

THESIS

RED MOUNTAIN OPEN SPACE AND SOAPSTONE PRAIRIE NATURAL AREA:
BOTANICAL INVENTORY, DISTRIBUTION MAPS OF SEVERAL SPECIES OF
INTEREST, AND FIELD GUIDE TO THE MOST COMMON PLANTS

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ABSTRACT

RED MOUNTAIN OPEN SPACE AND SOAPSTONE PRAIRIE NATURAL AREA: BOTANICAL INVENTORY, DISTRIBUTION MAPS OF SEVERAL SPECIES OF INTEREST, AND FIELD GUIDE TO THE MOST COMMON PLANTS

I inventoried the vascular plants of two natural areas in north-central Colorado, Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA), which encompass roughly 33,000 acres of predominantly shortgrass prairie and foothills shrubland habitats. I collected and/or documented 438 unique taxa from 78 distinct plant families across both regions; 328 taxa from 76 families at RMOS and 312 taxa from 64 families at SPNA. I documented 13 taxa of conservation concern, 65 non-native taxa, and a total of 196 new area records (169 at RMOS and 41 at SPNA). While inventorying the flora of RMOS and SPNA, I also noted the distributions of eight species of interest, as designated by Larimer County and City of Fort Collins officials, for the purpose of conservation and/or monitoring: *Cirsium flodmanii*, *Linaria dalmatica*, *Mentzelia speciosa*, *Mirabilis linearis*, *Pediomelum esculentum*, *Penstemon eriantherus*, *Solidago ptarmicoides*, and *Stephanomeria runcinata*. In addition, I created an easy-to-use field guide for the novice plant enthusiast that highlights the most common plants encountered along the public trail network within RMOS and SPNA. The creation of this guide had significant overlap with an already proposed field guide to the flora of the foothills of Larimer County, and as such, I joined a team of Larimer County officials and volunteers to help develop content for an upcoming guide, *Foothills Plant and Flower Guide*, with an expected publication date of Fall 2014.

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The successful completion of this project would have been unachievable without the amazing mentorship of Jennifer Ackerfield, CSU Herbarium Manager. She not only took the time to verify all of my specimens and assist me in the field on several occasions, but more importantly, gave me the confidence I needed to become a great botanist. Lastly, I would like to extend my gratitude to the numerous volunteers who devoted their time to helping me in the field: Laura Cascardi, Manuel Curtó, Sally Ebeling, Pam Smith, Natasha Stavros, and Luke Tembrock.

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LIST OF SYMBOLS

- New taxon record for RMOS
- ▼ New taxon record for SPNA
- ◇ Non-native taxon
- △ Uncommon taxon
- Rare taxon
- # CNHP tracked taxon
- * Photographic documentation (no vouchered specimens)

CHAPTER I
BOTANICAL INVENTORY OF RED MOUNTAIN OPEN SPACE AND SOAPSTONE
PRAIRIE NATURAL AREA

INTRODUCTION

Floristic inventories are fundamental to many aspects of botanical research. They are the framework of many ecological and biogeographical questions, assist with monitoring species of conservation concern, are an important component of molecular studies, and can greatly aid land managers in making conservation-focused decisions (Funk and Morin, 2000; Prather *et al.*, 2004). In addition, the preservation of vouchered specimens that often accompany botanical inventories provides not only a valuable resource for plant-identification verification, but can be used in the creation of new floras, or as educational tools (Heywood, 2001; Norris *et al.*, 2001; Prather *et al.*, 2004). As such, I conducted a botanical survey of two natural areas open to public recreation in north-central Colorado, Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA). Together, these two areas cover a plains-to-foothills transition zone along the Colorado/Wyoming border, which renowned Colorado Botanist W. A. Weber has suggested as needing “serious study” (Weber and Wittmann, 2001, pg. xvi). The goal of my survey was to fill this gap in botanical knowledge by documenting the vascular flora present at these locations, and to preserve voucher specimens for the purpose of assisting in conservation and management efforts as well as future botanical research.

Study areas

Soapstone Prairie Natural Area Site Description

SPNA is located along the Colorado/Wyoming border, approximately 25 miles north of Fort Collins, in Larimer County, Colorado, within the following coordinates: 40°53'59.232"N and 40°59'56.579"N latitude, and 105°0'2.778"W and 105°9'7.277"W longitude (Figs. 1.1, 1.2). The 18,728 acres of land encompassed within this natural area are owned and managed by the City of Fort Collins as part of their Natural Areas Program (NAP), whose goals are both to preserve and protect native vegetation and wildlife, while at the same time, providing non-motorized recreation to the public (City of Fort Collins Natural Areas Program, 2007). Through this program, the city has purchased over 40 tracts of land across Larimer County; SPNA is one of their largest sites, and thus offers the most public trails of any site managed by NAP. Currently, SPNA has more than 30 miles of trails for public hiking, mountain biking and/or horseback riding (Fig. 1.3), through a diverse range of ecosystems including shortgrass prairie, foothills shrublands, wetlands, riparian areas, cliffs, canyons, and shale barrens. The elevation at SPNA spans from roughly 6,000' in the eastern portion, to approximately 7,200' in the west (City of Fort Collins Natural Areas Program, 2007).

Historically, SPNA has been inhabited by humans for nearly 12,000 years; based on the archeological record and artifacts uncovered in the Lindenmeier Archeological Site, a National Historic Landmark situated in the center of the property, Folsom people lived in and around SPNA between 11,000 to 12,000 years ago (Wilmsen and Roberts, 1978; City of Fort Collins Natural Areas Program, 2007). After the Folsom inhabitants, several American Indian Tribes resided on the land, and then most recently, parcels of SPNA were under the private ownership of cattle and sheep ranchers (City of Fort Collins Natural Areas Program, 2007). In May 2004,

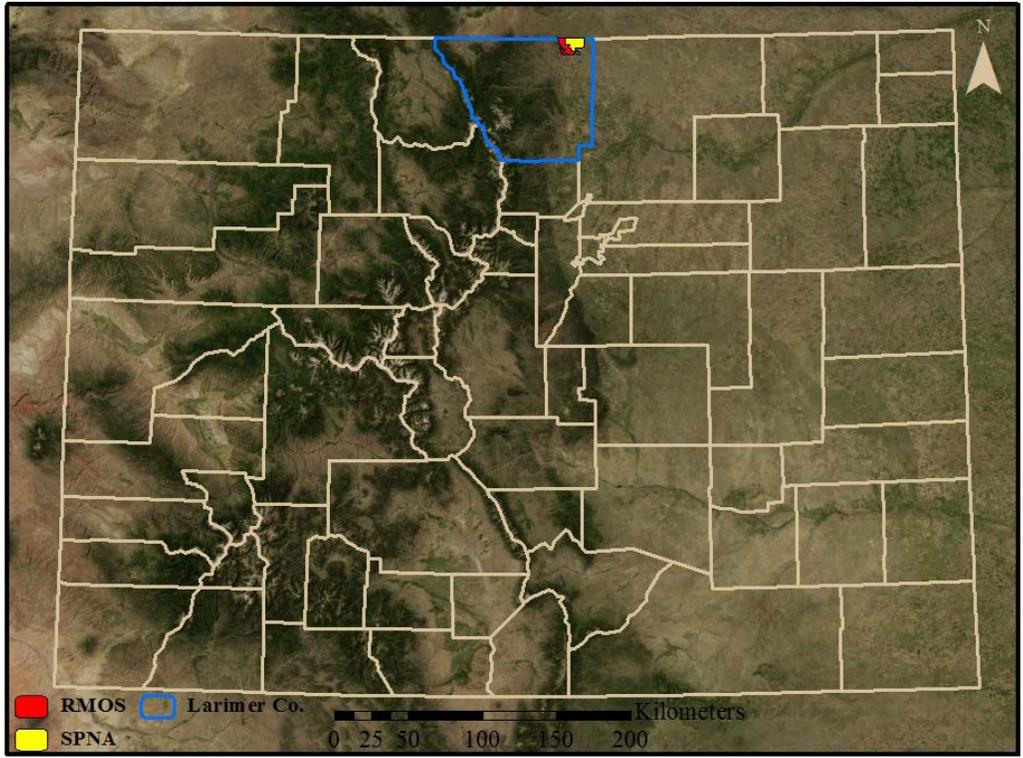


Figure 1.1. Map of Colorado counties showing locations of Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) within Larimer County.

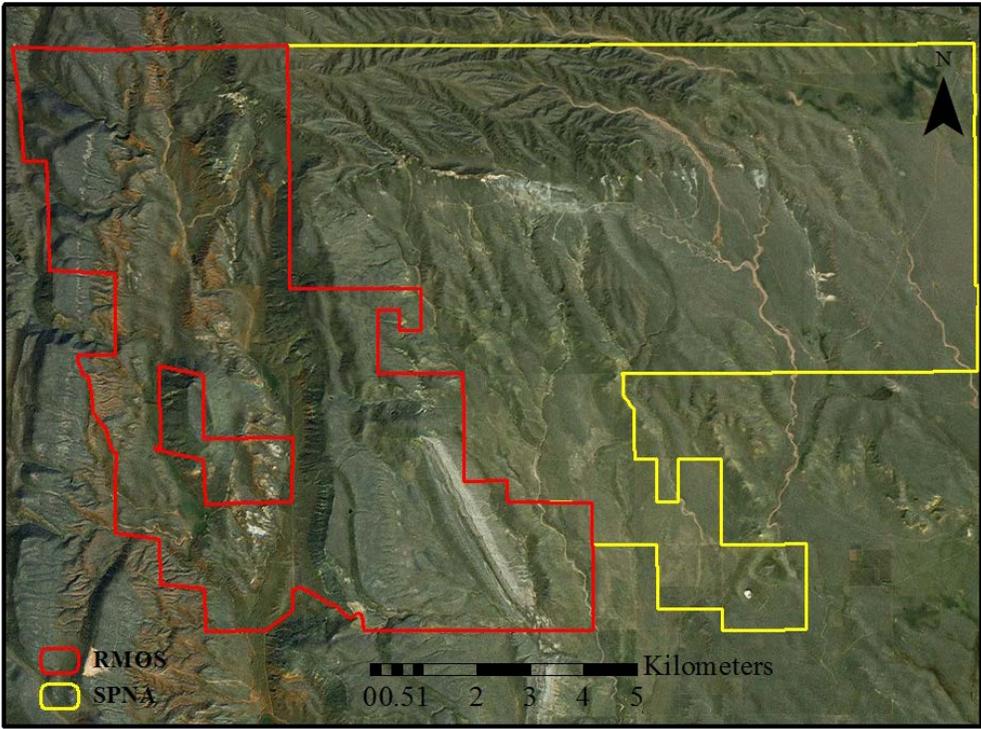


Figure 1.2. Close-up map of study sites; Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA).

the City of Fort Collins NAP purchased these individually owned parcels to develop what is now known as SPNA. After extensive management planning and baseline surveying, SPNA was opened to public recreation in 2009, while still managing moderate livestock grazing levels.

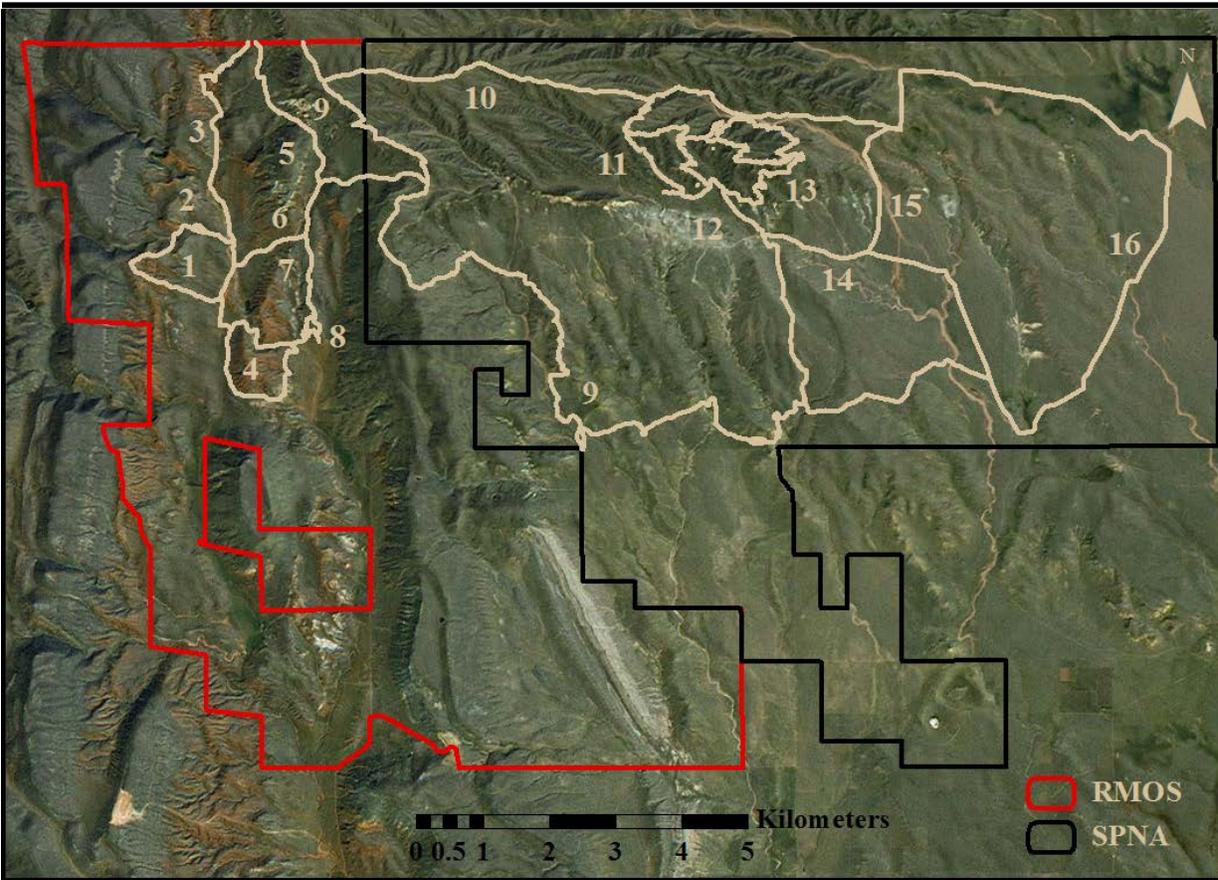


Figure 1.3. Map of Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) displaying public trails within the sites. The trails are named as follows: 1: K-Lynn Cameron Trail, 2: Stone Circle Trail, 3: Ruby Wash Trail, 4: Bent Rock Trail, 5: Salt Lick Trail, 6: Big Hole Wash Trail, 7: Sinking Sun Trail, 8: Rising Sun Trail, 9: Cheyenne Rim Trail, 10: Canyon Trail, 11: Towhee Loop, 12: Lindenmeier Trail, 13: Mahogany Loop, 14: Pronghorn Loop, 15: Sand Wash Trail, 16: Plover Trail.

Red Mountain Open Space Site Description

RMOS is also located along the Wyoming border, roughly 25 miles north of Fort Collins in Larimer County, Colorado. It is located directly west of SPNA, within the following coordinates: 40°54'0.724"N to 40°59'56.593"N latitude and 105°5'9.474"W to 105°12'49.164"W longitude (Figs. 1.1, 1.2). This 14,980-acre tract was purchased by Larimer County as part of the Laramie Foothills Mountains to Plains Project. The mission of this large-scale project is to protect and preserve approximately 140,000 acres along the northern Front Range (Larimer County Parks and Open Land Development, 2007). Currently, RMOS has roughly 15 miles of multi-use trails for hiking, mountain biking and/or horseback riding, some of which connect directly to the trails at SPNA (Fig. 1.3). RMOS encompasses an ecological transition zone, where the foothills of the Rocky Mountains to the west merge with the shortgrass prairie region to the east. The convergence of these two ecosystems results in a mosaic of varying topography, geology and soils, which are capable of supporting a wide range of plant communities and ecosystems. These communities and ecosystems include foothills grasslands, shortgrass prairie, mountain-mahogany shrublands, ponderosa-pine woodlands, shale barrens, saltbrush shrublands and riparian corridors. The elevation gradient at RMOS ranges from 5,900' to 7,458' (Larimer County Parks and Open Land Development, 2007).

According to archeological artifacts, RMOS shares a very similar land-use history to SPNA. It has also been historically occupied by humans, as homestead and hunting grounds for the Folsom people and American Indian Tribes, as well as cattle and sheep ranching throughout the 19th and 20th centuries (La Belle *et al.*, 2007). In two separate phases, in December 2004 and September 2007, Larimer County purchased what is now known as RMOS, and then in 2009

opened it to the public. Similar to SPNA, RMOS also continues to support moderate levels of livestock grazing (Larimer County Parks and Open Land Development, 2007).

Climate

As RMOS and SPNA are situated directly adjacent to one another, they both experience similar climatic patterns, which entail mainly dry winters with occasional snow, windy highly variable springs, hot low-humidity summers, and mild dry falls. The average annual temperature across both regions is 48.2°F with monthly averages ranging between 27.6°F in January and 70.6°F during July. The average annual precipitation documented at RMOS and SPNA is 15.08”, with a record low of 7.13” of precipitation in 1893, and a record high of 28” of precipitation in 1961 (Colorado Climate Center, 2014).

During my 2012 collecting season, these regions experienced below average precipitation levels and above average temperatures. In both March and August of 2012, precipitation levels reached record lows; in March, they received 0” of moisture and in August only 0.03”, compared to monthly averages of 1.16” and 1.43”, respectively. The precipitation total for the entire year of 2012 amounted to 10.55”, or 70% of the annual average. Also that year, the maximum average annual temperature reached a record high of 53.4°F, with average monthly temperatures ranging from 32.3°F to 75.9°F (Colorado Climate Center, 2014). The lack of moisture and atypically high temperatures resulted in poor collecting conditions, as many species either remained dormant or did not flower or fruit.

In contrast, 2013 was a much more productive season, with cooler average temperatures and significantly higher precipitation levels. The average temperature was 49.9°F, with monthly averages ranging between 27.9°F and 72.6°F. During every month in 2013, with the exception of

September, cooler temperatures were recorded than the respective months in 2012; April 2013 was, on average, 11.1°F cooler than April 2012. In addition, the precipitation levels were above the 100+ year averages in April, May and July of 2013, reaching totals of 2.84”, 2.83” and 1.90”, respectively (Colorado Climate Center, 2014). At the end of my surveying in September 2013, the Front Range of Colorado experienced an intense series of storms that lead to catastrophic flooding events. The precipitation levels recorded at RMOS and SPNA amounted to roughly 6-9” in a one-week period (Colorado Climate Center, 2014). This resulted in several trail closures and major wash-out sites within both properties, which ultimately ended my collecting season several weeks short. Overall, however, the combination of lower temperatures and higher precipitation values throughout the majority of my 2013 field work resulted in a more abundant and successful collecting season than the previous year.

Geology and soils

Geologically, SPNA and RMOS are mainly comprised of various rock formations and unconsolidated deposits, including sandstone, mudstone, siltstones, and conglomerates dating back to the Precambrian era. Several prominent geologic formations have been documented within SPNA, such as sandstone from the Ogallala Formation, calcareous shale from the Smoky Hill Shale Member of the Upper Cretaceous Niobrara Formation, middle shale and first sandstone members of the South Platte Formation, sandstone from the Upper Cretaceous Pierre Shale, sandstones of the lower Cretaceous Dakota group, and claystone, siltstone, sandstone, and limestone of the Upper Jurassic Morrison Formation (City of Fort Collins Natural Area Program, 2007; Collins, 2007). In addition, an ancient landslide in the southwest corner of SPNA uncovered rocks from the Colorado Group, including Mowry Shale, Graneros Shale, Greenhorn

Limestone, and Carlile Shale (City of Fort Collins Natural Area Program, 2007; Collins, 2007). Late Paleozoic rocks up to depths of 2,000' thick are prominent on the western portion of SPNA and throughout RMOS, which include (from youngest to oldest) limestone of the Lykins Formation, Lyons Sandstone, red siltstone and sandstone of the Owl Canyon Formation, pink quartzose sandstone and dolomitic limestone from the Lower Permian Ingleside Formation, and sandstone, limestone, siltstone, and shale of the Fountain Formation (Collins, 2007).

There are a total of 16 soil types present at SPNA, which range from various categories of clay loams and sandy loams to rock outcrops (City of Fort Collins Natural Areas Program, 2007). Additionally, alluvium, loess, fine sand, and windblown silt are present in the plains and valleys (Collins, 2007). Similarly, a variety of clay loams, sandy loams, complexes and rock outcrops have been documented at RMOS (Larimer County Parks and Open Land Development, 2007).

Prior botanical research

Given the overall diversity of ecosystems, geologic features and soil types, RMOS and SPNA are inhabited by a heterogeneous group of vascular plant species, including several rare and imperiled plant species and rare plant communities as identified by the Colorado Natural Heritage Program (CNHP) (City of Fort Collins Natural Areas Program, 2007; Larimer County Parks and Open Land Development, 2007). SPNA is also home to one species of fungus discovered in 2009 that was completely new to science (City of Fort Collins Natural Areas Program, 2009). Given the recent acquisition of these properties by the City of Fort Collins and Larimer County, there has been several botanical research efforts conducted on RMOS and SPNA prior to my botanical survey in 2012 – 2013 (outlined below). These efforts, combined

with my results, provide informative data to land managers faced with conservation decisions, as well as future scientific research at these sites.

During the summers of 1996 and 2004, CNHP conducted biological surveys of SPNA, which, combined with baseline vegetative surveys by NAP in 2006 and 2007 produced a list of 272 vascular-plant species (City of Fort Collins Natural Areas Program, 2007). Then, during a 24-hour BioBlitz of SPNA in June 2009, botanists located 51 new species of plants that had not been previously documented at SPNA (City of Fort Collins Natural Areas Program, 2009). Most recently, botanical surveys conducted by Denver Botanic Gardens (DBG) and Colorado State University (CSU) between 2010 and 2012, have reported more than 100 additional unique taxa to SPNA (SEINet, 2014).

Baseline vegetation surveys of RMOS were conducted during the fall of 2004 and spring of 2005 by CNHP and in 2006 by the Natural Resources Conservation Service (NRCS). Combined, both surveys identified 103 species of vascular plants, including nine threatened or endangered plant communities (Larimer County Parks and Open Land Development, 2007). RMOS was documented as being the northeastern-most extent of the *Pinus edulis* (pinyon pine) range and containing a champion *Acer glabrum* var. *glabrum* tree (Rocky Mountain maple), as identified by the Colorado Tree Coalition Champion Tree Program. Additionally, CNHP identified RMOS as a Potential Conservation Area with a “very high biodiversity significance” (Larimer County Parks and Open Land Development, 2007, pg. 11).

Despite the numerous botanical efforts conducted at RMOS and SPNA, there is still potential to discover undocumented species at these areas by conducting a more thorough inventory over a longer duration of time. Therefore, I conducted two seasons of field surveying that took place between April and September of 2012 and 2013.

MATERIALS AND METHODS

Site Selection

Prior to the start of my first field season, which began in March 2012, I identified 38¹ total off-trail, potential biodiversity “hotspot” regions within the study sites (20 in RMOS; 18 in SPNA) on which to focus my inventorying efforts (Fig. 1.4; Table 1.1). I selected these sites based on the following criteria: the presence of topographically or geologically interesting features, the existence of a unique ecosystem type, rare plants or rare-plant communities, and the relational position to other vegetatively similar sites. I also selected at least one region to represent each of the major ecological systems, as designated by the SPNA and RMOS Management Plans (City of Fort Collins Natural Areas Program, 2007; Larimer County Parks and Open Land Development, 2007). Lastly, I tried to ensure that my selected off-trail focus areas were spread latitudinally and longitudinally as even as possible within each site to thoroughly cover the landscape.

