilis* (L.) Bernh.**

Common in rocky places, including understory of shrublands. Cosmopolitan. [350, 379, 546]

***Dryopteris filix-mas* L. (Schott)**

Rare, found in forested ravine. Circumboreal. [391]

***Woodsia scopulina* D.C.Eaton**

Uncommon in rock crevices. NA. [430, 473]

Elatinaceae

***Elatine brachysperma* A.Gray**

Rare, found in Quarry Pond. NA. [Murphy s.n.]

Equisetaceae

***Equisetum arvense* L.**

Common in drainages. Circumboreal. [442, 534]

***Equisetum hyemale* L.**

Common in drainages. Circumboreal. [197, 446]

Ericaceae

***Arctostaphylos uva-ursi* (L.) Spreng.**

Common in forest understory. Circumboreal. [369, 680]

***Pterospora andromedea* Nutt.**

Uncommon in forest understory. NA. [617]

Euphorbiaceae

***Chamaesyce fendleri* (Torr. & A.Gray) Small**

Scattered in understory of shrublands. SWNA. [216]

***Euphorbia brachycera* Engelm.**

Scattered in understory of shrublands and grasslands. SWNA. [153]

***Euphorbia spathulata* Lam.**

Scattered on dry slopes. NA (and SA). [141]

***Tragia ramosa* Torr.**

Common in grasslands and shrublands. SWNA. [165, 482], [Clark 4362]

Fabaceae

***Amorpha fruticosa* L.**

Uncommon in disturbed drainages. NA. [445]

***Astragalus agrestis* G.Don**

Scattered in woodlands. NA (and EA). [295]

***Astragalus drummondii* Douglas**

Scattered in grasslands. WNA. [159, 414]

***Astragalus laxmannii* Jacq.**

Uncommon in moist meadows. WNA. [232]

***Astragalus parryi* A.Gray**

Uncommon on rocky outcroppings. SORO. [275, 361]

***Astragalus shortianus* Nutt.**

Uncommon on dry slopes. SORO. [351]

***Astragalus tridactylus* A.Gray**

Scattered on dry slopes. SORO. [723]

***Dalea candida* Willd.**

Common in grasslands and shrublands. NA. [175, 498], [Clark 4361]

***Dalea purpurea* Vent.**

Common in grasslands and shrublands. GP. [187, 550]

***Glycyrrhiza lepidota* Pursh**

Scattered in streams and meadows. WNA. [450, 677]

***Lotus corniculatus* L.**

Uncommon in disturbed areas. EA and NA. [172]

***Lupinus argenteus* Pursh**

Scattered near streams and dry areas. WNA. [203]

***Medicago lupulina* L.**

Naturalized plant, uncommon, near drainages. EU and AFR. [210]

***Medicago sativa* L.**

Scattered in grasslands and disturbed places. EA. [202]

***Melilotus albus* Medik.**

Common in disturbed areas. EA. [600]

***Melilotus officinalis* (L.) Lam.**

Common introduced plant of disturbed areas. EA. [460]

***Oxytropis lambertii* Pursh**

Common in dry rocky places. GP. [439, 629]

***Oxytropis sericea* Nutt.**

Common in grasslands and woodland openings. WNA. [155, 282], [Clark 4356], [Anderson 1498]

***Psoralidium tenuiflorum* (Pursh) Rydb.**

Common in grasslands. GP. [218]

***Thermopsis divaricarpa* A.Nelson**

Common in shrubland and woodland openings. SORO. [299, 427, 515]

***Trifolium repens* L.**

Common introduced clover in drainages and disturbed areas. EA. [171, 454, 634]

***Vicia ludoviciana* Nutt. ex Torr. & A.Gray**

Uncommon. Occurring in understory of shrublands. SWNA. (Weber and Wittman 19492)

Gentianaceae

***Frasera speciosa* Douglas ex. Griseb.**

Uncommon in forested canyons. WUS. [531, 559]

***Gentiana bigelovii* A.Gray**

Uncommon. Scattered in meadows. WNA. [674]

***Gentianella acuta* (Michx.)**

Uncommon in forest openings. NA. [616]

Geraniaceae

***Erodium cicutarium* (L.) L'Hér. ex Aiton**

Common plant of grasslands and woodland openings. EA. [311]