In addition to selecting the aforementioned 38 off-trail “hotspots” (Fig. 1.4; Table 1.1), I also included the 16 public trails at each site in my survey schedule (Fig. 1.3). These trails cover roughly 45 miles of varied habitats, including shortgrass prairie, canyons, foothills shrublands, foothills grasslands, saltbrush shrublands, and ponderosa-pine forest. Not only did this create a more robust inventory of the regions, but I was able to simultaneously collect data for the creation of a field guide documenting the most common plants of RMOS and SPNA as seen along the public trail network (see Chapter III).

¹ Initially I had selected 40 total “hotspots”, but upon meeting with City of Fort Collins officials in April 2012, I was informed that the area known as Round Butte Quad (shown below the beige line in the southwestern portion of SPNA in Fig. 1.4) was not to be included in my botanical survey due to it being under separate conservation easement. As such, I eliminated two “hotspot” sites from my target list, which brought my total number of off-trail sites to 38.

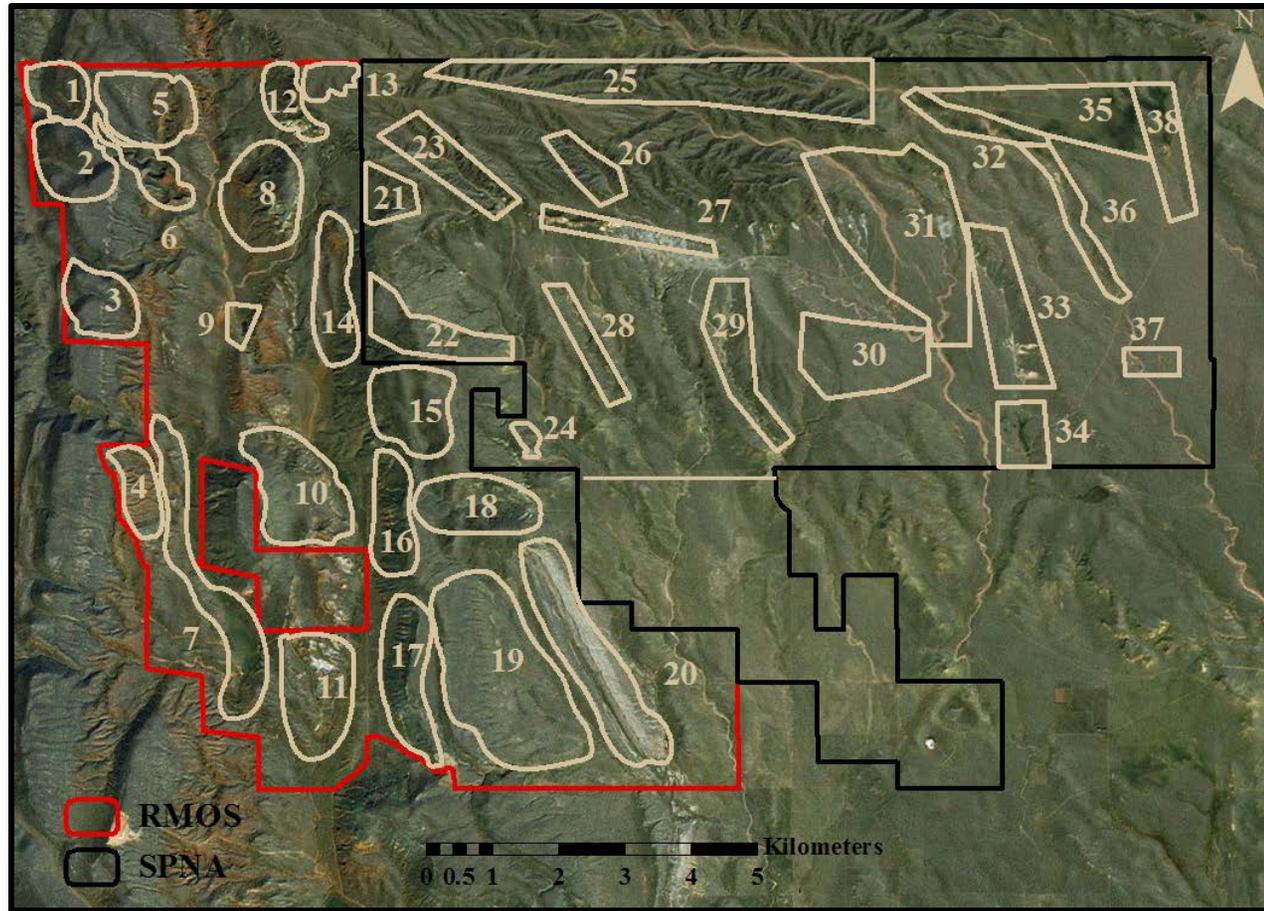


Figure 1.4. Map of Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) displaying the selected off-trail sites. The names of each site, as referenced in Table 1.1 are as follows: 1: N Sand Creek, 2: NW open ponderosa pine woodland, 3: W closed ponderosa pine woodland, 4: Boxelder Creek, 5: NC foothills shrubland, 6: Haygood Canyon, 7: W Table Mountain, 8: Ruby Wash/Big Hole Wash area, 9: Bent Rock wetland, 10: E Table Mountain, 11: S Table Mountain, 12: Salt Lick cliff, 13: NE foothills shrubland, 14: E border, 15: E foothills shrubland, 16: Antelope Valley Rd. ridge, 17: SC ridge, 18: E riparian area, 19: SC shortgrass prairie, 20: shale barrens, 21: W foothills shrubland, 22: SW foothills shrubland, 23: Cedar Canyon, 24: ponderosa pine woodland, 25: N canyon, 26: N foothills shrubland, 27: Lindenmeier site, 28: Rawhide Creek/aspens grove, 29: roadside riparian, 30: C shortgrass prairie, 31: Sand Creek, 32: N Spottewood Creek, 33: C Plover, 34: S wetland, 35: wet meadow, 36: S Spottewood Creek, 37: SE shortgrass prairie, 38: NE wet meadow.

Table 1.1. Selected off-trail sites within Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) including site numbers and names as designated in Figure. 1.4, site location, and qualifying selection criteria, which are abbreviated as follows: Colorado Natural Heritage designated “Potential Conservation Area” (CNHP PCA), major ecosystem (ME), known rare-plant locality (RP), known rare-plant-community locality (RPC), and unique geology (UG).

Site #	Area Name	Location	Selection Criteria
1	north Sand Creek	RMOS	ME
2	northwest open ponderosa pine woodland	RMOS	ME, RPC
3	west closed ponderosa pine woodland	RMOS	ME
4	Boxelder Creek	RMOS	ME
5	north central foothills shrubland	RMOS	ME, RPC
6	Haygood Canyon	RMOS	ME, RP, RPC
7	west Table Mountain	RMOS	ME
8	Ruby Wash/Big Hole Wash area	RMOS	ME, RPC
9	Bent Rock wetland	RMOS	ME, RPC
10	east Table Mountain	RMOS	CNHP PCA, ME
11	south Table Mountain	RMOS	ME, RPC
12	Salt Lick cliff	RMOS	ME, RPC
13	northeast foothills shrubland	RMOS	ME, RPC
14	east border	RMOS	ME, RPC
15	east foothills shrubland	RMOS	ME, RPC
16	Antelope Valley Rd. ridge	RMOS	ME, RPC
17	south central ridge	RMOS	ME
18	east riparian area	RMOS	ME
19	south central shortgrass prairie	RMOS	ME
20	shale barrens	RMOS	UG
21	west foothills shrubland	SPNA	ME, RPC
22	southwest foothills shrubland	SPNA	ME, RPC
23	Cedar Canyon	SPNA	ME
24	ponderosa pine woodland	SPNA	ME, UG
25	north canyon	SPNA	ME
26	north foothills shrubland	SPNA	ME, RPC
27	Lindenmeier site	SPNA	ME
28	Rawhide Creek/aspen grove	SPNA	ME
29	roadside riparian	SPNA	ME, RPC
30	central shortgrass prairie	SPNA	ME, RPC
31	Sand Creek	SPNA	ME, RPC
32	north Spottlewood Creek	SPNA	ME, RP, RPC
33	central Plover	SPNA	ME, RPC
34	south wetland	SPNA	CNHP PCA, ME
35	wet meadow	SPNA	ME, RP, RPC
36	south Spottlewood Creek	SPNA	ME, RPC
37	southeast shortgrass prairie	SPNA	ME, RPC
38	northeast wet meadow	SPNA	ME, RPC

My overall goal between two field seasons (2012 – 2013) was to visit each trail and designated off-trail area of interest at least once during each of the three different seasons: spring (March – May), summer (June – mid-August), and fall (mid-August – September). This allowed me to document the flora present at each site throughout the year and thereby conduct the most thorough and up-to-date botanical inventory of both RMOS and SPNA. I randomly assigned site locations for each date, and was careful to ensure that subsequent visits to the same site did not overlap seasonally. Also, I arranged my collecting schedule so that I sampled different ecosystems within each region from one day to the next.

Collecting

When travelling on the public trails, I surveyed the vegetation found within 10' of either trail edge, unless the need arose to travel farther. However, because the focus of my on-trail surveying was to document the flora that the public will encounter, a buffer zone of 10' was my primary focus. When travelling off-trail, however, I took a completely different approach; before going into the field, I identified geographic coordinates around the perimeter of each specified region, entered these coordinates into my Garmin 62s GPS unit, and chose a route. I attempted to select different routes for the subsequent visits to each site, although based on topography, this was not always feasible. In the field, while en-route to each site and within the confines of the perimeter of each site, I employed the “meander method” (Hartman and Nelson, 2008) to navigate from one waypoint to another throughout the site. During both on and off-trail hikes, I recorded my routes using the GPS so that I could plan my follow-up visit routes accordingly. Additionally, I downloaded the GPS data into ArcGIS10 Software Program to create a digital map documenting my routes and collecting points. I frequently monitored my progress and adjusted my collecting schedule as necessary.

When I encountered a plant specimen during a hike, I first ensured that it was not a federally listed rare or threatened plant species, that there were more than five individuals in the population, and that the species had not been previously collected by me at that particular location (RMOS or SPNA). If a specimen met all three of those criteria, I began by taking a GPS waypoint to mark the location of the soon-to-be collected specimen. I recorded the waypoint identification number assigned to that specimen into my field notebook. I took several digital photographs of the species, making sure to capture all potentially important characteristics that may assist in future identifications. I took extensive field notes regarding the size, flower color, abundance, habit, and dominant associated species of the specimen of focus. I also documented the soil or substrate type, slope, aspect, and elevation of the site. After all the necessary information was recorded, I carefully dug up two specimens (one for a collection to be housed at CSU Herbarium, and one for a duplicate collection to be housed at DBG's Kathryn Kalmbach Herbarium) which were most representative of the population. In certain instances, I collected more than two specimens if population numbers allowed, and it was necessary in order to document all relevant parts. I placed the collected specimens into a gallon-sized sealable bag, which I labeled with the waypoint identification number that I previously assigned to the specimen. I stored the specimen-containing sealable bag in a small portable cooler until I was able to transfer them to an herbarium press.

When I encountered rare or threatened taxa, provided there were more than 25 individuals in the population, I collected two specimens in the manner specified above, except in the event that a federal permit was required (i.e. *Oenothera coloradoensis* ssp. *coloradoensis*). However, if the population was smaller than 25 individuals, I simply photographed the specimen

and took the appropriate field notes. I employed this same method when I encountered a previously undocumented, non-rare species that had a population of less than five individuals.

Herbarium Specimen Preparation

Pressing and identifying

At the completion of each day's field survey, I pressed the collected specimens in sheets of folded newspaper and placed them inside an herbarium press. I transferred the field identification number from the bag on to the coordinating piece of newspaper. I periodically checked on the pressed specimens until they were completely dry, at which point I removed the folded sheets of newspaper from the press and stored them in the CSU Herbarium to later be identified and/or verified.

During the off-season when I was not conducting field work, I sorted the specimens by family and then later identified them to the species level, if not previously done in the field. I identified the specimens using a variety of plant identification keys (Wingate, 1994; Dorn, 2001; Weber and Wittmann, 2001; Shaw, 2008; Ackerfield, 2013). Once identified, I verified the specimens via comparison with CSU Herbarium's reference collection. Each collected specimen will be mounted onto 100% rag herbarium mounting paper in such a manner that all relevant parts (i.e. adaxial and abaxial surfaces of leaves, flowers, stems, roots, and fruits if applicable) are visible on the layout. The specimens will be secured to the mounting paper using CSU Herbarium's mounting protocol (<http://herbarium.biology.colostate.edu>).

Labeling, databasing, and imaging

After each specimen was accurately identified, I created individual herbarium labels in accordance with CSU Herbarium's labeling protocol (<http://herbarium.biology.colostate.edu>), which includes the county where the specimen was collected, family name of specimen, genus, species, subspecies or variety if applicable, authority, written description of location along with corresponding GPS coordinates, habitat characteristics, abundance, elevation, collector's name, collection date, and collection number. Once the specimens are mounted, they will receive an accession number, and the collection information listed on each herbarium label will be entered into CSU Herbarium's online database. Next, the specimens will be imaged using CSU Herbarium's Microsoft Silverlight Deep Zoom equipment. The uploaded image will be available in an online digital format on the CSU Herbarium's website (<http://herbarium.biology.colostate.edu>) to allow for greater public accessibility. The CSU Herbarium is also affiliated with Southwest Environmental Information Network (SEINet), a web interface that integrates images and information from various herbaria in southwestern U.S. (<http://swbiodiversity.org/seinet/index.php>), and thus my data will be publically accessible here as well. Placing digital images and corresponding label information into this multi-state database further increases the public accessibility of these data and the CSU Herbarium collection.

RESULTS AND DISCUSSION

In total, I collected and/or noted 438 distinct taxa from 78 vascular plant families; 328 taxa from 75 families at RMOS, and 312 taxa from 64 families within SPNA (Tables 1.2, 1.3). The families that account for the largest diversity at each location are: Asteraceae (98 total taxa; [67] RMOS, [68] SPNA), Poaceae (52; [41] RMOS, [33] SPNA), Fabaceae (29; [15] RMOS, [27] SPNA), Brassicaceae (19; [12] RMOS, [12] SPNA), and Rosaceae (18; [12] RMOS,

Table 1.2. Summary of RMOS and SPNA botanical inventory data; totals combined with data collected by previous researchers shown in parentheses.

	Total	RMOS	SPNA	Present at both RMOS & SPNA
Families	78 (82)	76 (77)	64 (75)	61 (71)
Genera	258 (308)	223 (242)	201 (257)	167 (191)
Species	430 (580)	326 (391)	308 (478)	201 (261)
Infraspecies	14 (16)	8 (9)	11 (12)	5
Unique taxa	438 (589)	328 (393)	312 (481)	201 (261)
Taxa of conservation concern	13 (21)	10 (11)	8 (13)	5 (6)
Non-native taxa	65 (90)	51 (55)	41 (73)	29 (47)
Percent non- native taxa	15.0 (15.4)	15.5 (14.0)	13.2 (15.2)	14.4 (18)
New area records	196	169	41	16

Table 1.3. Summary of taxa documented by major-plant-taxa categories; totals combined with data collected by previous researchers shown in parentheses.

	Total	RMOS	SPNA	Present at both RMOS & SPNA
Fern Allies				
families	2	2	2	2
distinct taxa	3 (5)	3 (4)	2 (3)	2
Ferns				
families	2	2	2	2
distinct taxa	3 (4)	3 (4)	2 (3)	2 (3)
Gymnosperms				
families	2	2	2	2
distinct taxa	4	4 (6)	2	2
Angiosperms				
families	72 (76)	69 (70)	58 (69)	55 (65)
distinct taxa	420 (571)	318 (379)	306 (475)	195 (255)

[12] SPNA). The genera with the most taxa represented are *Carex* (Cyperaceae; 12 taxa), *Astragalus* (Fabaceae; 11 taxa), *Erigeron* (Asteraceae; 9 taxa), *Potentilla* (Rosaceae; 9 taxa), and *Oenothera* (Onagraceae; 8 taxa). I documented 65 total invasive taxa, 49 of which I observed at RMOS, and 44 at SPNA. I also collected and/or noted 13 species of conservation concern (10 at RMOS and 8 at SPNA). During previous botanical work performed by CNHP, CSU, DBG,

NAP, and NRCS, between 2004 – 2012, and a 2009 BioBlitz, an additional 4 unique families and 151 unique taxa were documented², bringing the totals to 82 families with 589 unique taxa in the region encompassed by both RMOS and SPNA (Table 1.2). Together, the taxa found at RMOS and SPNA represent approximately 35% of all vascular flora known to occur in Larimer County (Colorado State University Herbarium Plant Taxa Database, 2014).

Taxa of conservation concern

I documented a total of 13 species of conservation concern between both RMOS and SPNA (Table 1.2). These species were listed as rare or uncommon by Ackerfield (2013) and/or tracked and carry state rankings of S1, S2, or S3 by the Colorado Natural Heritage Program (CNHP, 2013). These taxa are designated in the annotated checklist with “#” if tracked by CNHP, “□” if listed as rare by Ackerfield (2013) or CNHP, or “Δ” if listed as uncommon by either source. They are listed below, alphabetically by genus. Two species denoted with “Δ” in the annotated checklist (*Silene csereii* and *S. noctiflora*) are omitted from the following list because although uncommon, they are non-natives, and therefore not of the same conservation concern as uncommon or rare native taxa.

Besseyia wyomingensis (Plantaginaceae) was documented at both RMOS and SPNA between 6589 – 6650’ in elevation in a shaded canyon and on grassy hillside. Vouchers: 542, 558c.

² Although I did not personally verify the identity of the previous taxa documentations, they were identified by local professional botanists (e.g. Crystal Strouse, City of Fort Collins Natural Areas Program Botanist; Dina Clark, Herbarium Collection Manager, Museum of Natural History, University of Colorado Boulder; Jennifer Ackerfield, Herbarium Collection Manager, Colorado State University; Pam Regensburg, Kathryn Kalmbach Curatorial Assistant), and thus can be considered reliable data.

Hesperostipa neomexicana (Poaceae) was documented at RMOS at 6315' in elevation in foothills shrubland and mountain mahogany habitat. No vouchers were collected; field identified and photo-documented.

Juncus ensifolius (Juncaceae) was documented at RMOS along a creek leading into a wetland between 6345 – 6349' in elevation. Vouchers: 291a, 452d.

Mentzelia speciosa (Loasaceae) was documented at SPNA between 6485 – 6833' in elevation along public trails in gravel wash sites. See Chapter II for distribution map. Vouchers: 394, 699.

Musineon tenuifolium (Apiaceae) was documented at both RMOS and SPNA between 6289 – 7074' in elevation in canyons, along cliffs, in foothills shrublands, and along the public trails. Vouchers: 120, 333, 511, 513, 562.

Oenothera coloradoensis ssp. *coloradoensis* (Onagraceae) was documented at SPNA between 6313 – 6431' in elevation in several wet meadows. No vouchers were collected; field identified and photo-documented.

Pediomelum esculentum (Fabaceae) was documented at SPNA at 6375' in elevation in a wet meadow. Voucher: 688.

Pellaea glabella ssp. *simplex* (Pteridaceae) was documented at RMOS along a cliff wall in a canyon at 6596' in elevation. Voucher: 372.

Penstemon eriantherus var. *eriantherus* (Plantaginaceae) was documented at both RMOS and SPNA between 6112 – 6764' in elevation in dry, gravelly creek beds, eroded hillsides, along the public trails, and in shortgrass prairie. See Chapter II for distribution map. Vouchers: 202, 613.

Phacelia denticulata (Hydrophyllaceae) was documented at both RMOS and SPNA between the elevations of 6344 – 6919' along a public trail and in a canyon surrounded by foothills shrubland. Vouchers: 660b, 744a.

Solidago ptarmicoides (Asteraceae) was documented at RMOS between 6977 – 7037' in elevation in a washed out meadow and along a rocky drainage site. See Chapter II for distribution map. Vouchers: 422f, 461a.

Stanleya pinnata var. *bipinnata* (Brassicaceae) was documented at RMOS at 6194' in elevation in a gully below a prominent gypsum outcrop. Voucher: 718.

Stephanomeria runcinata (Asteraceae) was documented at both RMOS and SPNA between 6488 – 6728' in elevation in dry, gravelly creek beds, eroded hillsides and along the public trails. See Chapter II for distribution map. Vouchers: 301, 464.

In addition to the above listed 13 species, five other species of conservation concern have been documented as occurring in these locations as well: *Carex crawei* and *C. lasiocarpa* (Cyperaceae) at SPNA, *Cheilanthes eatonii* (Pteridaceae) at both RMOS and SPNA, *Liatris ligulistylis* (Asteraceae) at SPNA, and *Sisyrinchium pallidum* (Iridaceae) at SPNA (City of Fort Collins Natural Areas Program, 2007; Larimer County Parks and Open Lands Development, 2007). Previous collectors have also documented *Hesperostipa neomexicana*, *Juncus ensifolius* and *Solidago ptarmicoides* as occurring at SPNA. I found no new species of conservation concern at SPNA, however, *Juncus ensifolius*, *Solidago ptarmicoides*, and *Stephanomeria runcinata* are all new records for RMOS.

Non-native taxa

I noted a total of 65 non-native taxa across both locations, with 49 exotic taxa occurring at RMOS and 44 at SPNA (Table 1.2). These species are designated with “◊” in the annotated checklist. Combined with previously collected data, non-native taxa represent 14.9% of the vascular flora documented at RMOS and 15.8% of the vascular flora of SPNA. Five of the species I documented are listed on the Colorado’s Noxious Weed B List

(<http://www.cwma.org/noxweeds.html>) and these include *Carduus nutans* (Asteraceae), *Cirsium arvense* (Asteraceae), *Cynoglossom officinale* (Boraginaceae), *Elymus repens* (Poaceae), *Euphorbia esula* (Euphorbiaceae), and *Linaria dalmatica* (Plantaginaceae). Five additional species, *Arctium minus* (Asteraceae), *Convolvulus arvensis* (Convolvulaceae), *Erodium cicutarium* (Geraniaceae), *Tribulus terrestris* (Zygophyllaceae) and *Verbascum thapsus* (Scrophulariaceae) are currently on Colorado’s Noxious Weed C List

(<http://www.cwma.org/noxweeds.html>). I documented four new exotic species at SPNA, which are denoted with “◊▼” in the annotated checklist. These four exotics are *Chenopodium album* var. *album* (Chenopodiaceae), *Galium aparine* (Rubiaceae), *Lappula squarrosa* (Boraginaceae), and *Linum perenne* (Linaceae). At RMOS, I found 21 previously undocumented non-native taxa, which are denoted with “◊■” in the annotated checklist. These non-native taxa are *Arctium minus* (Asteraceae), *Barbarea vulgaris* (Brassicaceae), *Bidens frondosa* (Asteraceae), *Chenopodium album* var. *album* (Chenopodiaceae), *Cirsium arvense* (Asteraceae), *Conyza canadensis* (Asteraceae), *Cynoglossum officinale* (Boraginaceae) *Echinochloa crus-galli* (Poaceae), *Lappula occidentalis* (Boraginaceae), *Linum perenne* (Linaceae), *Marrubium vulgare* (Lamiaceae), *Melilotus albus* (Fabaceae), *M. officinalis* (Fabaceae), *Persicaria maculosa* (Polygonaceae), *Polygonum aviculare* (Polygonaceae), *Psathyrostachys junceus* (Poaceae), *Salsola tragus*

(Chenopodiaceae), *Silene noctiflora* (Caryophyllaceae), *Thinopyrum intermedium* (Poaceae), *Tribulus terrestris* (Zygophyllaceae), and *Verbena bracteata* (Verbenaceae).