***Geranium caespitosum* James**

Common in grasslands and forests. SWNA. [181]

Grossulariaceae

***Ribes aureum* Pursh**

Scattered in lower grasslands and drainages. NA. [326]

***Ribes cereum* Douglas**

Common in rocky outcroppings and dry hillsides. WNA. [191, 270]

Hydrangeaceae

***Jamesia americana* Torr. & A.Gray**

Common in forests and ravines. SWNA. [129]

Hydrophyllaceae

***Ellisia nyctelea* (L.) L.**

Scattered in *Pinus ponderosa* woodland. NA. [Hogan 5702]

***Hydrophyllum fendleri* (A.Gray) A.Heller**

Scattered in drainages and ravines. WNA. [456, 467]

Hypericaceae

***Hypericum perforatum* L.**

Uncommon introduced herb of grasslands. EA. [222]

Iridaceae

***Iris missouriensis* Nutt.**

Scattered in wet meadows. WNA. [300, 324]

***Sisyrinchium montanum* Greene**

Scattered in wet meadows and along streams. NA. [363, 409]

Juncaceae

***Juncus arcticus* Willd.**

Uncommon in cool ravines. Cosmopolitan. [378]

***Juncus dudleyi* Wiegand**

Uncommon along canyon streams. NA. [708]

***Juncus ensifolius* Wikstr.**

Scattered along canyon streams. WNA (and Canada), EU and East Asia. [554, 673]

***Juncus interior* Wiegand**

Common in wet meadows and along streams. GP. [185, 359, 422, 131]

***Schoenoplectus tabernaemontani* (C.C.Gmel.) Palla**

Uncommon along streams. Cosmopolitan [605]

Lamiaceae

***Hedeoma hispida* Pursh**

Uncommon in rocky places. GP. [Clark 4464]

***Marrubium vulgare* L.**

Common introduced plant in disturbed areas. EA and AFR. [452]

***Mentha* × *piperita* L.**

Scattered in disturbed drainages. EA. [667], [Scully 308]

***Monarda fistulosa* L.**

Common in wet meadows and woodland openings. NA. [208, 615]

***Monarda pectinata* Nutt.**

Scattered in grasslands. SWUS. [354, 413]

***Nepeta cataria* L.**

Scattered in disturbed areas and canyon floors. EA. [244, 595]

***Prunella vulgaris* L.**

Common along streams. Cosmopolitan. [205]

***Scutellaria brittonii* Porter**

Scattered in woodland openings. SORO. [337]

***Teucrium canadense* L.**

Rare in moist drainages between hogbacks. NA. [Scully 310]

Lentibulariaceae

***Utricularia vulgaris* L.**

Uncommon in seasonal ponds. NA and Asia. [510]

Liliaceae

***Calochortus gunnisonii* S.Watson**

Scattered in grasslands and shrublands. WNA (interior). [147, 477], [Clark 4368]

***Prosartes trachycarpa* S.Watson**

Uncommon in cool ravines. WNA. [395]

Loasaceae

- Mentzelia nuda* (Pursh) Torr. & A.Gray
Uncommon in disturbed grasslands. GP. [690]
- Mentzelia oligosperma* Nutt. ex Sims
Uncommon in bare soil of sparse grasslands. GP [258]
- Mentzelia speciosa* Osterh.
Uncommon on grassland slopes. SORO. [481]

Malvaceae

- Sphaeralcea coccinea* (Nutt.) Rydb.
Uncommon along roadsides. WNA (GP). [157]

Melanthiaceae

- Toxicoscordion paniculatum* (Nutt.) Rydb.
Scattered in understory of grassland and shrublands WNA. [333]

Montiaceae

- Claytonia rosea* Rydb.
Scattered in woodland openings. SWNA (interior). [273]
- Claytonia rubra* (Howell) Tidestr.
Uncommon but abundant at one site in open woodlands. WNA. [397]
- Phemeranthus parviflorus* (Nutt.) Kiger
Scattered in rocky grasslands and dry forest openings. GP. [440, 537]

Nyctaginaceae

- Mirabilis hirsuta* (Pursh) MacMill.
Scattered in grasslands. GP. [242, 538]

Oleaceae

- Syringa vulgaris* L.
One shrub found at old homestead. EU. [669]