New area records

In total, I documented 196 new taxa records for RMOS and SPNA combined, which are denoted in the annotated checklist with either “■,” signifying a new record for RMOS, or “▼,” signifying a new record for SPNA (Table 1.2). Newly discovered taxa at RMOS (169) account for the majority (> 85%) of these new records, as minimal botanical work had been conducted prior to my surveying. New area records at SPNA (41) make up a much smaller proportion of the total (< 25%), as this area has been extensively surveyed in the past. As mentioned previously, three of the newly documented species at RMOS are species of conservation concern, while 21, or 11%, are non-native taxa. No new species of conservation concern were located at SPNA, however, four of the newly documented taxa are non-native. Sixteen, or 8.2%, of the 196 previously undocumented taxa were found at both locations.

Unencountered, previously documented taxa

There are several possible reasons why I did not encounter the 151 taxa documented by previous researchers. First, approximately 75% of the time I conducted fieldwork alone, whereas many of the other research efforts were conducted in teams; BioBlitz research at SPNA was conducted by eight botanists (two teams of four; City of Fort Collins Natural Areas Program, 2009), DBG research at SPNA and RMOS was conducted in groups of two to four botanists (SEINet, 2014), and research efforts by CNHP at both locations were primarily conducted in groups of two to five botanists (CNHP, 2013). As I only visited each of my designated sites once

per season, what I was capable of locating in one day could not compare to what a team of botanists could locate and document in the same location in a single day's time. Second, because my collecting efforts were divided between on and off-trail sites within both RMOS and SPNA, I had to limit the time I spent at each designated area. This is in comparison to work conducted by DBG at SPNA in 2010, in which botanists surveyed in and around certain locales for several days at a time (SEINet, 2014). Although this method produced a large list of newly documented taxa, as efforts were focused around the most biodiverse areas within SPNA, it also resulted in many common taxa in less diverse locations remaining undocumented (SEINet, 2014).

Additionally, my 2012 collecting season was severely impacted by the dry, hot weather. Thus, if I happened to visit a previously documented biodiverse location in the 2012 season, it is possible that the species were either undetectable, or unidentifiable without flowers and/or fruits. Lastly, it is possible that I simply overlooked certain taxa in the field due to the superficial appearance to similar taxa, or because of my inexperience with Colorado flora, particularly during the 2012 season. Regardless, combining my results with those documented in the previously mentioned surveys, provides City of Fort Collins and Larimer County land managers with valuable data.

Conservation implications and future research

Considering that RMOS and SPNA have been occupied by humans for nearly 12,000 years and currently support both public recreation and livestock grazing, they are in fairly pristine condition. In total, the 33,700 acres included within RMOS and SPNA boundaries supports 589 unique plant taxa, or 35% of the known vascular plant species documented in Larimer County (1,675 taxa); however, these two areas combined make-up only 0.8% of the total land cover of the county (3,989,760 acres; Colorado State University Herbarium Plant Taxa

Database, 2014; U.S. Census Bureau, 2014). Given the diversity of habitats present at RMOS and SPNA, the number of plant taxa that occur there is to be expected. Also, taking into account the differing habitats between each region, it is no surprise that RMOS and SPNA only share in common 44% of total documented plant taxa. Overall, these regions are quite botanically diverse and support 21 documented species of concern along with 20 separate rare or threatened plant communities; thus, conserving the biodiversity that occurs there will likely be a concern for future land management decisions. Due to the fact that each area is owned and managed separately, this will require both individual and joint management tactics to attempt to preserve the biodiversity present across this region as a whole.

The data I have generated in this botanical inventory, combined with data generated in previous research efforts, will not only be useful in assisting land management decisions, but also in a variety of future studies related to RMOS, SPNA, as well as the species that occur there. For instance, researchers will be able to document species compositional changes over time, monitor ranges of exotic taxa and species of conservation concern within these properties, perform biogeographical studies of specific species occurring there, or use my checklist as baseline data for future bison-reintroduction studies; Colorado State University Animal Reproduction and Biotechnology Laboratory, the City of Fort Collins and WiLDIT team (Wildlife/Livestock Disease Investigations Team) of USDA-APHIS are proposing the reintroduction of a small herd of disease-free bison from Yellowstone National Park in a 500-acre parcel of land within SPNA (Restoring bison to Soapstone Prairie Natural Area, 2014).

Annotated checklist

Included in the appendix at the end of the document is the checklist of all taxa I documented between 2012 – 2013 organized by major vascular plant category (fern allies, ferns, gymnosperms, and angiosperms) and then further organized alphabetically by family, genus and species. Nomenclature follows that used in Ackerfield's *Flora of Colorado* (2013). Each entry is formatted as follows: *Scientific name* Taxonomic authority, common name; location; habitat; elevation; abundance; [voucher number].

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CHAPTER II

DISTRIBUTION MAPS OF SEVERAL SPECIES OF INTEREST AT RED MOUNTAIN OPEN SPACE AND SOAPSTONE PRAIRIE NATURAL AREA

INTRODUCTION

Today's land managers are faced with unique challenges when developing conservation strategies in light of our rapidly changing climate (Chen *et al.*, 2011; Forester *et al.*, 2013). As such, they have become increasingly reliant on forecasting tools, such as species distribution models (SDMs) and ecological niche models (ENMs), to help them prioritize their conservation efforts (Sinclair *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012; Syfert *et al.*, 2013; Bystriakova *et al.*, 2014). These predictive models incorporate species distribution data and environmental data to simulate potential current, future or past distributions of a given species (Sinclair *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012; Bystriakova *et al.*, 2014). SDMs, specifically, have also been used to identify areas prone to invasion by alien or weedy species, to find appropriate locations for species reintroductions, to highlight regions of highest conservation value, and to determine how community assemblages will be impacted by climate fluctuations (Sinclair *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012). Several recent studies have also used SDMs in conjunction with molecular and/or statistical phylogeographic data to generate more robust analyses looking at niche conservatism and the role refugia and/or previous dispersal barriers may have played in species' distributions (Cordellier and Pfenninger, 2009; Galbreath *et al.*, 2009; Wiens *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012; Forester *et al.*, 2013; Bystriakova *et al.*, 2014). Thus, these types of predictive models, whether used alone or in combination with other tools, have the capacity to greatly aid land management decisions. In fact, a review study by Rodríguez-

Castañeda *et al.* (2012) concluded that SDMs are now a commonplace tool used to guide policy and decision making in such topics as invasive species management, habitat preservation and the conservation of biodiversity.

As with most models, however, the quality of the output is dependent on the input quality. Studies have shown that predictive models, such as SDMs or ENMs, are most effective when the primary input data (species distribution data and environmental factors) are unbiased and of excellent quality (Jimenez-Valverde *et al.*, 2010; Sinclair *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012). The various environmental data used in SDMs or ENMs are accessible from global climate databases, digital elevation models and various software packages. Although these data are often readily available and are of high quality, they are also subject to regional variation (Syfert *et al.*, 2013). Current and historic species distribution data are typically acquired from herbaria, museum collections and online databases, and can also be variable in quality or availability (Loiselle *et al.*, 2003; Syfert *et al.*, 2013). For instance, Hortal *et al.* (2008) showed that the majority of historical distribution data available on online databases was subject to a geographical sampling bias, in which specimens were predominantly collected near publically accessible locations such as roads and rivers, rather than being collected systematically or randomly. This, they concluded, could significantly impact the predictions of an SDM, as the input values were not fully indicative of the species' true distribution (Hortal *et al.*, 2008). Although certain modelling programs have improved their predictive power by creating a means to correct for such sampling biases, ultimately, this still does not compete with the predictive power of higher quality input data (Phillips *et al.*, 2009).

As part of a larger scale botanical inventory project I conducted in 2012 – 2013 (see Chapter I), I also attempted to generate geographically unbiased species distribution data for

eight species of interest³ at Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) to be used for future monitoring and conservation efforts. Both of these locations, situated in northern Larimer County, Colorado, have had a long history of human inhabitation accompanied with cattle and sheep grazing (City of Fort Collins Natural Areas Program, 2007; La Belle *et al.*, 2007). Purchased in two separate phases in 2004 and 2007 by Larimer County and The City of Fort Collins, respectively, these locations are now protected public areas which offer limited recreation trails for hiking, biking and horseback riding. Thus, effective management tactics are imperative if land managers seek to maintain these moderate levels of cattle grazing and public recreation, while still protecting the areas' biodiversity.

Species of interest

In April 2013, City of Fort Collins Natural Areas Program Botanist, Crystal Strouse (pers. comm.), identified six species of interest at SPNA for which she wanted distribution data: *Solidago ptarmicoides*, *Stephanomeria runcinata*, *Pediomelum esculentum*, *Mentzelia speciosa*, *Mirabilis linearis*, and *Penstemon eriantherus*. In May 2013, Larimer County Natural Resources Specialist, Jeffrey Boring (pers. comm), cited two additional species of interest to generate species distribution maps for within RMOS: *Cirsium flodmanii* and *Linaria dalmatICA*.

Solidago ptarmicoides (Nees) Boivin (Asteraceae) (synonyms: *Aster ptarmicoides* (Nees) Torr. & A. Gray; *Doellingeria ptarmicoides* Nees; *Inula alba* Nutt.; *S. asteroides* Semple; *Oligoneuron album* (Nutt.) G. L. Nesom; *Unamia alba* (Nutt.) Rydb.), commonly known as prairie goldenrod (Fig. 2.1), is a perennial herb native to the United States, from Montana south to Oklahoma, with scattered abundances eastward to the Atlantic coast, and the southeastern regions of Canada (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.2). In five U.S. states (Conn.,

³ As designated by Larimer County and City of Fort Collins officials.

Mass., N.H., N.C., Tenn.) *S. ptarmicoides* is classified as an endangered species, in Indiana it is listed as a rare species, and it is presumed to be extirpated from Ohio (USDA NRCS, 2014). In the State of Colorado, *S. ptarmicoides* is uncommon and mostly found in El Paso, Teller and Park Counties (Fig. 2.3). However, local herbaria records also document scattered occurrences in Larimer County as well, primarily in forest clearings and open meadows between elevations of 6500' and 6900' (Ackerfield, 2013; SEINet, 2014; USDA NRCS, 2014). It typically grows in sandy soils, cracks of rocks, or in limestone substrate (Semple and Cook, 2006; Ackerfield, 2013).

Stephanomeria runcinata Nutt. (Asteraceae) (synonym: *Ptiloria ramosa* Rydb.) is an herbaceous perennial commonly named desert wirelettuce (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.4). Its native range is a narrow latitudinal band spanning from the mid-western United States northward into Canada (Fig. 2.5). Overall, *S. runcinata* has a somewhat scattered distribution pattern within the majority of the U. S. states where it occurs. The only exception is Wyoming, where its distribution is fairly widespread (USDA NRCS, 2014). Ackerfield (2013) lists *S. runcinata* as an uncommon species in Colorado; USDA NRCS (2014) indicates that *S. runcinata* only occurs in five counties (Garfield, Grand, Mesa, Moffat, and Weld), however, herbaria records confirm its presence in several other counties (Bent, Eagle, Larimer, Montezuma, and Rio Blanco) (SEINet, 2014) (Fig. 2.6). In Colorado, in particular, it is found growing in sandy, locations between the elevations of 5000' and 8500' (Gottlieb, 1971; Ackerfield, 2013; USDA NRCS, 2014).



Figure 2.1. *Solidago ptarmicoides* inflorescences and involucre bracts. a. inflorescences; b. involucre bracts.

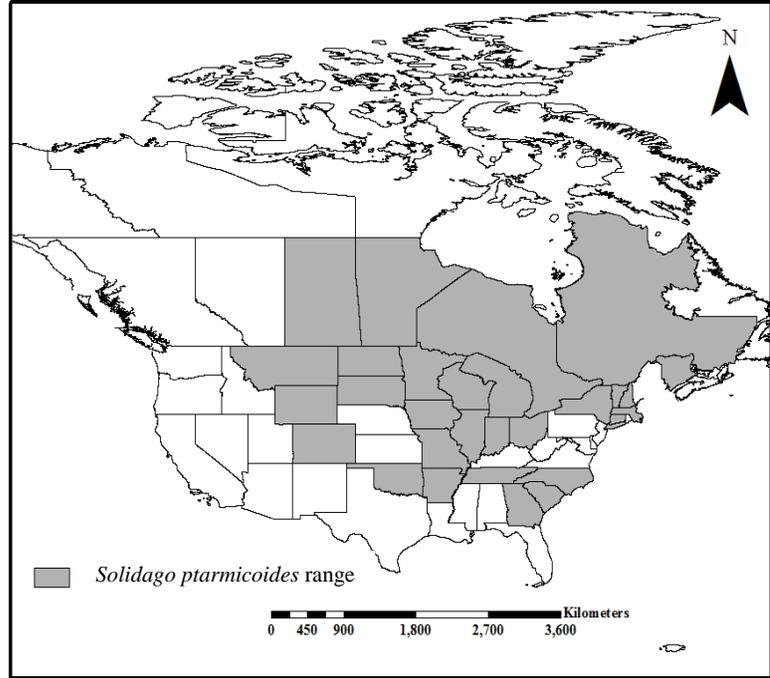


Figure 2.2. Native range of *Solidago ptarmicoides* in North America. Distribution data obtained from USDA NRCS (2014).

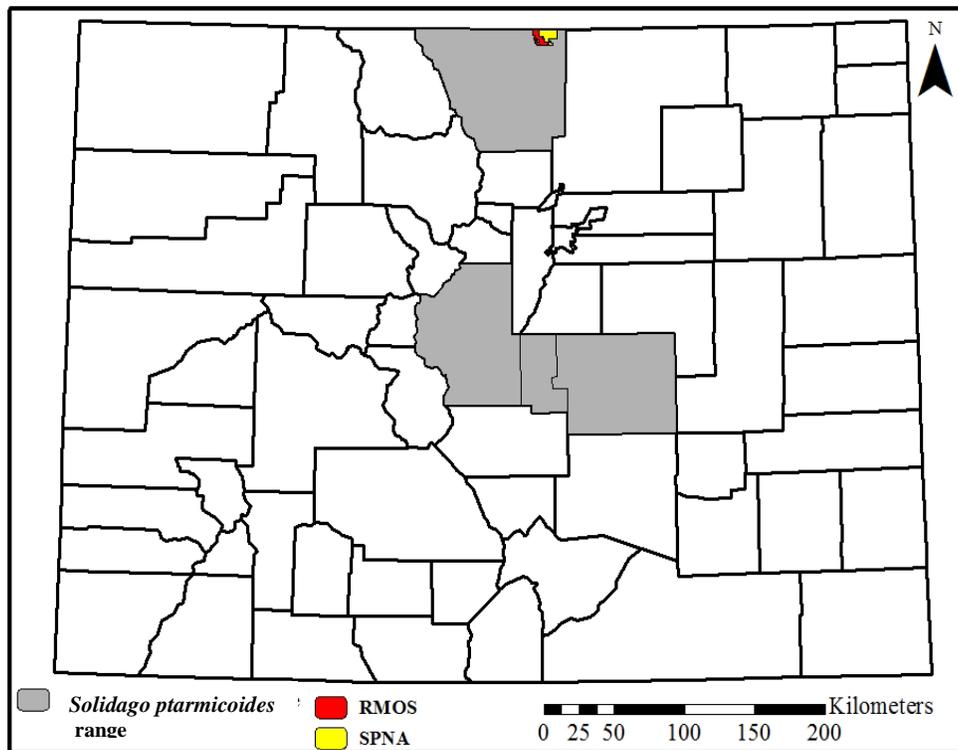
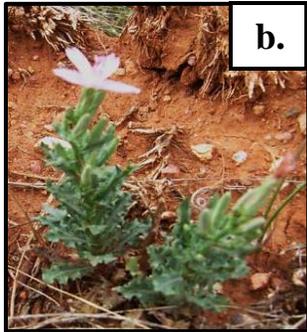


Figure 2.3. Native range of *Solidago ptarmicoides* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).



a.



b.

Figure 2.4. *Stephanomeria runcinata* inflorescence and habit. a. inflorescence; b. habit

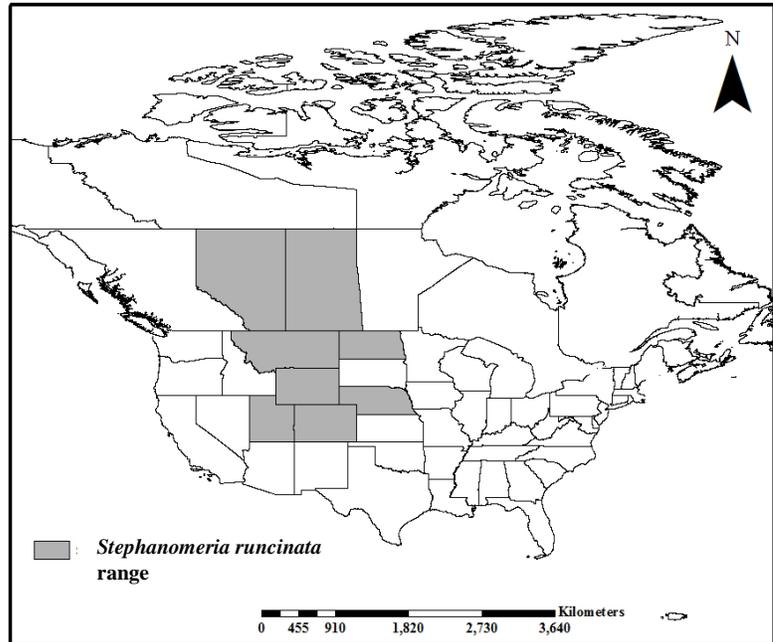


Figure 2.5. Native range of *Stephanomeria runcinata* in North America. Distribution data obtained from USDA NRCS (2014).

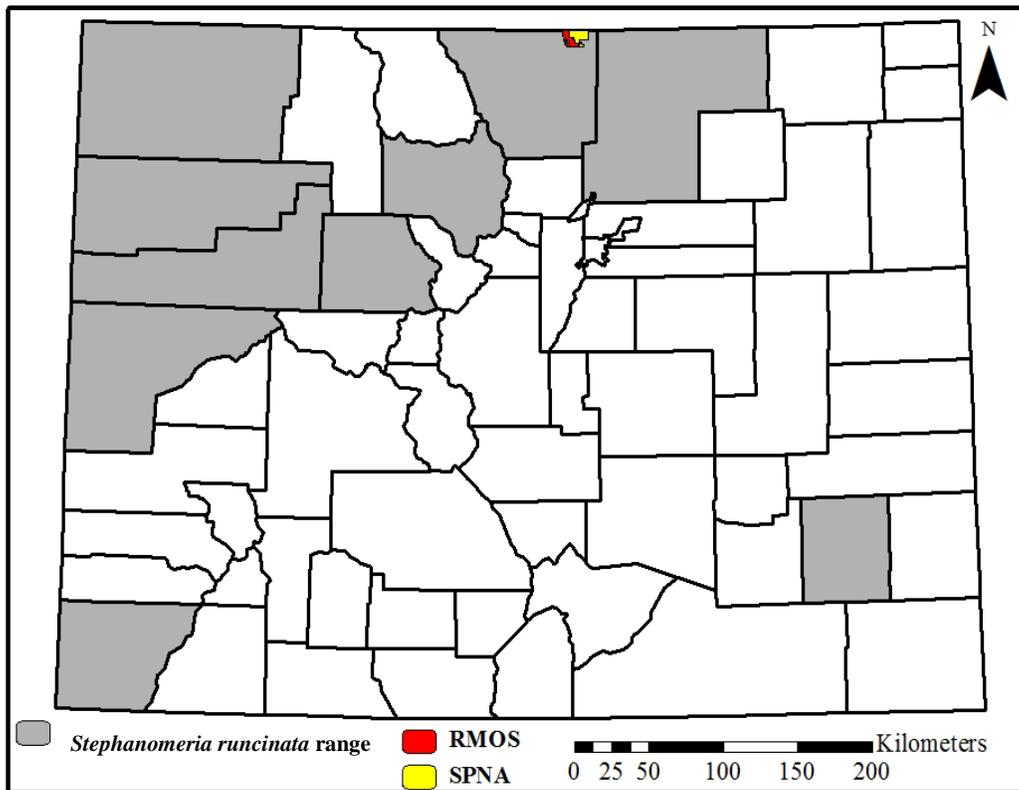


Figure 2.6. Native range of *Stephanomeria runcinata* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).

Pediomelum esculentum (Pursh) Rydb. (Fabaceae) (synonym: *Psoralea esulenta* Pursh), commonly referred to as large indian breadroot (Fig. 2.7), is an herbaceous perennial native to the midwestern United States and central Canada, with one disjunct location present in the eastern United States, in New York. (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.8). In Colorado, *P. esculentum* is cited as an uncommon species; it is only present in nine of the total 64 counties, mainly in the northeastern portion of the state (Ackerfield, 2013; SEINet, 2014; USDA NRCS, 2014) (Fig. 2.9). There, it typically occurs between 3500' and 6000' in elevation and is found primarily in sandy soil on the eastern plains (Ackerfield, 2013).

Mentzelia speciosa Osterh. (Loasaceae) (synonym: *M. sinuata* (Rydb) R. J. Hill; *Nuttallia speciosa* (Osterh.) Greene) is an herbaceous perennial, whose common name is jeweled blazingstar (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.10). It is native to the United States, with a distribution limited to only two states: Colorado and Wyoming (USDA NRCS, 2014) (Fig. 2.11). In the state of Wyoming, *M. speciosa* is only known to occur in Laramie County, while in Colorado it is documented in 21 counties, mostly along the Front Range of the Rocky Mountains and nearby high plains (Dorn, 2001; SEINet, 2014; USDA NRCS, 2014) (Fig. 2.12). There, it is found growing primarily in sandy soil between 5000' and 9000' in elevation (Ackerfield, 2013). The Colorado Natural Heritage Program ranks *M. speciosa* as a G3S3 species, meaning it is vulnerable both globally and statewide (CNHP, 2013).

Mirabilis linearis (Pursh) Heimerl (Nyctaginaceae) (synonyms: *Allonia decumbens* (Nutt.) Spreng.; *A. gausapoides* Standl.; *A. linearis* Pursh; *Calymenia decumbens* Nutt.; *M. decumbens* (Nutt.) Daniels; *M. diffusa* (A. Heller) C. F. Reed; *M. gausapoides* (Standl.) Standl.; *M. hirsuta* (Pursh) MacMill. var. *linearis* (Pursh) B. Boivin.; *M. lanceolata* (Rydb.) Standl.; *Oxybaphus angustifolius* Sweet; *O. decumbens* (Nutt.) Sweet; *O. diffusus* (A. Heller) W. C.



Figure 2.7. *Pedimelum esculentum* inflorescence.

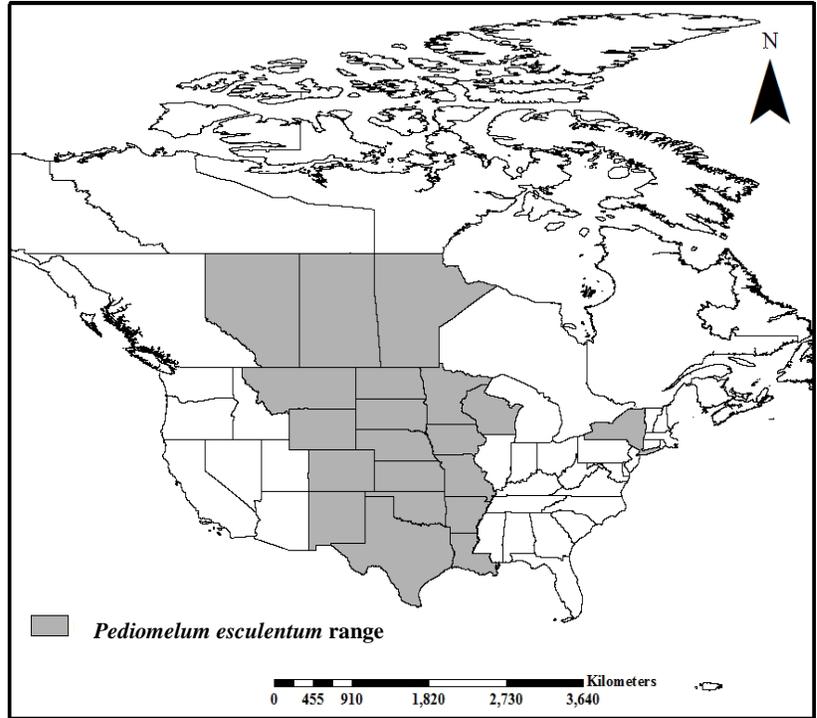


Figure 2.8. Native range of *Pedimelum esculentum* in North America. Distribution data from USDA NRCS (2014).

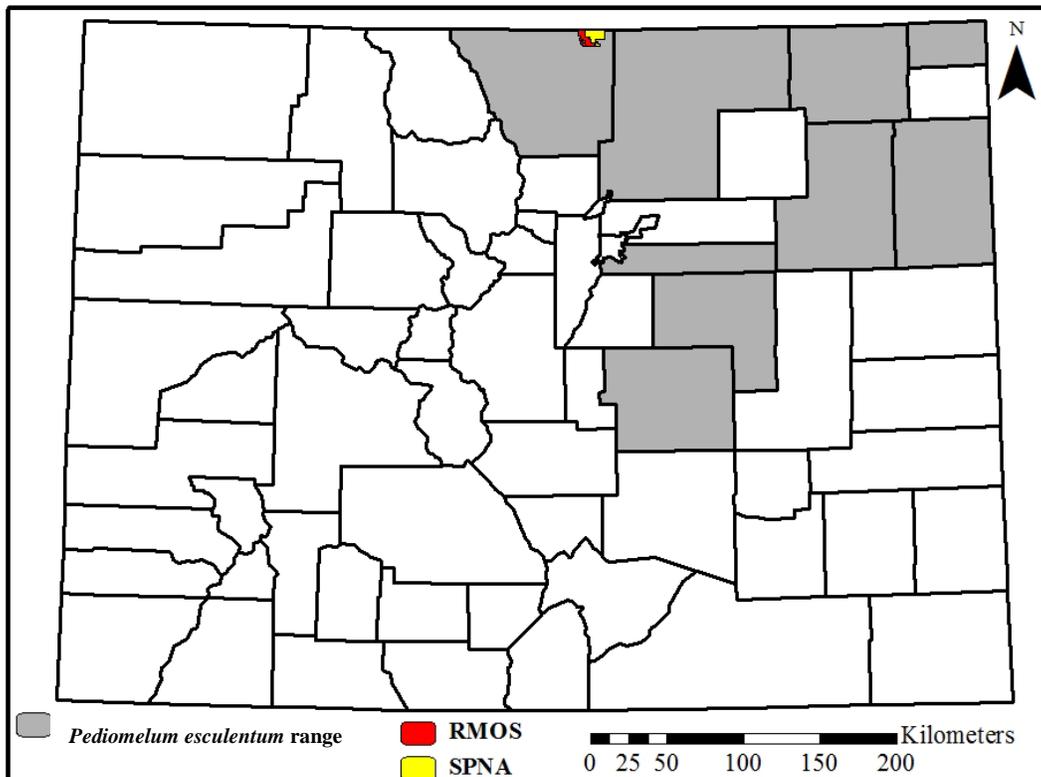


Figure 2.9. Native range of *Pedimelum esculentum* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).



Figure 2.10. *Mentzelia speciosa* flower and fruits. Photograph by Jennifer Ackerfield.

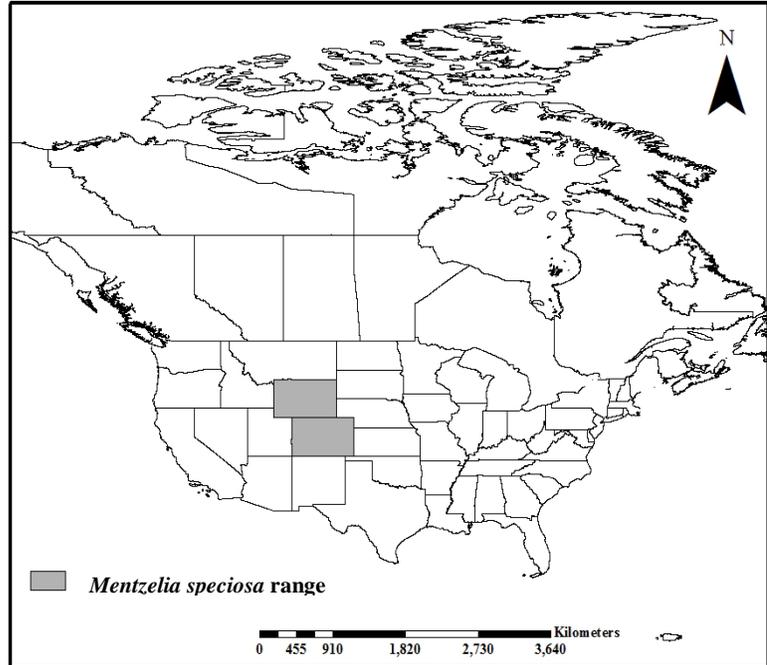


Figure 2.11. Native range of *Mentzelia speciosa* in North America. Distribution data from USDA NRCS (2014).

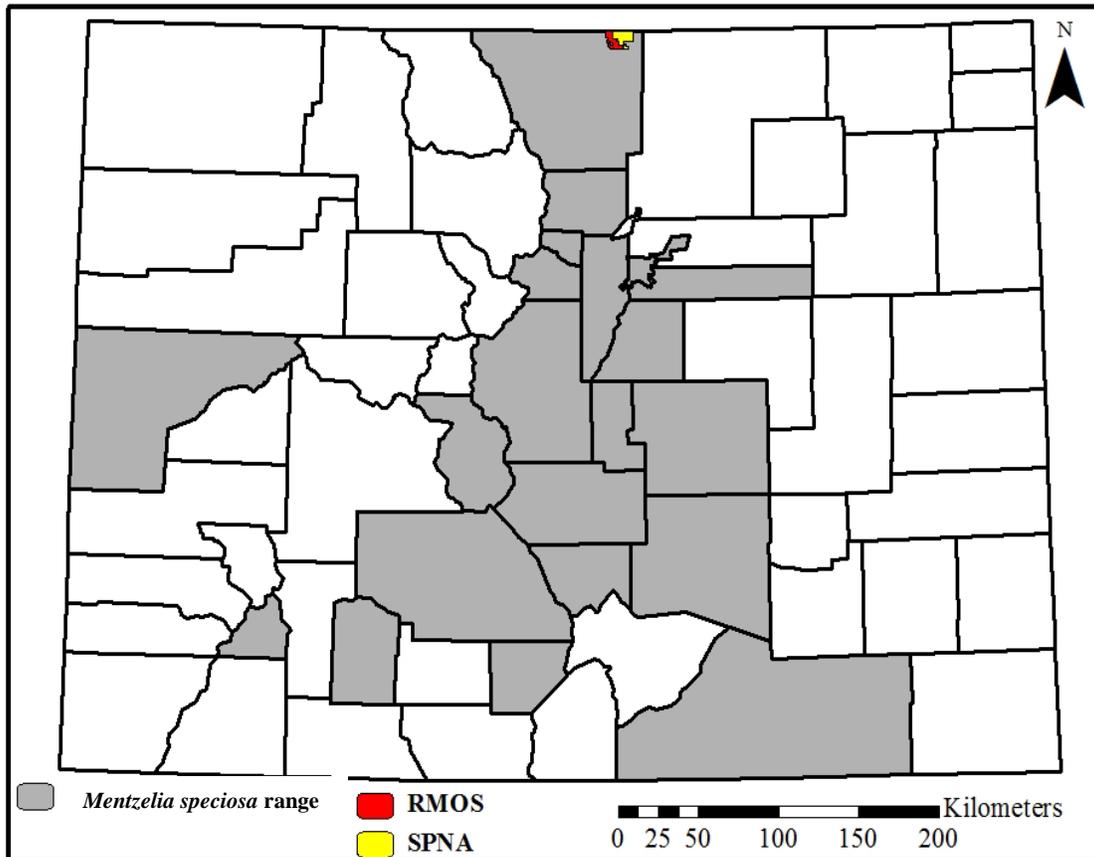
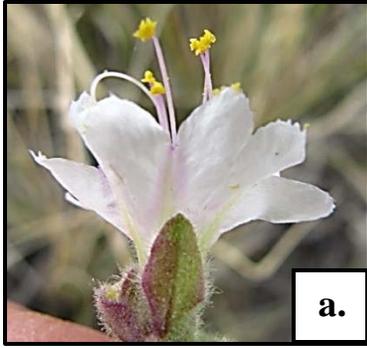


Figure 2.12. Native range of *Mentzelia speciosa* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).

Martin & C. R. Hutchins; *O. lanceolatus* (Rydb.) Standl.), commonly referred to as narrowleaf four o'clock, is a perennial plant that ranges in growth habit from herbaceous to subshrub (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.13). *Mirabilis linearis* is native to the United States and central Canada, and overall, has a widespread distribution (USDA NRCS, 2014) (Fig. 2.14). Similarly, in the State of Colorado, *M. linearis* is also widely distributed; it has been documented in 51 of the 64 counties (SEINet, 2014; USDA NRCS, 2014) (Fig. 2.15). Two separate varieties of *M. linearis* are recognized in Colorado; var. *linearis*, which is common and widespread throughout the state, and var. *subhispidata* (Heim.) Spellenberg, which is isolated to the southeastern plains in Baca County (Ackerfield, 2013). Together, both varieties are found between elevations of 3900' and 9500', primarily on the plains and in mountain valleys, in dry, sandy or rocky soil (Spellenberg, 1988; Ackerfield, 2013).

Penstemon eriantherus Pursh (Plantaginaceae), an herbaceous perennial commonly called fuzzytongue penstemon (Fig. 2.16), is native to the midwestern and northwestern United States, as well as western Canada (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.17). In Colorado, it is cited as an uncommon species, with known localities in only three counties (Larimer, Montezuma and Weld) (Ackerfield, 2013; SEINet, 2014; USDA NRCS, 2014) (Fig. 2.18). In these counties, it occurs in grasslands and open plains between 6000' and 7200' in elevation (Ackerfield, 2013).

Cirsium flodmanii (Rydb.) Arthur (Asteraceae) (synonyms: *C. ob lanceolatum* (Rydb.) K. Schum.; *C. nebranskense* (Britton) Lunnell var. *discissum* Lunell), commonly known as Flodman's thistle or prairie thistle (Fig. 2.19), is an herbaceous perennial native to Canada and northern United States (Ackerfield, 2013; USDA NRCS, 2014) (Fig. 2.20). Despite its weedy nature owing to horizontal runner roots, it has a fairly limited range Colorado. There, *C.*



a.



b.

Figure 2.13. Flower and fruits of *Mirabilis linearis* a. flower; b. bracts and fruit.

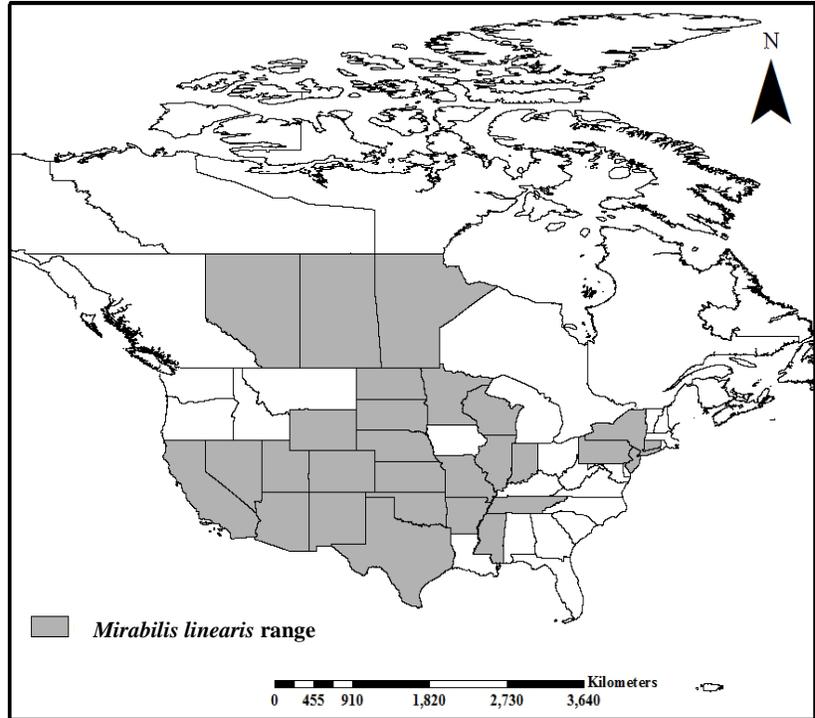


Figure 2.14. Native range of *Mirabilis linearis* in North America. Distribution data from USDA NRCS (2014).

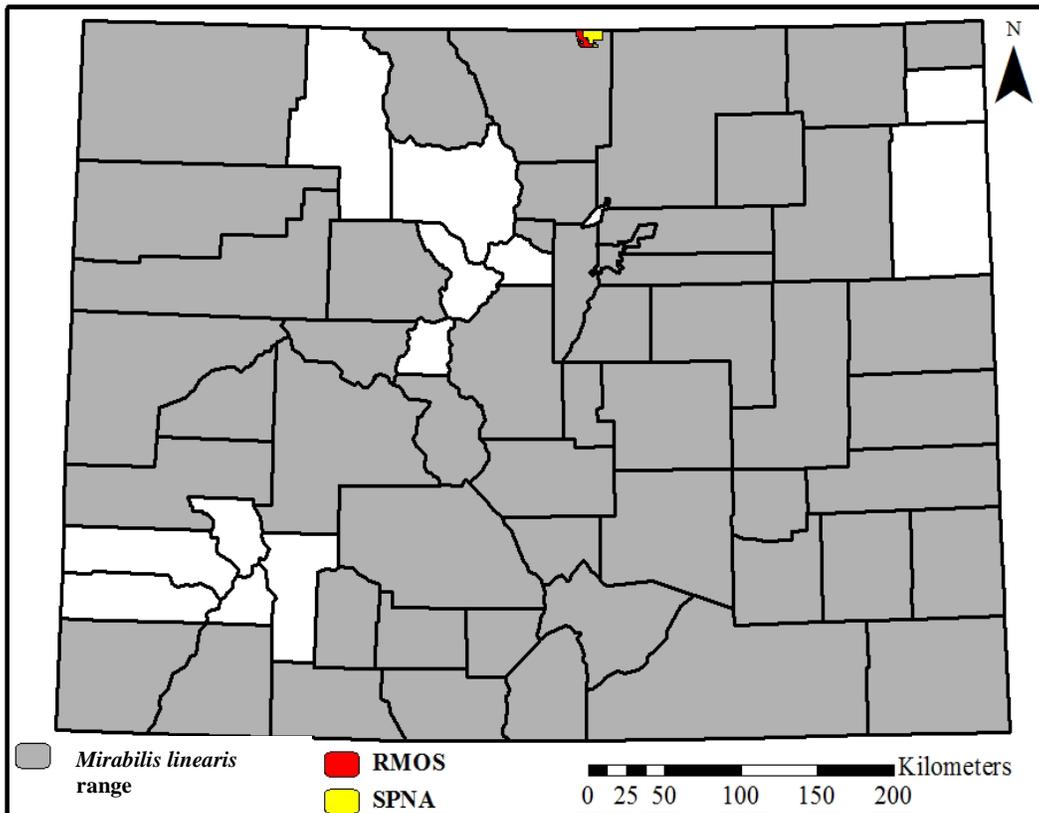


Figure 2.15. Native range of *Mirabilis linearis* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).

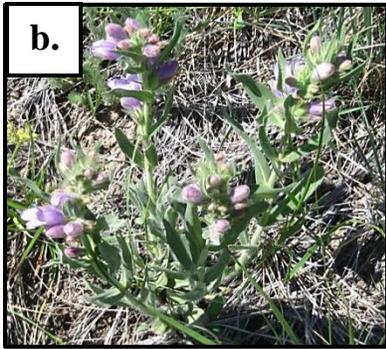


Figure 2.16. Flower and habit of *Penstemon eriantherus*. a. flower; b. habit.

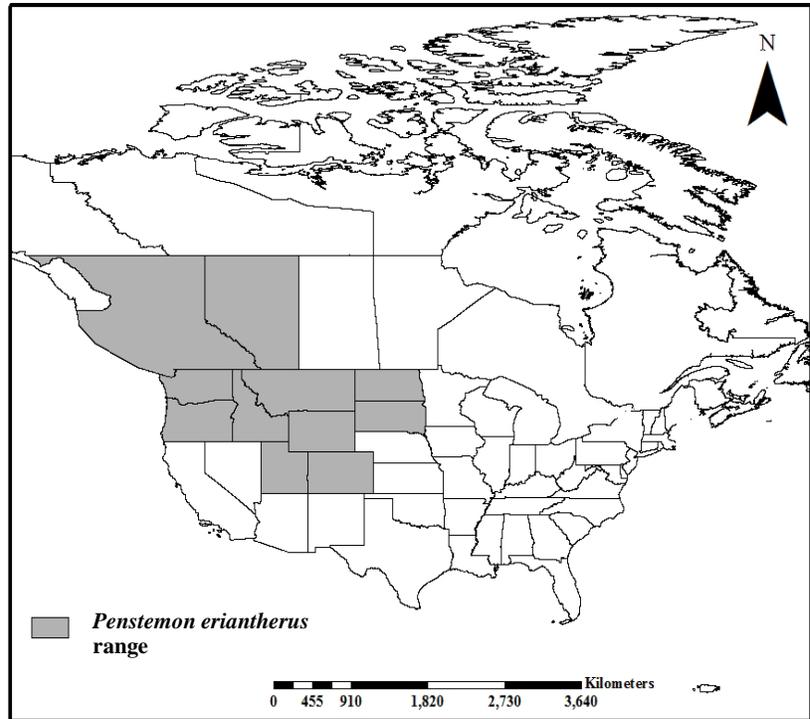


Figure 2.17. Native range of *Penstemon eriantherus* in North America. Distribution data from USDA NRCS (2014).

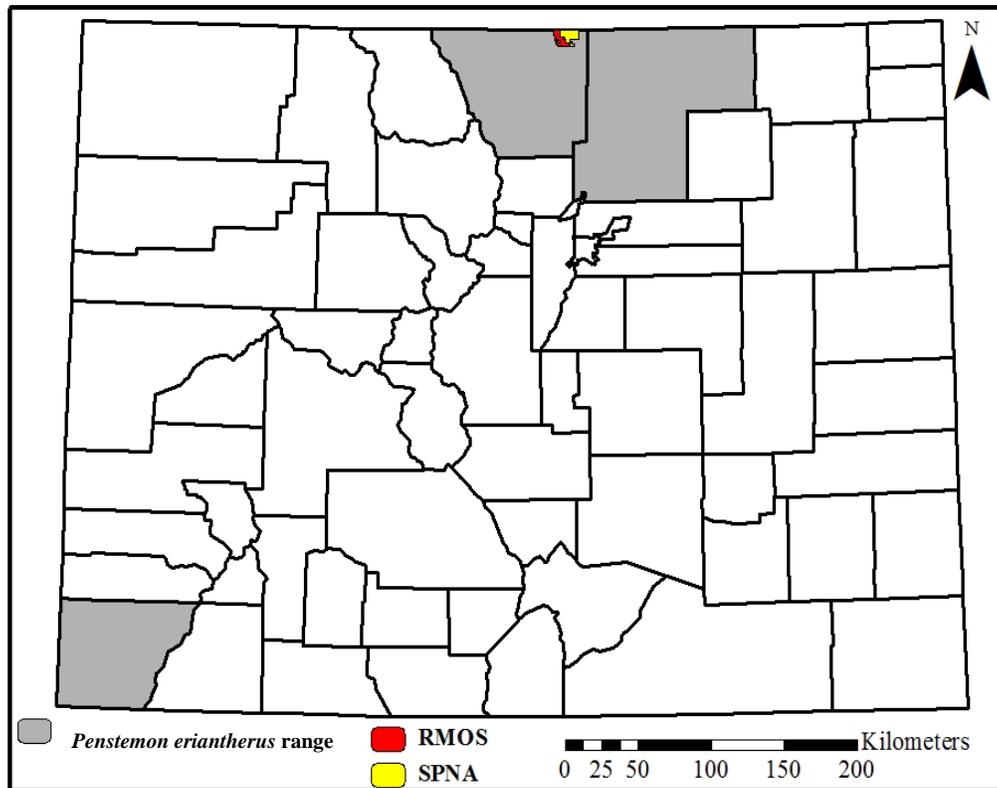


Figure 2.18. Native range of *Penstemon eriantherus* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).

flodmanii only occurs in 13 counties, primarily along the Front Range of the Rocky Mountains (Wilson and McCarty, 1984; Kiel, 2004; SEINet, 2014; USDA NRCS, 2014) (Fig. 2.21). In these counties, *C. flodmanii* can be found growing in moist prairies, meadows and riparian areas, between the elevations of 4800' and 8500'.

Linaria dalmatica (L.) Mill. (Plantaginaceae) is an herbaceous perennial known by the common name Dalmatian toadflax (Ackerfield, 2013) (Fig. 2.22). Originally native to the Mediterranean, *L. dalmatica* was introduced into North America in the late 1800s to early 1900s, where it quickly spread, both as an ornamental and through natural dispersal (Alex, 1962; Robocker, 1974; Lajeunesse, 1999). Currently, *L. dalmatica* is distributed across most of Canada and the United States, with the exception of the southeastern states (USDA NRCS, 2014) (Fig. 2.23). It is classified as a noxious weed in seven states; in Colorado, it is listed as a Noxious Weed List B species (USDA NRCS, 2014). It is scattered across Colorado, and is typically found along roadsides, in meadows and in disturbed locations, between 4600' and 9400' in elevation (Ackerfield, 2013; SEINet, 2014; USDA NRCS, 2014) (Fig. 2.24).

MATERIALS AND METHODS

While hiking in RMOS and SPNA as part of a larger botanical inventory project in 2012 – 2013 (see Chapter I), I also searched for the eight species of interest, as designated by Larimer County and City of Fort Collins officials, in an attempt to generate geographically unbiased distribution data. Boring (Larimer County) and Strouse (City of Fort Collins) identified the species of interest in the spring of 2013, thus I primarily conducted the distribution surveys between April – September 2013, during my second field season of general inventorying. While conducting fieldwork, I did occasionally travel on the public trails, however, the majority of my



Figure 2.19. *Cirsium flodmanii* habit.