Onagraceae

- Circaea alpina* L.
Uncommon, found in cool forests. NA and EA. [543]
- Epilobium brachycarpum* C.Presl
Scattered in drainages and along streams. NA. [646, 663]
- Epilobium ciliatum* Raf.
Scattered in drainages and along streams. NA, SA and Asia. [556, 582]
- Oenothera coronopifolia* Torr. & A.Gray
Uncommon in understory of shrublands. SWUS. [353]
- Oenothera curtiflora* W.L.Wagner & Hoch
Scattered in grasslands. NA. [489, 596]
- Oenothera howardii* (A.Nelson) M.E. Jones ex Prain
Uncommon in grasslands. SWUS. [341, 478]

- Oenothera suffrutescens* (Ser.) W.L.Wagner & Hoch
Uncommon along shale slopes. NA. [342, 357]
- Oenothera villosa* Thunb.
Scattered in disturbed areas. NA. [659, 722]

Orchidaceae

- Corallorhiza maculata* (Raf.) Raf.
Scattered in forests and woodlands. NA. [682, 711]
- Goodyera oblongifolia* Raf.
Rare. One population found in cool forested ravine. NA. [434]

Orobanchaceae

- Castilleja miniata* Douglas ex Hook.
Scattered in wet meadows. WNA. [231, 626]
- Castilleja sessiliflora* Pursh
Scattered in grasslands. GP [151], [Clark 4370]
- Orobanche fasciculata* Nutt.
Uncommon on dry slopes, with *Artemisia frigida*. WNA. [719]
- Orthocarpus luteus* Nutt.
Uncommon in lower montane meadows. WNA. [627]

Oxalidaceae

- Oxalis dillenii* Jacq.
Scattered in disturbed areas. NA. [146, 358]

Papaveraceae

- Argemone polyanthemus* (Fedde) G.B.Ownbey
Common in grasslands and along roadsides. GP. [166, 487]
- Corydalis aurea* Willd.
Scattered in forests. NA. [289, 389], [Weber and Wittman s.n.]

Phrymaceae

- Mimulus floribundus* Lindl.
Rare. One population found growing along a narrow forest stream. WNA. [372]
- Mimulus glabratus* Kunth
Scattered along streams and disturbed drainages. NA. [451]

Pinaceae

- Pinus ponderosa* P.Lawson & C.Lawson
Dominant pine in forests, woodlands, and savannas. WNA. [645]
- Pseudotsuga menziesii* (Mirb.) Franco
Common in lower montane forests. WNA. [433, 653]

Plantaginaceae

- Callitriche palustris* L.
Rare. One population found in seasonal pond. Circumboreal (to South America) [512], [Murphy s.n.]

***Collinsia parviflora* Lindl.**

Common in forest and woodland openings. WNA. [296, 303]

***Gratiola neglecta* Torr.**

Scattered in seasonal ponds and other moist areas. NA. [183, 514], [Murphy s.n.]

***Linaria canadensis* (L.) Dum. Cours.**

Found in *Pinus ponderosa* savanna. NA. [Clark 4472], [Murphy s.n.]

***Linaria dalmatica* (L.) Mill.**

Common noxious weed of grasslands. EA. [338, 707]

***Penstemon secundiflorus* Benth.**

Scattered in grasslands and hillsides. SORO. [327, 356]

***Penstemon virens* Pennell ex Rydb.**

Scattered in woodland openings. SORO. [127, 312]

***Penstemon virgatus* A.Gray**

Scattered in understory of shrublands. SWNA. [179]

***Plantago lanceolata* L.**

Scattered in disturbed areas. EA. [458]

***Plantago major* L.**

Scattered along streams. EA. [581]

***Plantago patagonica* Jacq.**

Uncommon in rocky outcroppings and dry meadows. NA (and SA). [168, 398]

***Veronica anagallis-aquatica* L.**

Common in drainages and streams. Cosmopolitan. [212, 280]

Poaceae

***Achnatherum hymenoides* (Roem. & Schult.) Barkworth**

Scattered in grasslands and shrublands. WNA. [215, 496]

***Achnatherum lettermanii* (Vasey) Barkworth**

Uncommon grass of forest openings. WNA. [561]