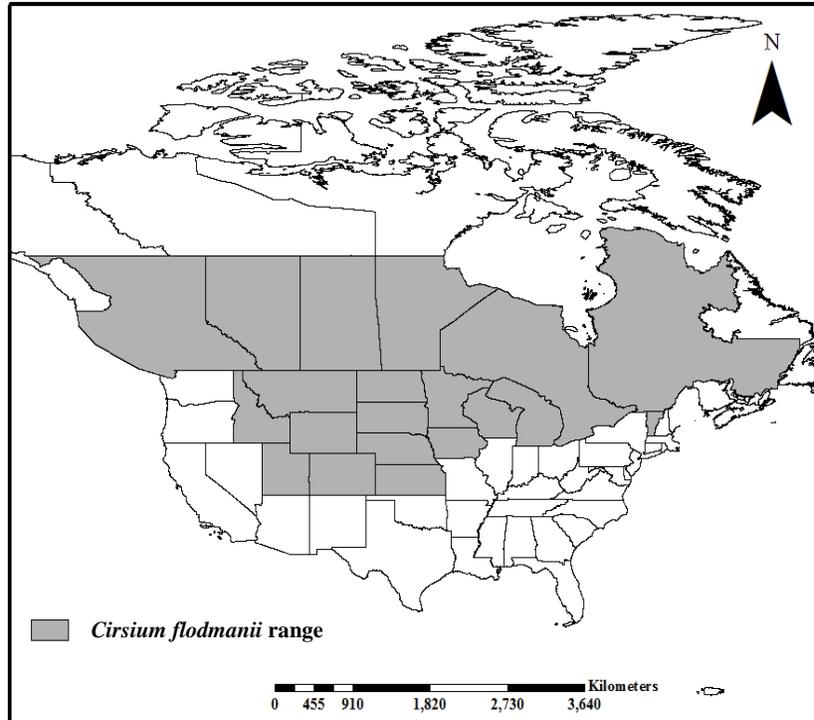


Figure 2.20. Native range of *Cirsium flodmanii* in North America. Distribution data from USDA NRCS (2014).

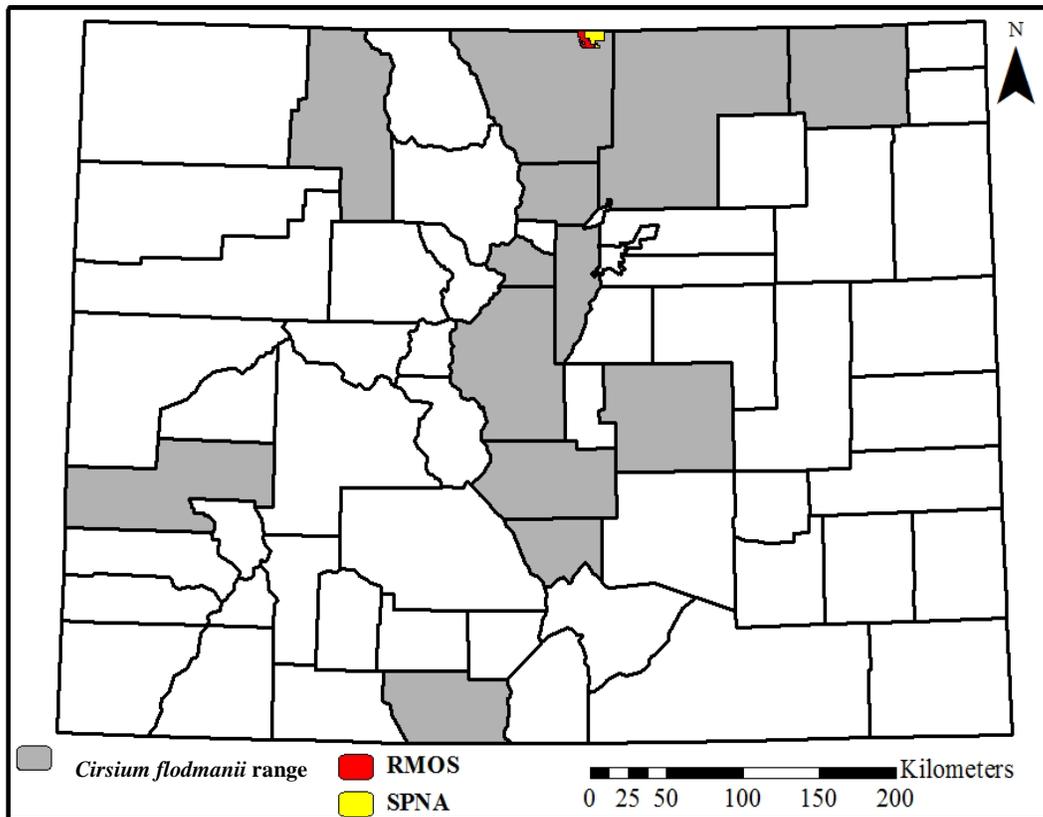


Figure 2.21. Native range of *Cirsium flodmanii* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).



Figure 2.22. *Linaria dalmatICA* inflorescence.

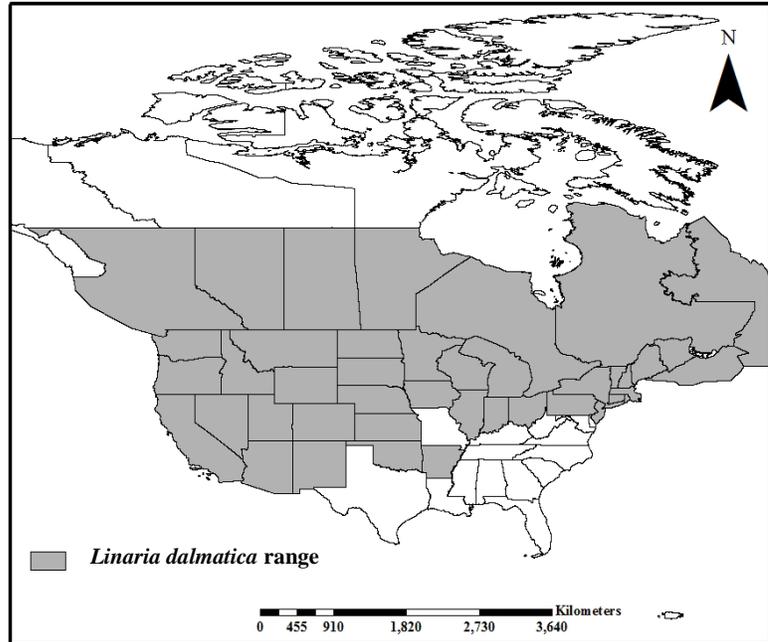


Figure 2.23. Current range of *Linaria dalmatICA* in North America (introduced). Distribution data from USDA NRCS (2014).

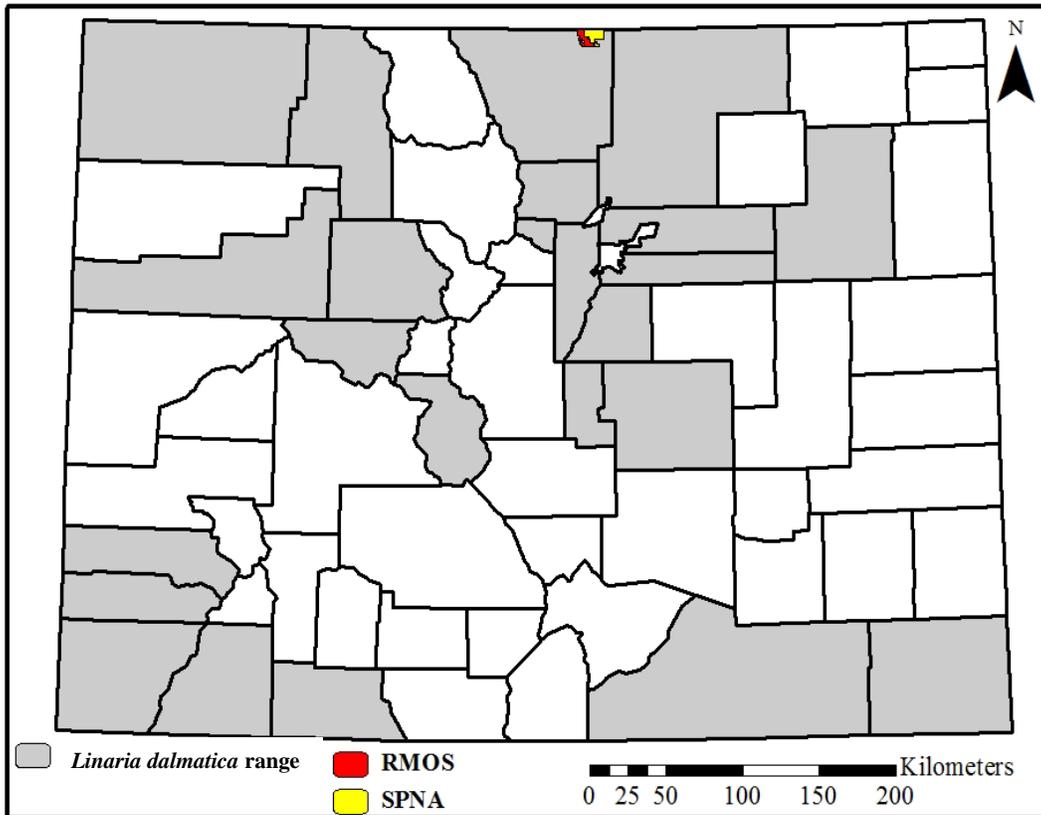


Figure 2.24. Distribution of *Linaria dalmatICA* in Colorado shown in relation to RMOS and SPNA. Distribution data compiled from SEINet (2014) and USDA NRCS (2014).

data were collected off-trail, while travelling to my off-trail destinations as designated in Chapter I, thereby deeming it unbiased. When I encountered a population of one of the eight species, I first verified its identity to species level using a technical dichotomous floral key (Weber and Wittman, 2001). Once confirmed, I then took a GPS waypoint with a Garmin GPSmap 62s GPS unit to document the latitude, longitude and elevation of the population. Additionally, I recorded the date, detailed locality information, habitat, dominant associated species, and the estimated population size. I also took representative photographs of each species with a Canon PowerShot SX200 IS digital camera.

Once I completed my field observations, I downloaded the GPS waypoints into Esri's ArcGIS ArcMap 10 (2010) mapping software program via Minnesota Department of Natural Resources' DNRGPS Application (6.0.0.15). At this time, I also searched my 2012 inventory data (Chapter I) for any additional population locations that I encountered prior to April 2013. For these data, I was missing estimated population sizes (all other database fields were noted upon the time of collection), and therefore, I used photographs of the species' surrounding areas to estimate the population sizes as accurately as possible. I added the 2012 distribution data points to my 2013 dataset and then overlaid all of the waypoints onto one map document per species. Each map displays 'World Imagery,' which I freely accessed from the ArcGIS Online database, and RMOS and SPNA boundary shapefiles, which I downloaded from The City of Fort Collins 'Free Downloadable GIS Data: Natural Areas' web page (<http://www.fcgov.com/gis/downloadable-data.php>). I also freely downloaded and overlaid aspect, geology and soil layers onto my maps; I obtained the aspect layer (Terrain DEM Elevation layer) from the ArcGIS Online database, the soil layer from the U.S. Department of Agriculture, Natural Resources Conservation Service, NRCS Soil Data for Colorado

(<http://soildatamart.nrcs.usda.gov/County.aspx?State=CO>), and the geology layer from the U.S. Geological Service, Mineral Resources On-Line Spatial Data, Colorado geologic map data website (<http://pubs.usgs.gov/of/2005/1351>). I used these layers to determine the aspect, geology and soil characteristics for each data point, which I then entered into the corresponding ArcMap attribute table of each species' shapefile, along with the information I noted while in the field.

RESULTS

Solidago ptarmicoides

While conducting my primary-distribution-map observations, from April – September 2013, I did not encounter any populations of *S. ptarmicoides* at either SPNA or RMOS. However, during the 2012 season of my botanical inventory (Chapter I), I discovered two populations of *S. ptarmicoides*, both located in RMOS. Although this was a species specifically requested for documenting at SPNA, these data can still provide valuable insight about the species and its distribution in general.

The two populations of *S. ptarmicoides* are both located in the northwest portion of RMOS, relatively close to one another, approximately 0.6 mile west of the Ruby Wash Trail (Fig. 2.25). The localities where I documented the populations are roughly 7000' in elevation (6977' and 7037'), and composed of mudstone/sandstone geology and rock-outcrop complex soils (Table 2.1). One population is located in an overgrown drainage wash within a south-facing meadow, while the other population is growing in a small, rocky drainage with a southeast-facing aspect. The predominant species growing in association with the populations of *S. ptarmicoides* included *Cercocarpus montanus*, *Grindelia subalpina*, *Hedeoma drummondii*,

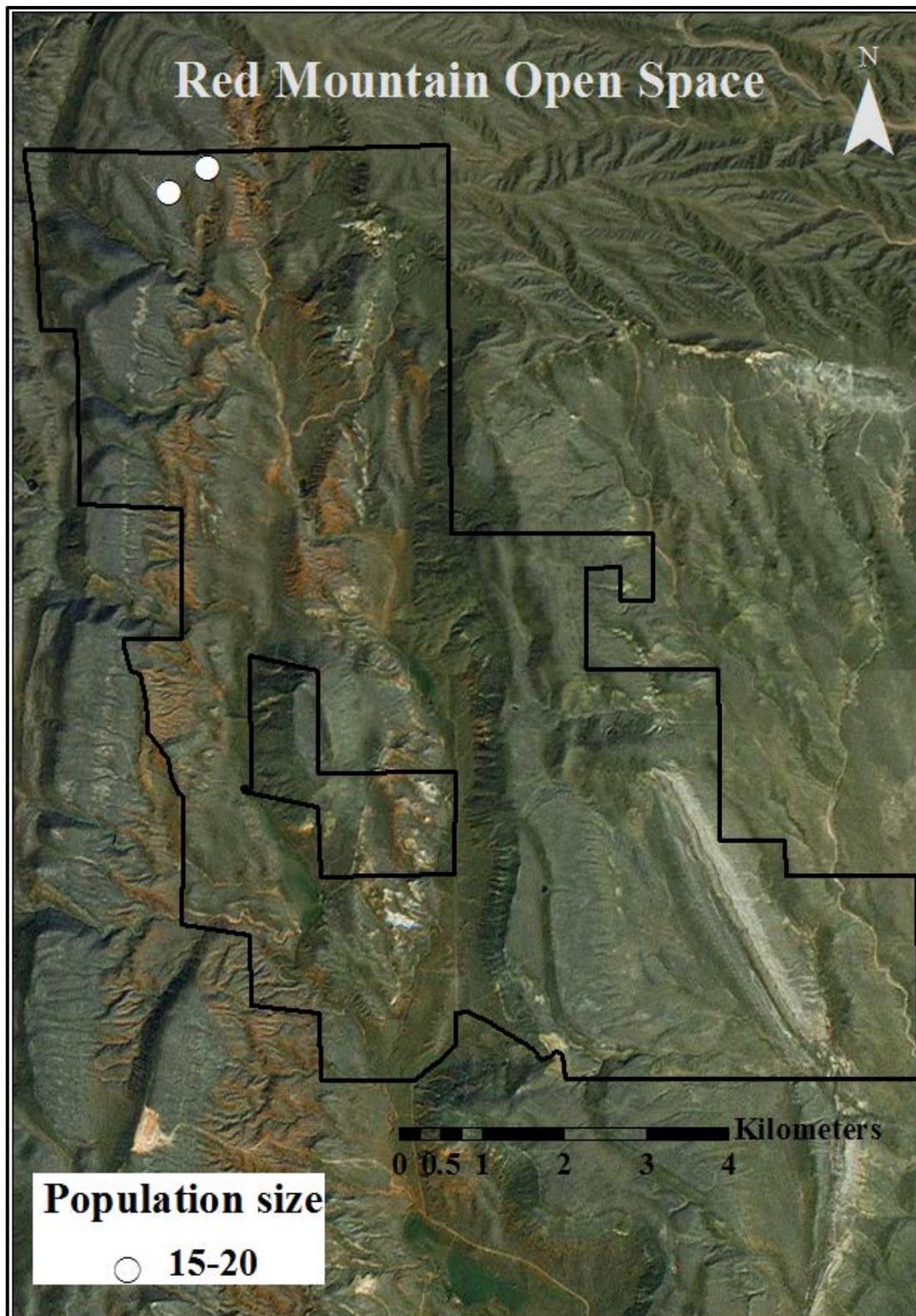


Fig. 2.25. *Solidago ptarmicoides* distribution map displaying population locations within Red Mountain Open Space.

Table 2.1. Distribution data for *Solidago ptarmicoides* populations found in Red Mountain Open Space in 2012, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population sizes.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	8/2/2012	40.996166 -105.18763 6977'	Red Mountain Open Space; In a meadow-like wash on northern end of property, ca. 0.6 mile west of Ruby Wash Trail and 0.1 mile south of northern RMOS boundary	Triassic-Permian mudstone/sandstone	Tieside, north slopes-Rock-outcrop complex, 10 to 45 percent slopes "Complex"	<i>Hedeoma drummondii</i> , <i>Linaria dalmatica</i> and Poaceae	15-20
2	8/10/2012	40.993598 -105.193209 7037'	Red Mountain Open Space; In a small drainage north of Haygood Canyon, ca. 0.6 mile west of Ruby Wash Trail and 0.3 mile south of northern RMOS boundary	Triassic-Permian mudstone/sandstone	Tieside, north slopes-Rock-outcrop complex, 10 to 45 percent slopes "Complex"	<i>Cercocarpus montanus</i> , <i>Grindelia subalpina</i> , <i>Juniperus scopulorum</i> , <i>Pinus ponderosa</i> , and Poaceae	15-20

Juniperus scopulorum, *Linaria dalmatica*, *Pinus ponderosa* var. *scopulorum*, and various genera/species within the Poaceae family. Both populations contain approximately 15 – 20 individuals, but as noted previously, this was a rough estimation based on photographs, as they were noted in 2012 before I began my formal distribution observations.

Stephanomeria runcinata

I documented 13 populations of *S. runcinata*, 11 of which I noted in 2013, and the remaining two were documentations from my botanical inventory collection in 2012. As this was designated a species of interest for SPNA, 10 of these records are specifically from this locale, however, as noted previously, distribution data from nearby RMOS could also provide valuable information, and thus, three records are reported from RMOS (Fig. 2.26).

All populations were found growing between the elevations of 6242' and 7084', and present on all aspects except east or west-facing locations. The underlying geology associated with these populations of *S. runcinata* is variable, but mainly consists of sandstone, mudstone and/or claystone (Table 2.2). Similarly, the soil types are also variable, but are primarily loams and rock-outcrop complexes. The ecological habitats associated with these 13 populations include steep gravelly hillsides, highly eroded drainages and shortgrass prairie. The populations range in size from less than five individuals, to upwards of 100 individuals, with the majority of the populations containing between 5 – 25 plants (Table 2.2). As the habitat of *S. runcinata* varies across RMOS and SPNA, so does the dominant associated species; the most frequently encountered associated species included *Achnatherum hymenoides*, *Artemisia frigida*, *Bouteloua gracilis*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Eriogonum brevicaulis* var. *brevicaule*, *Glycyrrhiza lepidota*, *Gutierrezia sarothrae*, *Helianthus pumilus*, *Musineon tenuifolium*, *Opuntia*

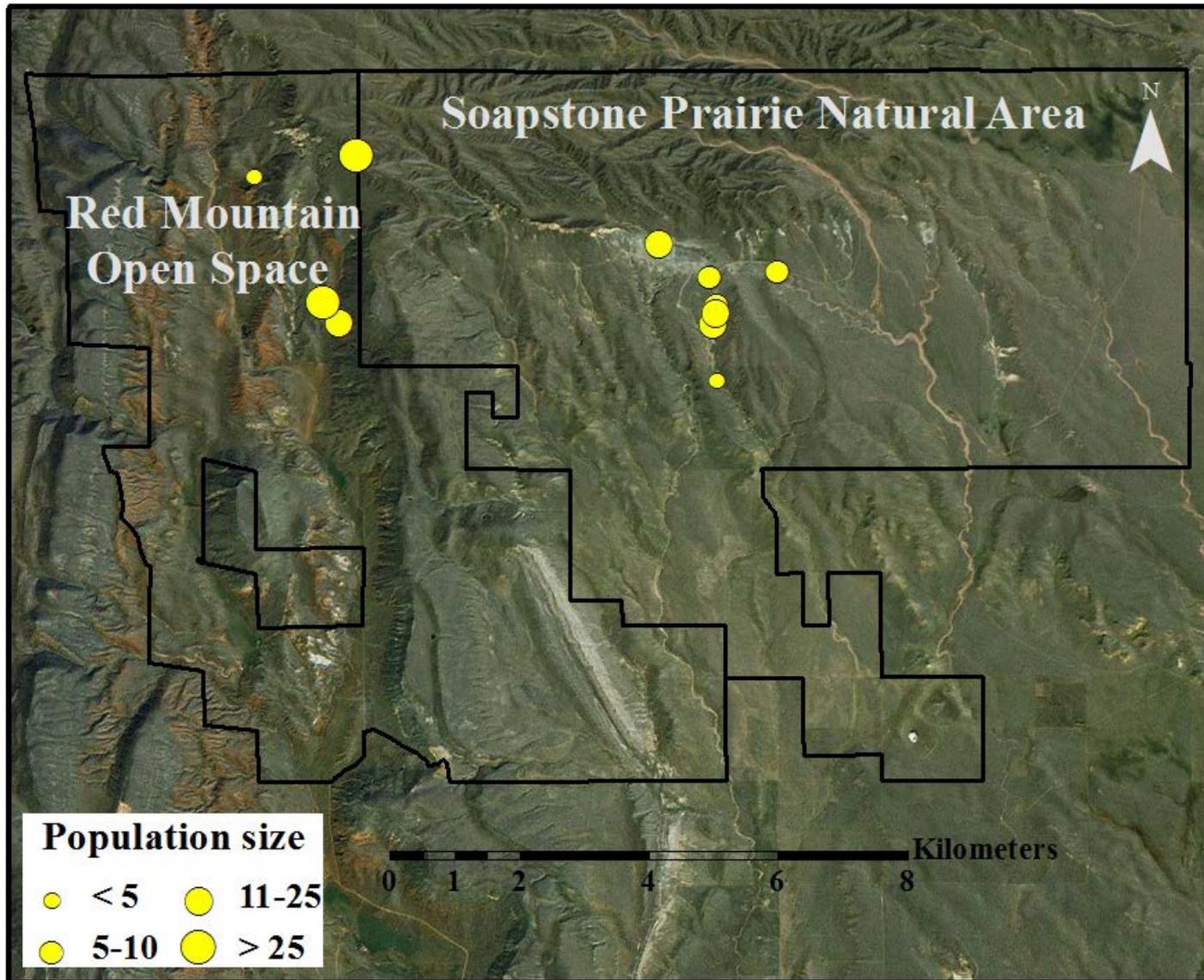


Figure 2.26. *Stephanomeria runcinata* distribution map showing population localities within both Soapstone Prairie Natural Area and Red Mountain Open Space. The size of the circle corresponds to the population size.

Table 2.2. Distribution data for *Stephanomeria runcinata* populations found in Red Mountain Open Space and Soapstone Prairie Natural Area in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population sizes.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	8/9/2012	40.983845, -105.172156 6728'	Red Mountain Open Space; On a steep red limestone wash, ca. 0.4 mile east of Ruby Wash Trail and 1 mile south of northern RMOS boundary	Cretaceous-Jurassic sandstone/mudstone	Purner-Rock-outcrop complex, 10 to 50 percent slopes "Complex"	<i>Eriogonum</i> sp. and <i>Musineon tenuifolium</i>	< 5
2	8/16/2012	40.974227, -105.097626 6488'	Soapstone Prairie Natural Area; White sandy soil at base of Lindenmeier Site, ca. 0.2 mile southwest of upper parking lot	Tertiary sandstone/claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Cercocarpus montanus</i> , <i>Ericameria nauseosa</i> and <i>Rhus trilobata</i>	~20
3	5/31/2013	40.963463, -105.156632 6337'	Red Mountain Open Space; Red limestone hillside at base of bluff on eastern edge of property, ca. 0.5 mile NE of parking lot	Triassic-Permian mudstone/sandstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Cercocarpus montanus</i> , <i>Opuntia polyacantha</i> and Poaceae	~15
4	5/31/2013	40.966349, -105.159324 6366'	Red Mountain Open Space; Highly eroded drainage network in red limestone at base of bluffs on eastern property boundary	Triassic-Permian mudstone/sandstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Ericameria nauseosa</i> , Poaceae and <i>Sphaeralcea coccinea</i>	>50
5	7/22/2013	40.986954, -105.153326 7082'	Soapstone Prairie Natural Area; Side of Cheyenne Rim Trail, just over Red Mountain Open Space eastern boundary	Tertiary sandstone/conglomerate	Larim gravelly sandy loam, 5 to 40 percent slopes "Consociation"	<i>Cercocarpus montanus</i> , <i>Eriogonum brevicaule</i> and <i>Oryzopsis hymenoides</i>	~20
6	7/22/2013	40.986746, -105.153192 7084'	Soapstone Prairie Natural Area; Side of Cheyenne Rim Trail, just over Red Mountain Open Space eastern boundary	Tertiary sandstone/claystone	Altvan loam, 3 to 9 percent slopes "Consociation"	<i>Cercocarpus montanus</i> and <i>Eriogonum brevicaule</i>	~50-100

Table 2.2 continued.

7	9/1/2013	40.955117, -105.087103 6242'	Soapstone Prairie Natural Area; Grassy hillside on west side of prominent drainage just east of Antelope Valley Road, ca. 0.8 mile north(west) of southern parking lot	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Bouteloua gracilis</i> and <i>Rhus trilobata</i>	< 5
8	9/1/2013	40.962765, -105.088343 6315'	Soapstone Prairie Natural Area; In center of prominent drainage just east of Antelope Valley Road, ca. 0.5 mile south of maintenance road that runs E-W below maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Glycyrrhiza lepidota</i> , <i>Gutierrezia sarothrae</i> , and <i>Rhus trilobata</i>	< 5
9	9/1/2013	40.963065, -105.087975 6316'	Soapstone Prairie Natural Area; In center of prominent drainage just east of Antelope Valley Road, ca. 0.5 mile south of maintenance road that runs E-W below maintenance house, in very white, sandy soil	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Gutierrezia sarothrae</i> and <i>Rhus trilobata</i>	~ 10-20
10	9/1/2013	40.964605, -105.087423 6338'	Soapstone Prairie Natural Area; Grassy hillside east of prominent drainage just east of Antelope Valley Road, ca. 0.4 mile south of maintenance road that runs E-W below maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Gutierrezia sarothrae</i> and <i>Rhus trilobata</i>	~25
11	9/1/2013	40.965764, -105.086984 6361'	Soapstone Prairie Natural Area; Sandy mound east of steep cliff within prominent drainage, just east of Antelope Valley Road, ca. 0.3 mile south of maintenance road that runs E-W below maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Bouteloua gracilis</i> , <i>Helianthus pumilus</i> and <i>Stipa comata</i>	5-10
12	9/1/2013	40.96966, -105.088351 6415'	Soapstone Prairie Natural Area; Sandy meadow next to prominent drainage just east of Antelope Valley road, just south of intersection with maintenance road that runs E-W below maintenance house	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Bouteloua gracilis</i> , <i>Eriogonum brevicaulis</i> , and <i>Rhus trilobata</i>	~10

Table 2.2 continued.

13	9/1/2013	40.970327, -105.075752 6377'	Soapstone Prairie Natural Area; South of maintenance road that runs E-W below maintenance house, just south of house, in sandy soil of shortgrass prairie	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Bouteloua gracilis</i> , <i>Gutierrezia sarothrae</i> and <i>Rhus trilobata</i>	~10
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Table 2.3. Distribution data for *Pediomelum esculentum* populations found in Soapstone Prairie Natural Area in 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	6/18/2013	40.984588 -105.030666 6375'	Soapstone Prairie Natural Area; Moist drainage swale leading into Spottlewood Creek, ca. 1.5 miles southeast of northwest corner of Plover Trail	Tertiary sandstone/ claystone	Keith silty clay loam, 0 to 3 percent slopes "Consociation"	<i>Koeleria macrantha</i> , <i>Packera fendleri</i> and <i>Scutellaria britonnii</i>	~15

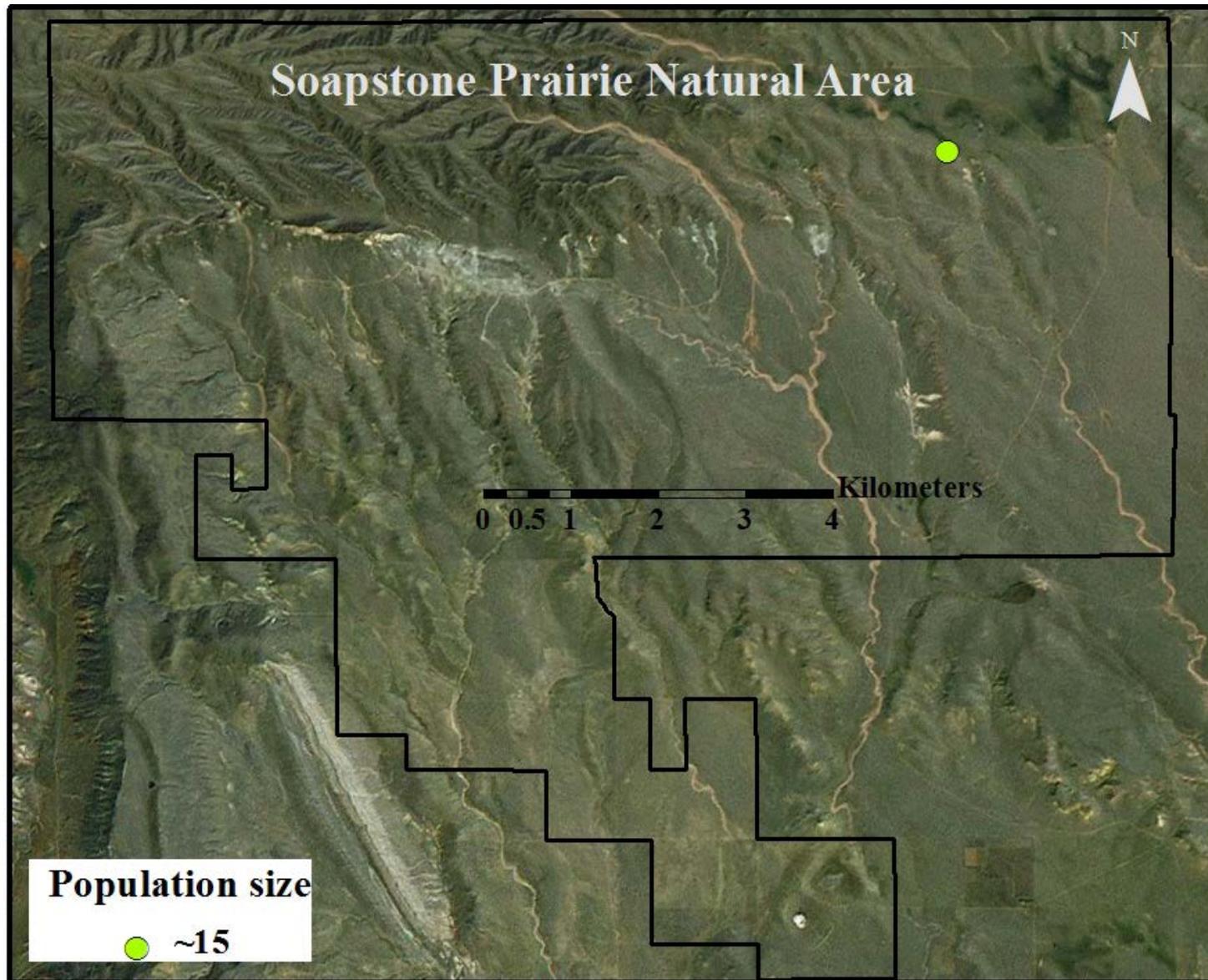


Figure 2.27. *Pediomelum esculentum* distribution map showing population localities within Soapstone Prairie Natural Area.

polyacantha var. *polyacantha*, *Rhus trilobata* var. *trilobata*, *Sphaeralcea coccinea*, and *Stipa comata*.

Pediomelum esculentum

Throughout both my 2012 and 2013 field seasons, I encountered a single population of *P. esculentum* in the northeastern region of SPNA, which is located in a moist drainage swale feeding into Spottlewood Creek (Table 2.3; Fig. 2.27). The population is comprised of approximately 15 individuals and is situated on an east-facing aspect at 6375' in elevation. The soil type found at this site is a silty clay loam with an underlying geology of sandstone/claystone (Table 2.3). The main associated species surrounding *P. esculentum* at this site consist of *Koeleria macrantha*, *Packera fendleri* and *Scutellaria britonii*.

Mentzelia speciosa

I documented two populations of *M. speciosa* in SPNA; one in 2012 and one in 2013 (Fig. 2.28; Table 2.4). Both populations consist of less than 25 individuals and were found between 6485 – 6833' in elevation. One population is present on a southeast-facing aspect, while the other is on a northeast facing aspect. The associated soils consist of complexes and sandy loams, while the geology is mainly comprised of sandstone and/or claystone. Both populations were documented in gravel washes off the side of public trails growing with such associated species as *Achnatherum hymenoides*, *Bouteloua gracilis*, *Geranium caespitosum*, *Linaria dalmatica*, *Opuntia polyacantha* var. *polyacantha*, *Rhus trilobata* var. *trilobata*, and *Rosa woodsii*.

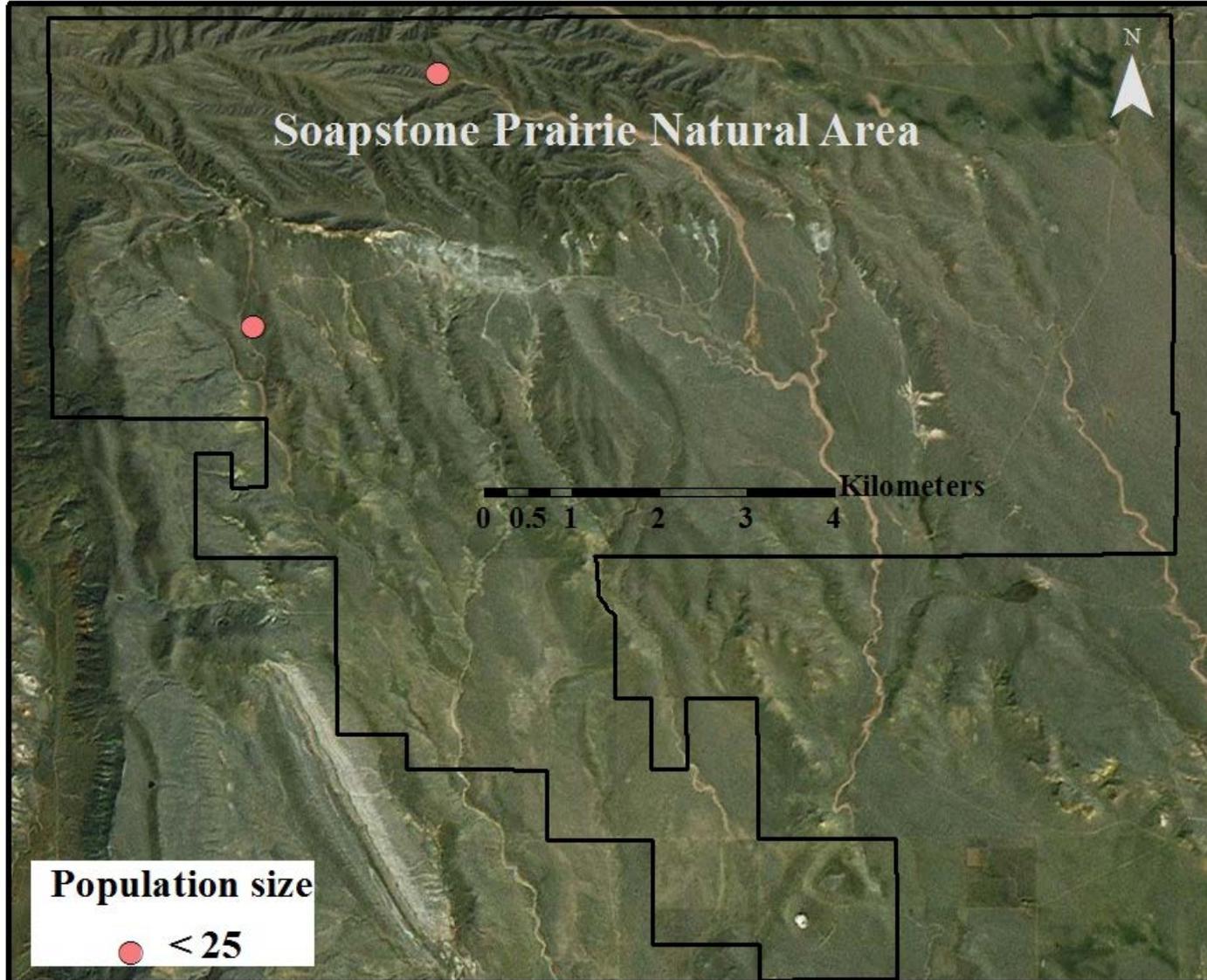


Figure 2.28. *Mentzelia speciosa* distribution map showing population localities within Soapstone Prairie Natural Area.

Table 2.4. Distribution data for *Mentzelia speciosa* populations found in Soapstone Prairie Natural Area in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	7/22/2012	40.966656 -105.12531 6485'	Soapstone Prairie Natural Area; Cheyenne Rim Trail, at trail and gravelly sandwash, ca. 1.5 miles north of <i>Pinus ponderosa</i> forest	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Opuntia polyacantha</i> , <i>Bouteloua gracilis</i> , <i>Linaria dalmatica</i> , <i>Rhus trilobata</i> , and <i>Geranium caespitosum</i>	< 25
2	6/26/2013	40.992587 -105.100004 6833'	Soapstone Prairie Natural Area; Gravel wash on north side of Canyon Trail, ca. 2.3 miles west of intersection with Sand Wash Trail	Tertiary sandstone/ conglomerate	Paoli fine sandy loam, 0 to 1 percent slopes "Consociation"	<i>Achnatherum hymenoides</i> , <i>Linaria dalmatica</i> , <i>Oreocarya thyrsoiflora</i> , <i>Rosa woodsii</i>	< 25

Mirabilis linearis

Between April – September of 2013, I documented 12 *M. linearis* populations, 11 of which I encountered at SPNA and one at RMOS. I also documented two additional populations occurring at SPNA while conducting field work in 2012 (Fig. 2.29). All 14 populations consist of no more than 10 individuals, with the majority containing less than five. The elevational range of the population sites is between 6098' and 7144' and they occur on all aspects except northwest and southeast facing locales. The soil types range from various types of loams (clay, sandy, and silt) to rock-outcrop complexes and the associated geology consists of predominantly sandstone, claystone and mudstone, although two populations were found growing on shale/bentonite (Table 2.5). The overall habitats where the populations exist vary from shortgrass prairie, dry stream banks, drainage swales, and gravelly soil along the public trails. There were many additional species growing in association with *M. linearis*, including *Achnatherum hymenoides*, *Artemisia frigida*, *Astragalus* spp., *Bouteloua gracilis*, *Buchloë dactyloides*, *Dalea candida*, *Eremogone fendleri*, *Eriogonum* spp., *Gutierrezia sarothrae*, *Helianthus pumilus*, *Heterotheca villosa*, *Iva axillaris*, *Liatris punctata*, *Linaria dalmatica*, *Lygodesmia juncea*, *Opuntia polyacantha* var. *polyacantha*, *Potentilla* spp., *Pseudoroegneria spicata*, *Rhus trilobata* var. *trilobata*, *Sphaeralcea coccinea*, *Stipa comata*, and *Yucca glauca* var. *glauca*.

Penstemon eriantherus

I encountered 24 populations of *P. eriantherus*; 22 in 2013 and two from my botanical inventory survey in 2012 (Chapter I). The majority of the populations (21) were documented at SPNA, as The City of Fort Collins specifically requested this information, however I included the three localities at RMOS, as these data may also be useful for future management inquiries

(Table 2.6; Fig. 2.30). The populations are growing between the elevations of 6112' and 6841' and present on all aspects, except northwest-facing. They range in size from less than five individuals, to upwards of 25 individuals, however, most sites contain between 5 and 10 plants (Table 2.6). The underlying geology of *P. eriantherus* sites includes sandstone, mudstone, claystone, or (Table 2.6; Fig. 2.30). The populations are growing between the elevations of 6112' and 6841' and present on all aspects, except northwest-facing. They range in size from less than five individuals, to upwards of 25 individuals, however, most sites contain between 5 and 10 plants (Table 2.6). The underlying geology of *P. eriantherus* sites includes sandstone, mudstone, claystone, or shale/bentonite, while the soil types range from clay loams to silt loams, or rock-outcrop complexes. Due to the number of *P. eriantherus* encounters, there was a great diversity of associated species, including *Allium textile*, *Artemisia frigida*, *Astragalus drummondii*, *Atriplex canescens*, *Cercocarpus montanus*, *Ericameria nauseosa*, *Gutierrezia sarothrae*, *Harbouria trachypleura*, *Linaria dalmatica*, *Musineon divaricatum*, *M. tenuifolium*, *Opuntia polyacantha* var. *polyacantha*, *Oxytropis sericea*, *Penstemon angustifolius*, *P. secundiflorus*, various genera/species of Poaceae, *Rhus trilobata* var. *trilobata*, and *Yucca glauca* var. *glauca*.

Cirsium flodmanii

Within RMOS, I did not encounter any populations of *C. flodmanii* throughout my 2012 and 2013 collecting seasons. Although this was designated as a species of interest for RMOS specifically, I did note three additional populations of *C. flodmanii* within SPNA, two in 2012 and one in 2013, which I have included in the distribution-data results (Fig. 2.31). All three of the populations were found in moist locations, such as wetlands and drainage gullies, which are characteristic habitats for this species.

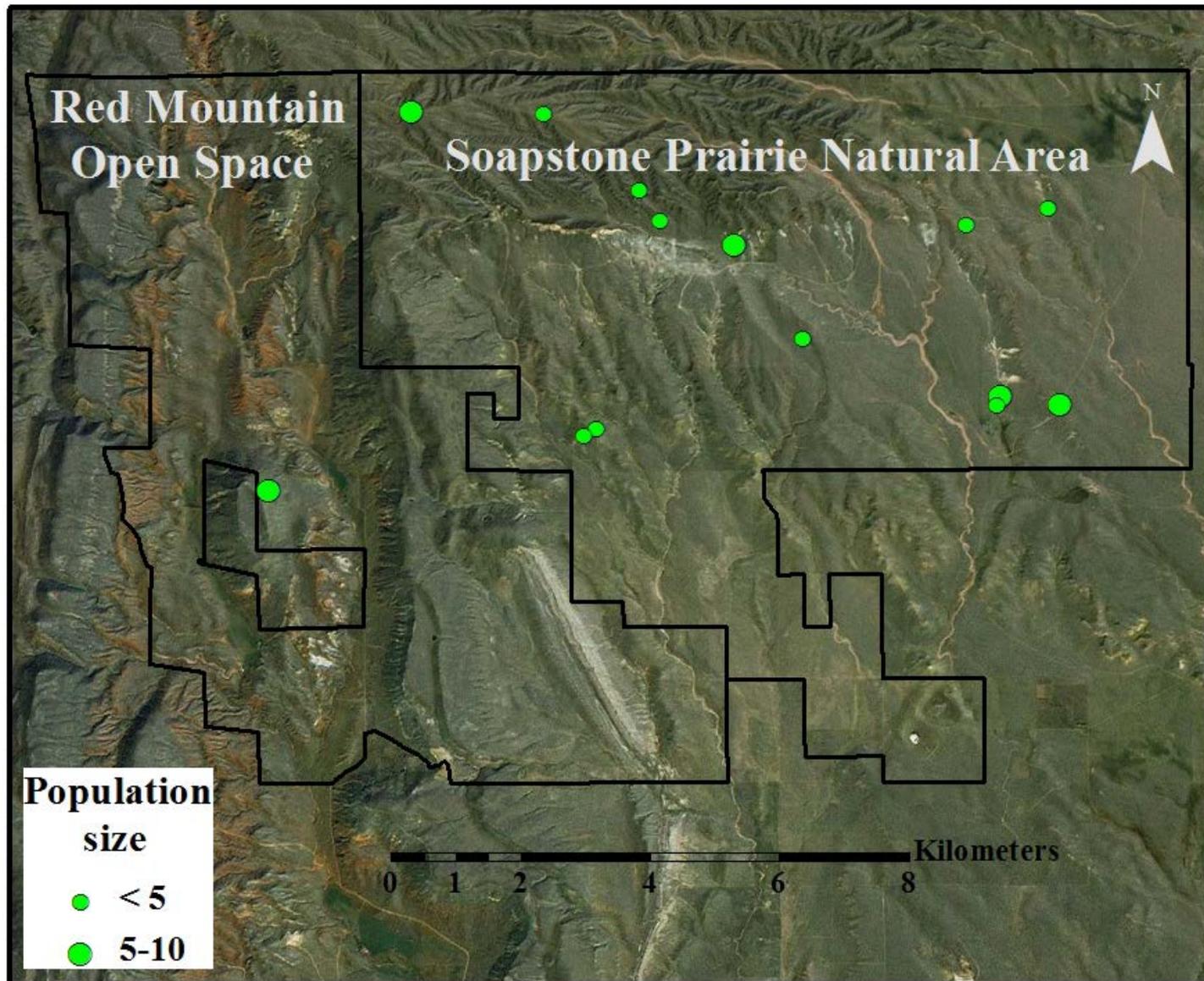


Figure 2.29. *Mirabilis linearis* distribution map showing population localities within both Soapstone Prairie Natural Area and Red Mountain Open Space. The size of the circle corresponds to the population size.

Table 2.5. Distribution data for *Mirabilis linearis* populations found in Soapstone Prairie Natural Area and Red Mountain Open Space in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	8/7/2012	40.951793, -105.024304 6168'	Soapstone Prairie Natural Area; In shortgrass prairie on eastern leg of Plover Trail, ca. 0.75 mile north of southern tip of trail	Tertiary sandstone/ claystone	Altvan loam, 0 to 3 percent slopes "Consociation"	<i>Bouteloua gracilis</i> , <i>Buchloë dactyloides</i> and <i>Sphaeralcea coccinea</i>	~10
2	8/16/2012	40.97417, -105.083932 6461'	Soapstone Prairie Natural Area; Ca. 0.2 mile east of Rawhide Flats Road in shortgrass prairie, 0.5 mile southeast of upper parking lot	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Bouteloua gracilis</i> , <i>Liatris punctata</i> , <i>Opuntia polyacantha</i> , and <i>Stipa comata</i>	~5-10
3	7/18/2013	40.940351, -105.169814 6368'	Red Mountain Open Space; Eastern approach to Table Mountain	Cretaceous- Jurassic sandstone /mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Opuntia polyacantha</i> , <i>Pseudoroegneria spicata</i> and <i>Yucca glauca</i>	~5-10
4	7/22/2013	40.98186, -105.101556 6752'	Soapstone Prairie Natural Area; Side of Towhee Loop Trail, ca 0.4 mile from trailhead/northern parking lot	Tertiary sandstone/ conglomerate	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Helianthus pumilus</i> , <i>Opuntia polyacantha</i> , <i>Stipa comata</i> , and <i>Yucca glauca</i>	1
5	7/22/2013	40.99243, -105.119101 7059'	Soapstone Prairie Natural Area; Side of Canyon Trail, ca. 0.9 mile west of intersection with Towhee Loop Trail	Tertiary sandstone/ conglomerate	Altvan loam, 3 to 9 percent slopes "Consociation"	<i>Artemisia frigida</i> , <i>Bouteloua gracilis</i> , <i>Eremogone fendleri</i> , and <i>Potentilla</i> spp.	1
6	7/22/2013	40.993004, -105.143116 7144'	Soapstone Prairie Natural Area; Side of Canyon Trail, ca. 2.25 miles west of intersection with Towhee Loop Trail	Tertiary sandstone/ conglomerate	Altvan loam, 3 to 9 percent slopes "Consociation"	<i>Artemisia frigida</i> , <i>Astragalus</i> spp., <i>Eremogone fendleri</i> , and <i>Heterotheca villosa</i>	~5-10

Table 2.5 continued.