***Achnatherum robustum* (Vasey) Barkworth**

Scattered on dry slopes. SWNA. [638]

***Achnatherum scribneri* (Vasey) Barkworth**

Scattered in grasslands and forest openings. SORO. [486, 565]

***Aegilops cylindrica* Host**

Scattered along roadsides. EA. [491]

***Agropyron cristatum* (L.) Gaertn.**

Abundant introduced plant of grasslands and roadsides. EA. [527]

***Agrostis exarata* Trin.**

Uncommon in ephemeral pond. WNA. [505]

***Agrostis gigantea* Roth**

Introduced plant of drainages and moist areas. EA. [601]

***Agrostis scabra* Willd.**

Common grass in rocky outcroppings and meadows. NA (and Asia) [236, 701]

***Agrostis stolonifera* L.**

Uncommon grass of ephemeral ponds. EA. [519, 524]

***Alopecurus aequalis* Sobol.**

Common grass of moist places. Circumboreal. [501]

***Alopecurus geniculatus* L.**

Uncommon introduced grass in moist places. EA. [184]

***Andropogon gerardii* Vitman**

Common prairie grass. NA. [247, 591], [Clark 4466]

***Aristida adscensionis* L.**

Uncommon bunch grass of dry and disturbed places. NA (to South America). [Senser 320]

***Aristida basiramea* Engelm. ex Vasey**

Rare annual grass of barren places and rocky outcroppings. GP. [Clark 4469], [Scully 283]

***Aristida purpurea* Nutt.**

Common grass of grasslands, shrublands, and woodland openings. WNA (and GP). [160, 568, 633, 698]

***Bouteloua curtipendula* (Michx.) Torr.**

Scattered in grasslands. NA (to SA). [255]

***Bouteloua gracilis* (Kunth) Lag. ex Griffiths**

Abundant of grasslands and shrublands. [253, 577, 699, 700, 721]

***Bromus briziformis* Fisch. & C.A.Mey.**

Introduced grass. Scattered in disturbed woodlands openings. EA. [220], [Senser 282]

***Bromus ciliatus* L.**

Uncommon grass of dry woodlands. NA. [583]

***Bromus richardsonii* Link**

Uncommon grass of forests. WNA. [564]

***Bromus squarrosus* L.**

Uncommon in disturbed areas. EU. [Senser 115]

***Bromus tectorum* L.**

Dominant introduced grass at the study area. Present in most habitats. EA and AFR. [313, 423]

***Buchloë dactyloides* (Nutt.) Engelm.**

Scattered in prairie dog towns and lower grasslands. GP. [228]

***Dactylis glomerata* L.**

Common grass of disturbed areas and drainages. EA and AFR. [449]

***Danthonia parryi* Scribn.**

Uncommon grass, found in lower montane meadow. SORO. [625]

***Danthonia spicata* (L.) P.Beauv. ex Roem. & Schult.**

Common grass of meadows and forests. NA. [221, 523, 614]

***Dichanthelium linearifolium* (Scribn.) Gould**

Scattered grass dry forest and rocky outcroppings. ENA. [476], [Clark 4462]

***Dichanthelium oligoanthes* (Schult.) Gould**

Common in dry places. NA. [169, 518], [Clark 4369, 4470]

***Echinochloa crus-galli* (L.) P.Beauv.**

Introduced grass. Scattered along roadsides. Asia and Africa. [678]

***Elymus albicans* (Scribn. & J.G.Sm.) Á.Löve**

Common in woodlands and shrublands. WNA. [230, 329, 420]

***Elymus canadensis* L.**

- Scattered along streams and moist places. NA. [186, 544]
- Elymus elymoides* (Raf.) Swezey**
Scattered in shrublands and dry places. WNA. [138, 483]
- Festuca saximontana* Rydb.**
Common in forests and rocky slopes. NA. [388, 402, 475]
- Glyceria grandis* S.Watson**
Uncommon along streams. NA. [241]
- Hesperostipa comata* (Trin. & Rupr.) Barkworth**
Common in grasslands and shrublands. WNA. [142]
- Hesperostipa neomexicana* (Thurb.) Barkworth,**
Common in grasslands and shrublands. SWNA. [412], [Clark 4353], [Senser 170]
- Hordeum jubatum* L.**
Common along roadsides and in moist areas. NA (and Siberia). [182, 502]
- Koeleria macrantha* (Ledeb.) Schult.**
Common grass of woodlands and savannas. NA (and EA). [226, 323]
- Leucopoa kingii* (S.Watson) W.A.Weber**
Scattered in woodlands and forests. WNA. [229, 424, 590]
- Leymus ambiguus* (Vasey & Scribn.) D.R.Dewey**
Scattered in woodlands and forests. SORO. [474, 703]
- Leymus triticoides* (Buckley) Pilg.**
Uncommon along streams. WNA. [715]
- Muhlenbergia alopecuroides* (Griseb.) P.M.Peterson & Columbus**
Common in shrublands and woodlands. SWNA (to SA). [189, 650, 672, 705], [Clark 4460, 4465, 4473]
- Muhlenbergia montana* (Nutt.) Hitchc.**
Common grass of forests and woodlands. WNA (to Central America). [225, 508, 560]
- Muhlenbergia paniculata* P.M.Peterson**
Uncommon grass of disturbed places. GP. [702]
- Muhlenbergia racemosa* (Michx.) Britton, Sterns & Poggenb.**
Uncommon in disturbed drainages. NA. [656]
- Muhlenbergia richardsonis* (Trin.) Rydb.**
Uncommon. Found in grasslands. WNA. [609]
- Nassella viridula* (Trin.) Barkworth**
Scattered in grasslands and shrublands. GP. [135]
- Panicum virgatum* L.**
Common in grasslands and shrublands. NA (and Central America). [607, 660, 683]
- Pascopyrum smithii* (Rydb.) Barkworth & D.R.Dewey**
Common in grasslands and woodland openings. NA. [143, 173, 571, 630]
- Phleum pratense* L.**
Common along streams. EA. [211, 532]
- Piptatherum micranthum* (Trin. & Rupr.) Barkworth**
Scattered in the woodland understory. WNA. [161, 431], [Clark 4366]
- Poa compressa* L.**
Abundant introduced grass. EU. [134, 390, 455, 465, 509], [Clark 4363]
- Poa fendleriana* (Steud.) Vasey**
Scattered in forests and ravines. WNA. [390, 404]
- Poa interior* Rydb.**
Uncommon grass of dry woodlands. NA. [292]
- Poa pratensis* L.**
Abundant introduced grass. EA. [286, 348, 364, 400]
- Poa secunda* J.Presl**
Uncommon grass found in dry woodlands. WNA (and SA). [405]
- Poa trivialis* L.**
Uncommon grass in wet meadow above drainage. EU. [348]
- Poa wheeleri* Vasey**
Scattered in dry woodlands. WNA. [276]
- Puccinellia nuttalliana* (Schult.) Hitchc.**
Uncommon grass of ephemeral ponds. NA. [506]
- Schedonorus arundinaceus* (Schreb.) Dumort.**
Uncommon introduced grass. Found along trails. EU. [462]
- Schedonorus pratensis* (Huds.) P.Beauv.**
Introduced grass. Found in disturbed areas. EA. [318, 453]
- Schizachyrium scoparium* (Michx.) Nash**
Common prairie grass. NA. [252, 592], (Clark 4471)
- Secale cereale* L.**
Uncommon grass of disturbed places. EA. [174]
- Setaria verticillata* (L.) P.Beauv.**
Introduced grass. Scattered along roadsides. EU. [648]
- Sporobolus compositus* (Poir.) Merr.**
Scattered in grasslands. GP. [643]
- Sporobolus cryptandrus* (Torr.) A.Gray**
Common in grasslands. NA. [263, 589]
- Vulpia octoflora* (Walter) Rydb.**
Uncommon grass, found in dry woodlands. NA. [272]

Polemoniaceae

***Aliciella pinnatifida* (Nutt. ex A.Gray) J.M.Porter**

Scattered in woodlands. SWUS. [314, 399]

***Collomia linearis* (Cav.) Nutt.**

Scattered in woodlands. NA. [144]

***Gilia ophthalmoides* Brand**

Uncommon, found along trail in forested area. WNA. [578]

***Ipomopsis spicata* (Nutt.) V.E.Grant**

Uncommon in shrublands. WNA (interior) [305]