7	7/23/2013	40.951632, -105.035942 6098'	Soapstone Prairie Natural Area; Near creek that runs through southern wet meadow, inside southern portion of Plover Trail, ca. 0.5 mile north of southern property boundary	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Buchloë dactyloides</i> , <i>Eriogonum</i> spp., <i>Lygodesmia juncea</i> , <i>Sphaeralcea coccinea</i> ,	<5
8	7/23/2013	40.953042, -105.035237 6111'	Soapstone Prairie Natural Area; Near creek that runs through southern wet meadow, inside southern portion of Plover Trail, ca. 0.7 mile north of southern property boundary	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Bouteloua gracilis</i> , <i>Iva axillaris</i> and <i>Lygodesmia juncea</i>	~10
9	8/6/2013	40.948628, -105.109474 6260'	Soapstone Prairie Natural Area; West of Rawhide Creek in sandy soil, ca. 0.25 mile north of Cheyenne Rim Trail and 0.75 mile east of ponderosa pine forest	Cretaceous shale/bentonite	Midway clay loam, 5 to 25 percent slopes "Consociation"	<i>Achnatherum hymenoides</i> , <i>Eriogonum</i> sp., <i>Yucca glauca</i>	<5
10	8/6/2013	40.947641, -105.111836 6263'	Soapstone Prairie Natural Area; West of Rawhide Creek in sandy soil, ca. 0.2 mile north of Cheyenne Rim Trail and 0.6 mile east of ponderosa pine forest	Cretaceous shale/bentonite	Midway clay loam, 5 to 25 percent slopes "Consociation"	<i>Dalea candida</i> , <i>Linaria dalmatica</i> , <i>Rhus trilobata</i> , and <i>Yucca glauca</i>	<5
11	8/19/2013	40.978919, -105.026395 6334'	Soapstone Prairie Natural Area; Side of Spottlewood Creek, ca. 2.25 miles southeast of northeast corner of Plover Trail	Tertiary sandstone/ claystone	Paoli fine sandy loam, 0 to 1 percent slopes "Consociation"	<i>Bouteloua gracilis</i> , <i>Liatris punctata</i> and <i>Stipa comata</i>	<5
12	8/19/2013	40.976828, -105.041421 6413'	Soapstone Prairie Natural Area; West side of Spottlewood Creek, ca 0.7 mile west of creek, in a drainage swale of a grassy meadow	Tertiary sandstone/ conglomerate	Altvan loam, 3 to 9 percent slopes "Consociation"	<i>Artemisia frigida</i> , <i>Bouteloua gracilis</i> , and <i>Gutierrezia sarothrae</i>	<5
13	9/1/2013	40.96093, -105.071539 6342'	Soapstone Prairie Natural Area; Shortgrass prairie ca. 0.25 mile east of westernmost leg of Pronghorn Loop, roughly half way between northern and southern parking lots	Tertiary sandstone/ claystone	Altvan loam, 3 to 9 percent slopes "Consociation"	<i>Bouteloua gracilis</i> and <i>Opuntia polyacantha</i>	<5

Table 2.5 continued.

14	9/29/2013	40.977563, -105.09767 6658'	Soapstone Prairie Natural Area; Off side of Lindenmeier Overlook Trail	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Achnatherum hymenoides</i> , <i>Gutierrezia sarthrae</i> and <i>Helianthus pumilus</i>	~5
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Table 2.6. Distribution data for *Penstemon eriantherus* populations found in Soapstone Prairie Natural Area and Red Mountain Open Space in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	5/28/2012	40.993544 -105.171156 6764'	Red Mountain Open Space; Salt Lick Trail, ca. 0.4 miles from northern RMOS boundary, directly on side of trail	Cretaceous-Jurassic sandstone/ mudstone	Redthayne-Tyzak- Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Harbouria trachypleura</i> , <i>Linaria dalmatica</i> , <i>Rhus trilobata</i> , and Poaceae	~5
2	6/8/2012	40.997374 -105.172939 6841'	Red Mountain Open Space; Salt Lick Trail, at northern most tip of trail, right at the CO/WY border	Cretaceous-Jurassic sandstone/ mudstone	Redthayne-Tyzak- Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Cercocarpus montanus</i> , <i>Opuntia polyacantha</i> and Poaceae	1
3	6/7/2013	40.946798 -105.079365 6112'	Soapstone Prairie Natural Area; Grassy hillside on side of prominent drainage east of Rawhide Flats Road, ca. 0.25 mile NE of southern parking lot	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Gutierrezia sarthrae</i> , <i>Musineon divaricatum</i> and <i>Vicia americana</i>	<5

Table 2.6 continued.

4	6/7/2013	40.948406 -105.080832 6145'	Soapstone Prairie Natural Area; Gravelly wash on eastern side of prominent drainage east of Rawhide Flats Road, ca. 0.3 mile north of southern parking lot and 0.25 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Achnatherum hymenoides</i> , <i>Rhus trilobata</i> and <i>Sphaeralcea coccinea</i>	~10
5	6/7/2013	40.948548 -105.080887 6155'	Soapstone Prairie Natural Area; Gravelly wash on eastern side of prominent drainage east of Rawhide Flats Road, ca. 0.3 mile north of southern parking lot and 0.25 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Rhus trilobata</i> and <i>Sphaeralcea coccinea</i>	~5
6	6/7/2013	40.948637 -105.081091 6149'	Soapstone Prairie Natural Area; Gravelly wash on eastern side of prominent drainage east of Rawhide Flats Road, ca. 0.3 mile north of southern parking lot and 0.25 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Rhus trilobata</i> and <i>Sphaeralcea coccinea</i>	~5
7	6/7/2013	40.949051 -105.081516 6155'	Soapstone Prairie Natural Area; Center of prominent drainage swale on east side of Rawhide Flats Road, ca. 0.35 north of southern parking lot and 0.2 east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Achnatherum hymenoides</i> and <i>Atriplex canescens</i>	~20
8	6/7/2013	40.949814 -105.081933 6167'	Soapstone Prairie Natural Area; Sandy wash near cottonwoods in center of prominent drainage swale east of Rawhide Flats Road, ca. 0.45 mile north of southern parking lot and 0.2 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Atriplex canescens</i> , <i>Convolvulus arvensis</i> , <i>Linum lewisii</i> , and Poaceae,	~10
9	6/7/2013	40.950883 -105.082655 6183'	Soapstone Prairie Natural Area; Grassy hillside on east side of prominent drainage swale just east of Rawhide Flats Road, ca. 0.5 mile north of southern parking lot and 0.2 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Astragalus drummondii</i> , <i>Penstemon angustifolius</i> , <i>Rhus trilobata</i> , and <i>Vicia americana</i>	<5
10	6/7/2013	40.950883 -105.082655 6183'	Soapstone Prairie Natural Area; Center of prominent drainage swale just east of Rawhide Flats Road, ca. 0.6 mile north of southern parking lot and 0.15 mile east of road	Cretaceous shale/bentonite	Renohill-Midway clay loams, 3 to 15 percent slopes "Complex"	<i>Astragalus</i> sp., <i>Ericameria nauseosa</i> and <i>Rosa</i> sp.	~10

Table 2.6 continued.

11	6/7/2013	40.95502 -105.087007 6240'	Soapstone Prairie Natural Area; Western wall of prominent drainage swale just east of Rawhide Flats Road, ca. 0.85 mile north of southern parking lot and 0.15 mile east of road	Cretaceous shale/bentonite	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Ericameria nauseosa</i> , <i>Rhus trilobata</i> and <i>Vicia americana</i>	~15
12	6/8/2013	40.9678 -105.087888 6392'	Soapstone Prairie Natural Area; Center of prominent drainage swale just east of Rawhide Flats Road, ca. 0.2 mile south of maintenance road that runs E-W south of Lindenmeier Site and maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Ericameria nauseosa</i> , <i>Linum lewisii</i> and Poaceae	<10
13	6/8/2013	40.967407 -105.087615 6366'	Soapstone Prairie Natural Area; Sandy hillside on western side of prominent drainage swale just east of Rawhide Flats Road, ca. 0.2 mile south of maintenance road that runs E-W south of Lindenmeier Site and maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Linum lewisii</i> and <i>Rosa</i> sp.	~7
14	6/8/2013	40.963619 -105.087914 6303'	Soapstone Prairie Natural Area; Sandy hillside on western side of prominent drainage swale just east of Rawhide Flats Road, ca. 0.5 mile south of maintenance road that runs E-W south of Lindenmeier Site and maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Oryzopsis hymenoides</i> , <i>Physaria ludoviciana</i> and <i>Rosa</i> sp.	~10
15	6/8/2013	40.957752 -105.088187 6248'	Soapstone Prairie Natural Area; Gravelly center of prominent drainage swale just east of Rawhide Flats Road, ca. 0.9 mile south of maintenance road that runs E-W south of Lindenmeier Site and maintenance house	Tertiary sandstone/ claystone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Harbouria trachypleura</i> , <i>Scutellaria brittonii</i> and <i>Zygadenus elegans</i>	~15
16	6/8/2013	40.97041 -105.092501 6429'	Soapstone Prairie Natural Area; Shortgrass prairie off side of maintenance road that runs E-W just south of Lindenmeier site	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Cymopterus</i> sp., <i>Musineon tenuifolium</i> and Poaceae	~15

Table 2.6 continued.

17	6/8/2013	40.972037 -105.093661 6454'	Soapstone Prairie Natural Area; Base of Lindenmeier site, ca 0.1 mile north of maintenance road that runs E-W below site	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Harbouria</i> <i>trachypleura</i> and <i>Rhus trilobata</i>	~5
18	6/8/2013	40.975 -105.099085 6540'	Soapstone Prairie Natural Area; Base of Lindenmeier site, ca. 0.3 mile southwest of northern parking lot	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Achnatherum</i> <i>hymenoides</i> , <i>Cercocarpus</i> <i>montanus</i> and <i>Comandra</i>	~5
19	6/8/2013	40.973878 -105.101925 6479'	Soapstone Prairie Natural Area; Base of Lindenmeier site, ca. 0.5 mile west of Rawhide Flats Road and 0.1 mile north of maintenance road that runs E-W below site	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Astragalus</i> sp. and Poaceae	~5
20	6/8/2013	40.97236 -105.098325 6437'	Soapstone Prairie Natural Area; Sandy wash at base of Lindenmeier site, just north of maintenance road that runs E-W below site, ca. 0.4 mile west of Rawhide Flats Road	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Gutierrezia</i> <i>sarothrae</i> , <i>Ipomopsis spicata</i> , <i>Linaria dalmatica</i> , and Poaceae	~10
21	6/8/2013	40.972236 -105.098278 6431'	Soapstone Prairie Natural Area; Gravelly drainage at base of Lindenmeier site, just north of maintenance road that runs E-W below site, ca. 0.4 mile west of Rawhide Flats Road	Tertiary sandstone/ claystone	Bainville-Epping silt loams, 5 to 20 percent slopes "Complex"	<i>Achnatherum</i> <i>hymenoides</i> , <i>Linaria dalmatica</i> , <i>Oenothera</i> sp., and <i>Penstemon</i> <i>seundiflorus</i>	~5
22	6/17/2013	40.964315 -105.17779 6381'	Red Mountain Open Space; Side of Bent Rock Trail, on western side of prominent burm around wetland, just north of Bent Rock Canyon	Triassic-Permian mudstone/ sandstone	Kirtley-Purner complex, 5 to 20 percent slopes "Complex"	<i>Agropyron</i> <i>cristatum</i> , <i>Astragalus</i> <i>drummondii</i> , <i>Oreocarya</i> <i>thrysiflora</i> , and <i>Oxytropis sericea</i>	~5

Table 2.6 continued.

23	6/18/2013	40.98836 -105.036165 6403'	Soapstone Prairie Natural Area; On bank of Spottlewood Creek, ca 1.15 miles southeast of northwest corner of Plover Trail	Tertiary sandstone/ claystone	Keith silty clay loam, 0 to 3 percent slopes "Consociation"	<i>Opuntia polyacnatha</i> , <i>Penstemon secundiflorus</i> , <i>Rosa woodsii</i> , and <i>Yucca glauca</i>	<10
24	6/18/2013	40.987488 -105.033421 6393'	Soapstone Prairie Natural Area; Side of Spottlewood Creek, ca 1.3 miles southeast of northwest corner of Plover Trail	Tertiary sandstone/ claystone	Keith silty clay loam, 0 to 3 percent slopes "Consociation"	<i>Allium textile</i> , <i>Penstemon secundiflorus</i> , Poaceae, and <i>Zygadenus elegans</i>	~25

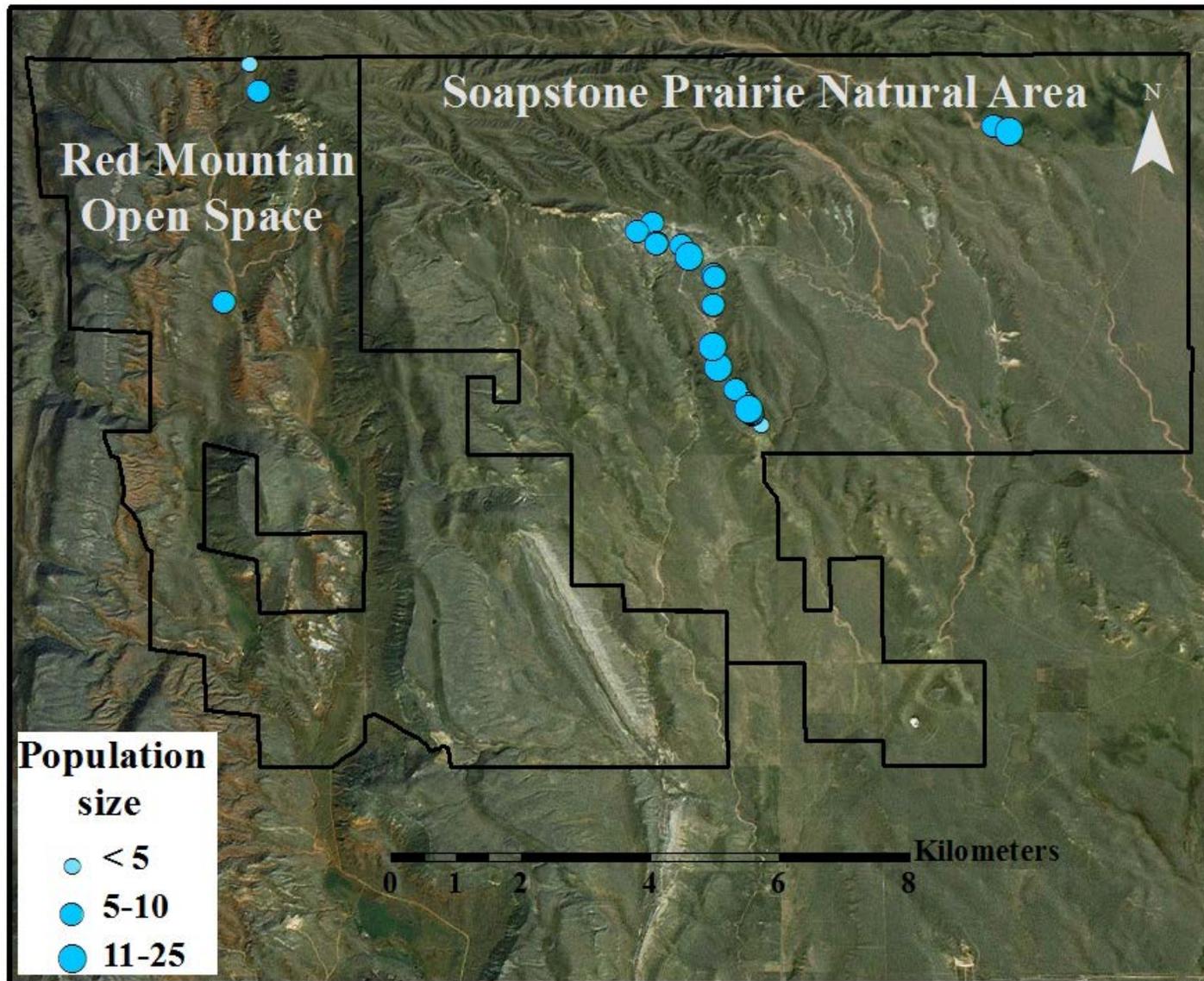


Figure 2.30. *Penstemon eriantherus* distribution map showing population localities within both Soapstone Prairie Natural Area and Red Mountain Open Space. The size of the circle corresponds to the population size.

All locations are between 6074' and 6626' in elevation and are positioned on east, south, or southeast-facing aspects. The populations include anywhere from 15 – 50 individuals, with only one documentation containing greater than 50 plants (Table 2.7). The primary geology present at the sites consists of sandstone, mudstone, claystone or shale/bentonite. The soils types are primarily rock-outcrop complexes. Additional taxa growing nearby these populations include such species as *Artemisia frigida*, *A. ludoviciana*, *Bouteloua gracilis*, *Cirsium* spp., *Equisetum laevigatum*, *Gutierrezia sarothrae*, *Juncus* spp., *Liatris punctata*, *Linaria dalmatica*, *Linum lewisii*, *Oenothera suffretescens*, *Opuntia polyacantha* var. *polyacantha*, *Rhus trilobata* var. *trilobata*, *Rosa woodsii*, *Schizachyrium scoparium*, *Stipa neomexicana*, and *Yucca glauca* var. *glauca*.

Linaria dalmatica

In 2013, I noted 25 locations of *L. dalmatica* populations, which combined with 17 sites documented in 2012, totaled 42 distribution points at RMOS (Fig. 2.32). The populations were found on all aspects, between 6202' and 7027' in elevation, and were primarily growing on sandstone/mudstone geology layers in the northern half of the property. The associated soil types range from rocky outcrop complexes to various types of loams (Table 2.8). The habitats where *L. dalmatica* occurs at RMOS are variable and include such locations as drainage swales, gravel washes, dry stream banks, dry meadows, mountain mahogany hillsides, alongside the public trails, and on grassy knolls. The majority of the populations were fairly large in number, with many containing upwards of 250 individual plants, and only 12 documented populations with less than 50 individuals. The dominant species growing in association with these *L. dalmatica* populations included *Achillea millefolium*, *Allium* spp., *Artemisia* spp., *Atriplex canescens*,

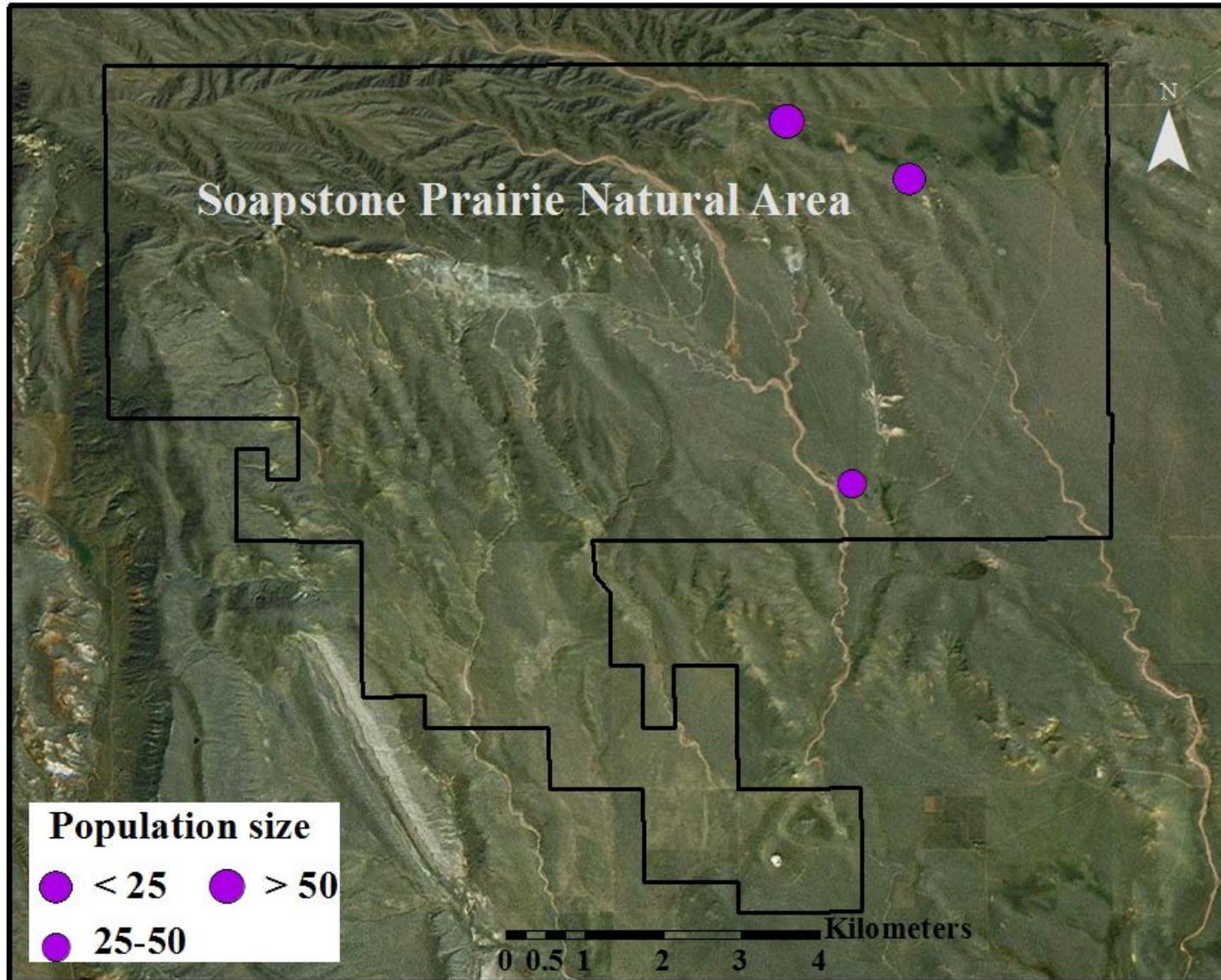


Figure 2.31. *Cirsium flodmanii* distribution map showing population localities within both Soapstone Prairie Natural Area. The size of the circle corresponds to the population size.