Polygonaceae

***Eriogonum alatum* Torr.**

Scattered in grasslands and dry slopes. WNA. [152, 570]

***Eriogonum effusum* Nutt.**

Common in grasslands and shrublands. GP. [259, 693, 717]

***Eriogonum flavum* Nutt.**

Common in grasslands and shrublands. GP. [192], [Clark 4359]

***Eriogonum umbellatum* Torr.**

Common on dry slopes and forest openings. WNA. [130]

***Fallopia convolvulus* (L.) Á.Löve**

Uncommon vine of disturbed areas near trails, EA and AFR. [194, 631]

***Persicaria hydropiper* (L.) Opiz**

Uncommon introduced plant of disturbed drainages. Cosmopolitan. [718]

***Polygonum aviculare* L.**

Introduced plant found along roadsides. EA. [679]

***Polygonum engelmannii* Greene**

Uncommon. Found in grasslands. WNA. [239]

***Rumex acetosella* L.**

Common plant of disturbed woodlands. EA. [223, 664]

***Rumex crispus* L.**

Common plant of disturbed wet areas. EA. [237]

Potamogetonaceae

***Potamogeton diversifolius* Raf.**

Uncommon, found in ephemeral ponds. NA. [511]

Primulaceae

***Anagallis minima* (L.) E.H.L.Krause**

Uncommon, found in old quarry. Cosmopolitan. (Murphy s.n.)

***Androsace occidentalis* Pursh**

Uncommon, found in mosses of rocky outcropping. WNA. [724]

***Androsace septentrionalis* L.**

Uncommon, found in cool forested ravine. Circumboreal. [384]

***Dodecatheon pulchellum* (Raf.) Merr.**

Uncommon, found in canyon stream. WNA. [470]

Pteridaceae

***Cheilanthes feei* T.Moore**

Common fern of cliffs. WNA. [254], [Scully 292]

Ranunculaceae

***Aconitum columbianum* Nutt.**

Uncommon along cool forest streams. WNA. [624]

***Actaea rubra* (Aiton) Willd.**

Uncommon in forests. NA. [Jennings s.n.]

***Anemone patens* L.**

Scattered in grasslands and woodlands. Circumboreal. [340, 371]

***Aquilegia coerulea* James**

Uncommon in cool forested ravine. SORO. [385]

***Clematis hirsutissima* Pursh**

Uncommon in woodlands. WNA. [375]

***Clematis orientalis* L.**

Uncommon in disturbed drainages. EA. [665]

***Delphinium carolinianum* Walter**

Scattered in shrublands. GP. [139]

***Delphinium geyeri* Greene**

Common in grasslands and shrublands. SORO. [132, 488], [Clark 4357]

***Ranunculus abortivus* L.**

Uncommon. Found along a cool forested stream. ENA. [547]

***Ranunculus flammula* L.**

Uncommon in ephemeral ponds and quarries. Circumboreal. [503]

***Ranunculus ranunculinus* (Nutt.) Rydb.**

Scattered along the forest edges. SORO. [301, 403]

***Ranunculus uncinatus* D.Don**

Uncommon on in moist places. WNA. [King 3]

***Thalictrum fendleri* Engelm. ex A.Gray**

Uncommon in shaded canyons. WNA. [540]

Rhamnaceae

***Ceanothus herbaceus* Raf.**

Scattered on rocky slopes and woodland openings. GP. [355, 421]

Rosaceae

***Amelanchier alnifolia* (Nutt.) Nutt. ex M.Roem.**

Scattered on cliffs, shrublands and grasslands. WNA. [408]

***Cercocarpus montanus* Raf.**

Abundant, dominant component of shrublands. WNA. [269, 345, 567], [Clark 4467]

***Crataegus succulenta* Schrad. ex Link**

Uncommon, found along roadsides. NA. [661]

***Fragaria vesca* L.**

Scattered along canyon streams. NA. [553]

***Fragaria virginiana* Mill.**

Scattered along forested streams. NA. [373]

***Geum macrophyllum* Willd.**

Scattered along streams and wet meadows. Circumboreal. [238, 724]

***Physocarpus monogynus* (Torr.) J.M.Coult.**

Common shrub of forests and rocky slopes. WNA. [128, 250, 330]

***Potentilla fissa* Nutt.**

Scattered on rocky outcroppings and dry places. WNA. [432]

***Potentilla hippiana* Lehm.**

Scattered in shrublands. SORO (WNA). [193]

***Potentilla recta* L.**

Uncommon, found near trails. EA. [178]

***Prunus americana* Marshall**

Scattered on slopes and along roadsides. ENA. [704]

***Prunus virginiana* L.**

Common on rocky slopes and along drainages. NA. [325, 468, 603]

***Purshia tridentata* (Pursh) DC.**

Common shrub of rocky outcroppings and dry places. WNA. [320], [Clark 4468]

***Rosa arkansana* Porter**

Scattered in grasslands and shrublands. GP. [206, 336]

Rosa blanda Aiton

Common in woodlands and along streams. WNA. [394]

Rubus deliciosus Torr.

Common on cliffs and along forested canyons. SORO. [328, 555]

Rubus idaeus L.

Uncommon, found along narrow mossy streams. Circumboreal. [381]

Rubiaceae

Galium aparine L.

Introduced and common in woodlands. EA and AFR. [123, 291]

Galium boreale L.

Scattered in forests. Circumboreal. [535]

Galium triflorum Michx.

Scattered in forests. Circumboreal. [549]

Salicaceae

Populus angustifolia James

Common in riparian areas. WNA. [479, 720]

Populus deltoides W.Bartram ex Marshall

Scattered in riparian areas. NA. [484]

Populus tremuloides Michx.

Scattered in canyons and lower montane areas. NA. [380]

Salix amygdaloides Andersson

Common along streams and moist places. NA. [444, 525]

Salix exigua Nutt.

Common along streams and drainages. WNA. [200, 447, 574]

Santalaceae

Comandra umbellata (L.) Nutt.

Scattered in grasslands. NA. [347]

Sapindaceae

Acer glabrum Torr.

Common in canyons and cool ravines. WNA. [267, 387], [Anderson 672]

Saxifragaceae

Heuchera bracteata (Torr.) Ser.

Scattered on cliffs and in ravines. SORO. [437, 716]

Heuchera parvifolia Nutt. ex Torr. and A.Gray

Common on cliffs and in rock crevices. WNA. [315]

Micranthes rhomboidea (Greene) Small

Scattered on mossy slopes in forest openings. WNA. [302]

Scrophulariaceae

Scrophularia lanceolata Pursh

Common in drainages. NA. [195, 415]

Verbascum blattaria L.

Scattered in grasslands. EA and AFR. [608]

Verbascum thapsus L.

Abundant in most habitats. EA and AFR. [662]

Selaginellaceae

Selaginella densa Rydb.

Scattered along rocky outcroppings and streams. WUS (and western Canada). [319, 382], [Clark 4459]

Selaginella weatherbiana R.M.Tryon

Uncommon on shaded sandstone outcrops in forests. SORO. [Scully 284]

Solanaceae

Physalis hederifolia A.Gray

Scattered in disturbed places. SWNA. [156]

Physalis heterophylla Nees

Scattered in grasslands. ENA. [485]

Physalis longifolia Nutt.

Scattered in grasslands. NA. [188]

Typhaceae

Typha latifolia L.

Common in lower elevation streams and drainages. Cosmopolitan. [599, 657]

Ulmaceae

Ulmus pumila L.

Uncommon, found along roadsides. Asia. [655]

Urticaceae

Parietaria pensylvanica Muhl. ex Willd.

Scattered in the shade under ledges. NA. [162]

Urtica dioica L.

Scattered along streams and drainages. NA. [584, 621]

Verbenaceae

Verbena bracteata Lag. & Rodr.

Scattered in dry, disturbed places. Cosmopolitan. [516, 637]

Verbena hastata L.

Uncommon, found along lower drainages. NA. [654]

Violaceae

Viola canadensis L.

Common in woodlands and wet meadows. NA. [288, 349]

Viola kitaibeliana Roem. & Schult.

Scattered in grassy, rocky places. EU. [King 6]

Viola nuttallii Pursh

Common in woodlands and grasslands. GP. [287]

Viola pedatifida G.Don

Rare prairie violet, found in grasslands. GP. [307], [Scully 311]

Vitaceae

Parthenocissus vitacea (Knerr) Hitchc.

Uncommon along streams. NA. [471]

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