Table 2.7. Distribution data for *Cirsium flodmanii* populations found in Soapstone Prairie Natural Area in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	7/9/2012	40.991755 -105.04919 6429'	Soapstone Prairie Natural Area; Wetland ca. 0.5 mile southeast of northeastern-most corner of Plover Trail, 0.1 mile north of Spottlewood Creek	Tertiary sandstone/ claystone	Keith silty clay loam, 0 to 3 percent slopes "Consociation"	<i>Juncus</i> sp., <i>Linum lewisii</i> and <i>Rosa woodsii</i>	>50
2	8/7/2012	40.949377 -105.03959 6074'	Soapstone Prairie Natural Area; Lush shortgrass prairie off side of Plover Trail, near southern wetland, ca. 0.2 mile south of intersection with Pronghorn Loop	Cretaceous shale/bentonite	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , <i>Bouteloua gracilis</i> , <i>Cirsium</i> sp., and <i>Equisetum laevigatum</i>	25-50
3	8/19/2013	40.984771 -105.030582 6370'	Soapstone Prairie Natural Area; Center of Spottlewood Creek, ca. 1.7 miles southeast of northwest corner of Plover Trail, in a dry grassland hillside	Tertiary sandstone/ claystone	Keith silty clay loam, 0 to 3 percent slopes "Consociation"	<i>Artemisia ludoviciana</i> , <i>Bouteloua gracilis</i> , <i>Gutierrezia sarothrae</i> , <i>Liatris punctata</i> , and <i>Schizachyrium scoparium</i>	15-20

Bouteloua gracilis, *Bromus tectorum*, *Cercocarpus montanus*, *Cirsium* spp., *Ericameria nauseosa*, *Euphorbia bracteata*, *Grindelia subalpina*, *Gutierrezia sarothrae*, *Harbouria trachypleura*, *Hedeoma drummondii*, *Helianthus annuus*, *H. pumilus*, *Krascheninnikovia lanata*, *Linum lewisii*, *Opuntia polyacantha* var. *polyacantha*, *Penstemon* spp., various genera/species in the Poaceae family, *Potentilla* spp., *Rhus trilobata* var. *trilobata*, *Stipa comata*, *Tragopogon dubius*, and *Yucca glauca* var. *glauca* (Table 2.8).

DISCUSSION

Species-distribution data are a fundamental component of various types of conservation efforts, from identifying areas of high conservation priority, highlighting those areas prone to invasion by weedy species, monitoring species' ranges over time, and predicting how species and community distributions have changed, and will change, in relation to environmental variables (Sinclair *et al.*, 2010; Rodríguez-Castañeda *et al.*, 2012; Bystrakova *et al.*, 2014). Thus, these data can be used alone for general observation purposes, or more commonly, with forecasting models, such as SDMs or ENMs (Rodríguez-Castañeda *et al.*, 2012). In both cases, distribution data are a useful tool to educate and guide managers in maintaining the biodiversity present in the lands they oversee.

By generating preliminary distribution data for the eight designated species of interest at RMOS and SPNA, I have provided the City of Fort Collins and Larimer County officials with the baseline information necessary to determine the most effective land management strategies to apply in the context of either conserving uncommon species and their habitats, or preventing weedy species from further range expansion. For instance, officials may be interested in minimizing the impact of grazing and/or recreation on uncommon species such

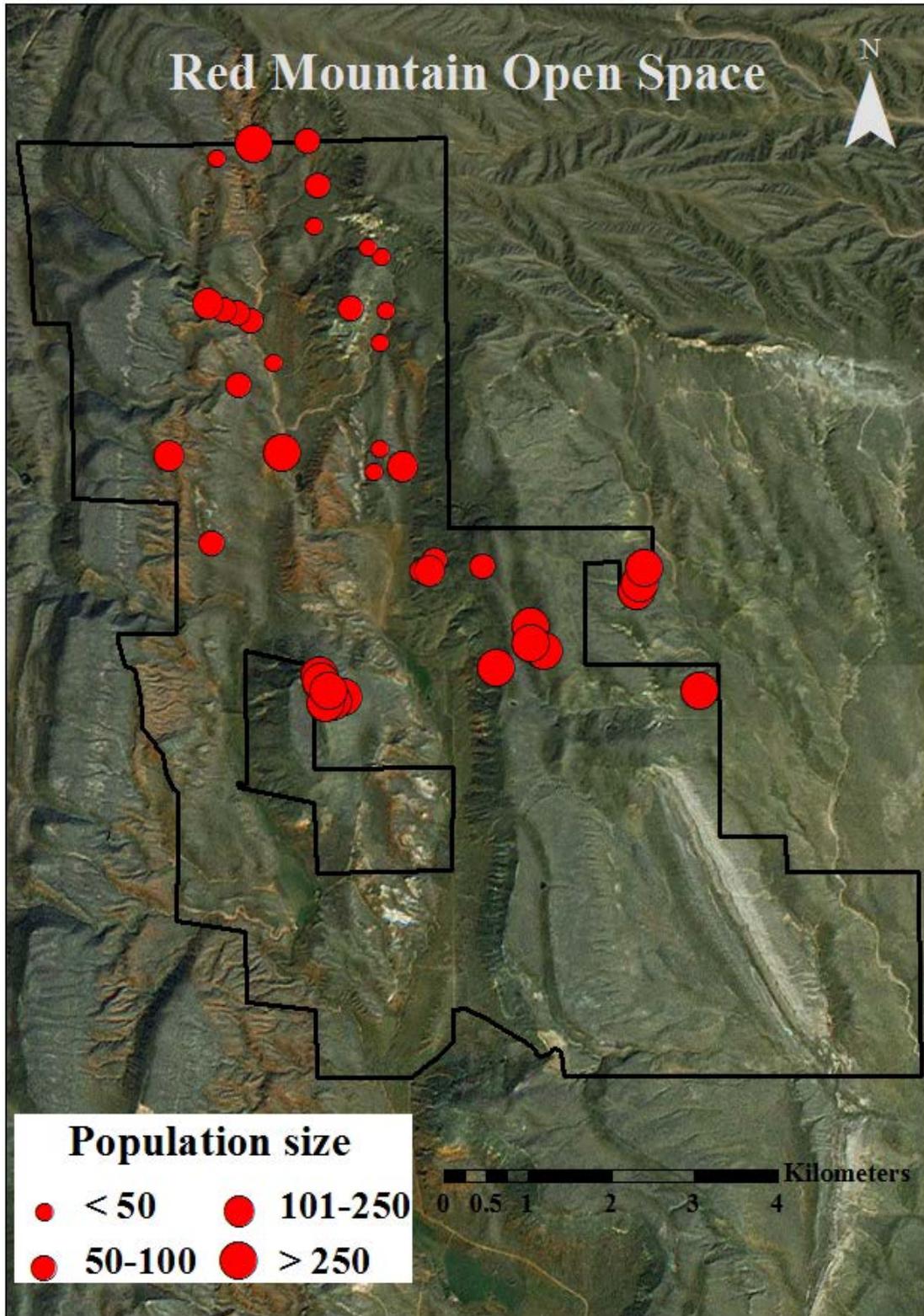


Figure 2.32. *Linaria dalmatica* distribution map showing population localities within Red Mountain Open Space. As noted in figure legends, the size of the circle corresponds to the population size.

Table 2.8. Distribution data for *Linaria dalmatica* populations found in Red Mountain Open Space in 2012 and 2013, including date noted, geographic coordinates and elevation, detailed locality information, geology types, soil types, dominant associated species, and estimated population size.

No.	Date	Latitude, longitude & elevation	Location	Geology	Soil	Associated species	Population size
1	5/28/2012	40.976846, -105.162533 6606'	Red Mountain Open Space; Big Hole Wash Trail, ca. 0.3 miles north of junction with Salt Lick Trail, 1.3 miles north of parking lot, and 0.5 miles west of Soapstone Prairie Natural Area boundary	Cretaceous-Jurassic sandstone/mudstone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> , Fabaceae and Poaceae	< 50
2	5/28/2012	40.980325, -105.161599 6652'	Red Mountain Open Space; Salt Lick Trail, ca. 0.6 mile north of intersection with Sinking Sun Trail	Cretaceous-Jurassic sandstone/mudstone	Bainville-Keith complex, 2 to 9 percent slopes "Complex"	<i>Ericameria nauseosa</i> , <i>Euphorbia</i> sp. and Poaceae	< 50
3	5/28/2012	40.985958, -105.162194 6812'	Red Mountain Open Space; Salt Lick Trail, ca. 0.6 miles north of intersection with Big Hole Wash Trail, and 0.5 miles west of Soapstone Prairie Natural Area boundary	Cretaceous-Jurassic sandstone/mudstone	Purner-Rock-outcrop complex, 10 to 50 percent slopes "Complex"	<i>Harbouria trachypleura</i> , <i>Linum lewisii</i> , Poaceae, and <i>Rhus trilobata</i>	< 50
4	5/28/2012	40.986957, -105.16402 6795'	Red Mountain Open Space; Salt Lick Trail, ca. 1 mile north of junction with Big Hole Wash Trail, near large section of whitish sandstone directly to the east of trail	Cretaceous-Jurassic sandstone/mudstone	Rock-outcrop "Consociation"	<i>Cercocarpus montanus</i> , <i>Linum lewisii</i> and Poaceae	< 50
5	5/28/2012	40.993544, -105.171156 6764'	Red Mountain Open Space; Salt Lick Trail, ca. 0.4 miles from northern RMOS boundary, directly on side of trail	Cretaceous-Jurassic sandstone/mudstone	Redthayne-Tyzak-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Harbouria trachypleura</i> , Poaceae and <i>Rhus trilobata</i>	50-100
6	5/28/2012	40.99832, -105.172545 6864'	Red Mountain Open Space; Salt Lick Trail, right at CO/WY border	Cretaceous-Jurassic sandstone/mudstone	Redthayne-Tyzak-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Bromus tectorum</i> , <i>Ericameria nauseosa</i> , <i>Erigeron</i> sp., and <i>Prunus</i> sp.	50-100

Table 2.8 continued.

7	5/28/2012	40.989224, -105.17172 6749'	Red Mountain Open Space; Ca. 0.1 mile west of Salt Lick Trail, on a grassy knoll adjacent to the prominent white sandstone area to the east	Cretaceous-Jurassic sandstone/mudstone	Redthayne-Tyzak-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Antennaria</i> sp., <i>Linaria dalmatica</i> , <i>Opuntia polyacantha</i> , and Poaceae	< 50
8	6/20/2012	40.974736, -105.177618 6400'	Red Mountain Open Space; Ruby Wash Trail, ca. 0.5 mile north of northern intersection with K-Lynn Cameron Trail, in a small drainage ditch alongside the trail	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	<i>Ericameria nauseosa</i> , <i>Hedeoma drummondii</i> and Poaceae	< 50
9	6/20/2012	40.979385, -105.180865 6454'	Red Mountain Open Space; Ruby Wash Trail, ca. 1 mile north of intersection with Big Hole Wash Trail, in a sandy wash just off side of trail	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	<i>Ericameria nauseosa</i> and Poaceae	50-100
10	6/20/2012	40.972563, -105.182582 6455'	Red Mountain Open Space; Just south of northern leg of K-Lynn Cameron Trail on Sand Creek stream bank, ca. 0.5 mile west of Ruby Wash Trail	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	Poaceae, <i>Populus</i> sp. and <i>Rosa</i> sp.	50-100
11	7/10/2012	40.955964, -105.186435 6344'	Red Mountain Open Space, Ca. 0.5 mile west of western leg of Bent Rock Trail, 0.3 mile east of western RMOS boundary	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	<i>Artemisia frigida</i> and Poaceae	50-100
12	7/10/2012	40.965082, -105.192699 6626'	Red Mountain Open Space; Ca. 1 mile northwest of Bent Rock Trail on red limestone hillside, 0.75 mile east of western RMOS boundary	Triassic-Permian mudstone/sandstone	Purner-Rock-outcrop complex, 10 to 50 percent slopes "Complex"	<i>Opuntia polyacantha</i> , <i>Rhus trilobata</i> and <i>Yucca glauca</i>	~250
13	7/16/2012	40.981076, -105.187044 6549'	Red Mountain Open Space, north-facing side of Haygood Canyon, in a dry meadow, ca. 0.3 mile east of prominent bend in canyon	Triassic-Permian mudstone/sandstone	Purner-Rock-outcrop complex, 10 to 50 percent slopes "Complex"	Poaceae	~250

Table 2.8 continued.

14	8/2/2012	40.998, -105.18028 6798'	Red Mountain Open Space; Gravelly wash alongside steep canyon wall, just south of northern RMOS boundary, ca. 0.4 mile west of Ruby Wash Trail	Triassic-Permian mudstone/ sandstone	Tieside, north slopes- Rock-outcrop complex, 10 to 45 percent slopes "Complex"	<i>Achillea millefolium</i> and <i>Artemisia frigida</i>	250-500
15	8/2/2012	40.996371, -105.185698 6964'	Red Mountain Open Space; In a grassy meadow at northern end of property, ca. 0.1 mile south of northern RMOS boundary, and 0.5 mile west of Ruby Wash Trail	Triassic-Permian mudstone/ sandstone	Tieside, north slopes- Rock-outcrop complex, 10 to 45 percent slopes "Complex"	<i>Bouteloua gracilis</i> and <i>Opuntia polyacantha</i>	< 50
16	8/9/2012	40.980634, -105.166532 7027'	Red Mountain Open Space; In a grassy meadow atop steep sandstone slope, ca. 0.7 mile east of Ruby Wash Trail and 1.25 mile south of northern RMOS boundary	Cretaceous- Jurassic sandstone/ mudstone	Kirtley loam, 3 to 9 percent slopes "Consociation"	<i>Artemisia frigida</i> , <i>Cercocarpus montanus</i> and <i>Opuntia polyacantha</i>	50-100
17	9/1/2012	40.942708, -105.146069 6509'	Red Mountain Open Space; On a grassy trail zigzagging up hillside, ca. 0.4 mile east of Antelope Valley Road and 1.5 mile southeast of parking lot	Cretaceous- Jurassic sandstone/ mudstone	Haplustolls-Rock- outcrop complex, steep "Complex"	<i>Cercocarpus montanus</i> and <i>Ericameria nauseosa</i>	> 250
18	5/30/2013	40.93961, -105.167676 6502'	Red Mountain Open Space; Grassy hillside on eastern approach to Table Mountain Summit, ca. 1 mile west of Antelope Valley Road	Cretaceous- Jurassic sandstone/ mudstone	Haplustolls-Rock- outcrop complex, steep "Complex"	<i>Opuntia polyacantha</i> , <i>Potentilla</i> sp. and <i>Rhus trilobata</i>	> 250
19	5/30/2013	40.93921, -105.169177 6695'	Red Mountain Open Space; Grassy/rocky hillside on eastern approach to Table Mountain Summit, ca. 0.25 mile from summit	Cretaceous- Jurassic sandstone/ mudstone	Haplustolls-Rock- outcrop complex, steep "Complex"	<i>Opuntia polyacantha</i> , Poaceae and <i>Yucca glauca</i>	> 250
20	5/30/2013	40.939065, -105.170314 6794'	Red Mountain Open Space; Grassy/rocky hillside on eastern approach to Table Mountain Summit, ca. 0.25 mile from summit	Cretaceous- Jurassic sandstone/ mudstone	Carnero loam, 3 to 9 percent slopes "Consociation"	<i>Cercocarpus montanus</i> , Poaceae, <i>Viola nuttallii</i> , and <i>Yucca glauca</i>	> 250

Table 2.8 continued.

21	6/2/2013	40.940097, -105.116881 6202'	Red Mountain Open Space; Grassy drainage swale, ca. 0.5 mile south of <i>Pinus ponderosa</i> forest at SPNA	Cretaceous shale/bentonite	Heldt clay loam, 3 to 6 percent slopes "Consociation"	<i>Allium textile</i> , <i>Opuntia polyacantha</i> and <i>Vicia americana</i>	~500
22	6/17/2013	40.965377, -105.176318 6360'	Red Mountain Open Space; Sandy wash area at mouth of wetland just north of Bent Rock canyon	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	<i>Grindelia subalpina</i> , <i>Penstemon</i> sp. and <i>Verbascum thapsus</i>	> 250
23	7/2/2013	40.96568, -105.162494 6458'	Red Mountain Open Space; Side of Sinking Sun Trail, ca. 0.5 mile north of the parking lot/trailhead	Triassic-Permian mudstone/sandstone	Connerton-Barnum complex, 3 to 9 percent slopes "Complex"	<i>Calochortus gunnisonii</i> , <i>Delphinium geyeri</i> and <i>Linaria dalmatica</i>	< 50
24	7/18/2013	40.941931, -105.171269 6371'	Red Mountain Open Space; Northeast side of Table Mountain, ca 0.5 mile below summit	Cretaceous-Jurassic sandstone/mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Opuntia polyacantha</i> , <i>Tragopogon dubius</i> and <i>Yucca glauca</i>	>250
25	7/18/2013	40.941255, -105.170863 6389'	Red Mountain Open Space; Northeast side of Table Mountain, ca 0.5 mile below summit	Cretaceous-Jurassic sandstone/mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Artemisia ludoviciana</i> , <i>Cercocarpus montanus</i> and <i>Yucca glauca</i>	>250
26	7/18/2013	40.941154, -105.170824 6390'	Red Mountain Open Space; Northeastern approach to Table Mountain, just below summit, under shade of rocks	Cretaceous-Jurassic sandstone/mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Cercocarpus montanus</i> , <i>Opuntia polyacantha</i> <i>Yucca glauca</i>	< 50
27	7/18/2013	40.940351, -105.169814 6368'	Red Mountain Open Space; Eastern approach to Table Mountain	Cretaceous-Jurassic sandstone/mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Artemisia</i> spp., <i>Opuntia polyacantha</i> and <i>Yucca glauca</i>	>250

Table 2.8 continued.

28	7/24/2013	40.952987, -105.156385 6463'	Red Mountain Open Space; Grassy hillside at base of prominent bluffs on east side of Antelope Valley Road, ca. 0.2 mile east of road and 0.5 mile southeast of parking lot	Triassic-Permian mudstone/ sandstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Cercocarpus montanus</i> , <i>Opuntia polyacantha</i> and <i>Stipa comata</i>	~100
29	7/24/2013	40.95293, -105.155625 6529'	Red Mountain Open Space; Grassy hillside at base of prominent bluffs on east side of Antelope Valley Road, ca. 0.25 mile east of road and 0.5 mile southeast of parking lot	Cretaceous- Jurassic sandstone/ mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	Chenopodiaceae and <i>Helianthus pumilus</i>	~200
30	7/24/2013	40.953965, -105.154676 6567'	Red Mountain Open Space; Mountain mahogany hillside on prominent bluffs on east side of Antelope Valley Road, ca. 0.3 mile east of road and 0.55 mile southeast of parking lot	Cretaceous- Jurassic sandstone/ mudstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Opuntia polyacantha</i>	~ 100
31	7/24/2013	40.953356, -105.14794 6907'	Red Mountain Open Space; Mountain mahogany hillside atop prominent bluff on east side of Antelope Valley Road, ca. 0.6 mile east of road and 0.9 mile southeast of parking lot	Cretaceous- Jurassic sandstone/ mudstone	Baller-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Cercocarpus montanus</i> and <i>Stipa comata</i>	~ 100
32	7/24/2013	40.946973, -105.141048 6740'	Red Mountain Open Space; Grassy meadow on east side of prominent bluff on east side of Antelope Valley Road, ca 1.1 mile east of road and 1.3 mile southeast of parking lot	Quaternary landslide/talus	Carnero loam, 3 to 9 percent slopes "Consociation"	<i>Bouteloua gracilis</i> and <i>Cercocarpus montanus</i>	> 500
33	7/24/2013	40.944423, -105.139187 6822'	Red Mountain Open Space; Grassy meadow on east side of prominent bluff on east side of Antelope Valley Road, ca 0.8 mile east of road and due east of Table Mountain	Quaternary landslide/talus	Baller-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Cercocarpus montanus</i> , <i>Cirsium</i> sp. and <i>Opuntia polyacantha</i>	~300-500
34	7/24/2013	40.945224, -105.141164 6746'	Red Mountain Open Space; Grassy meadow on east side of prominent bluff on east side of Antelope Valley Road, ca 0.7 mile east of road and due east of Table Mountain	Quaternary landslide/talus	Baller-Rock-outcrop complex, 15 to 45 percent slopes "Complex"	<i>Cercocarpus montanus</i> and <i>Opuntia polyacantha</i>	~300-500

Table 2.8 continued.

35	7/26/2013	40.980092, -105.182729 6504'	Red Mountain Open Space; Ca. 0.2 mile into Haygood Canyon from southern entrance, in a shady, upland site off the side of Sand Creek	Triassic-Permian mudstone/ sandstone	Purn-Rocker	<i>Rhus trilobata</i> and <i>Tragopogon dubius</i>	~100
36	7/26/2013	40.98048, -105.184684 6526'	Red Mountain Open Space; Ca. 0.25 mile into Haygood Canyon from southern entrance, on the south side of Sand Creek in dry grass/shrubland	Triassic-Permian mudstone/ sandstone	Purn-Rocker	<i>Achillea millefolium</i> , <i>Allium cernuum</i> and <i>Rhus trilobata</i>	~100
37	8/6/2013	40.950666, -105.125931 6391'	Red Mountain Open Space; Grassy hillside north of ponderosa pine forest at Soapstone Prairie Natural Area, just over boundary line	Cretaceous shale/bentonite	Midway clay loam, 5 to 25 percent slopes "Consociation"	<i>Atriplex canescens</i> , <i>Helianthus pumilus</i> and <i>Opuntia polyacantha</i>	>500
38	8/6/2013	40.951537, -105.125471 6373'	Red Mountain Open Space; Grassy meadow ca. 0.25 mile north of ponderosa pine forest at Soapstone Prairie Natural Area, just over boundary line	Cretaceous shale/bentonite	Midway clay loam, 5 to 25 percent slopes "Consociation"	Chenopodiaceae, <i>Helianthus annuus</i> and <i>Rhus trilobata</i>	>250
39	8/6/2013	40.953145, -105.124896 6388'	Red Mountain Open Space; Grassy meadow ca. 0.3 mile north of ponderosa pine forest at Soapstone Prairie Natural Area, just over boundary line	Cretaceous shale/bentonite	Midway clay loam, 5 to 25 percent slopes "Consociation"	<i>Opuntia polyacantha</i> , <i>Rhus trilobata</i> and <i>Stipa comata</i>	>1000
40	8/29/2013	40.963879, -105.159221 6335'	Red Mountain Open Space; Grassy hillside ca. 0.2 mile east of Sinking Sun Trail and 0.4 mile northeast of parking lot	Triassic-Permian mudstone/ sandstone	Otero sandy loam, 5 to 9 percent slopes "Consociation"	<i>Artemisia frigida</i> , <i>Bromus tectorum</i> , <i>Stipa comata</i> , and <i>Yucca glauca</i>	100-150
41	8/29/2013	40.964502, -105.159266 6334'	Red Mountain Open Space; Steep hillside of drainage wash ca. 0.2 mile east of Sinking Sun Trail and 0.4 mile northeast of parking lot	Triassic-Permian mudstone/ sandstone	Otero sandy loam, 5 to 9 percent slopes "Consociation"	<i>Gutierrezia sarothrae</i> , <i>Krascheninnikovia lanata</i> and <i>Mentzelia</i> sp.	< 50

Table 2.8 continued.

42	8/29/2013	40.963327, -105.16335 6419'	Red Mountain Open Space; Side of Sinking Sun Trail, ca. 0.2 mile north of intersection with Rising Sun Trail, in gravelly soil	Triassic-Permian mudstone/sandstone	Haplustolls-Rock-outcrop complex, steep "Complex"	<i>Cercocarpus montanus</i> , <i>Chamaesyce serpyllifolia</i> and <i>Opuntia polyacantha</i>	< 50
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as *Solidago ptarmicoides*, *Stephanomeria runcinata*, *Pediomelum esculentum*, and *Penstemon eriantherus*. By using the data I generated, in combination with data obtained from previous surveys conducted between 1996 and 2011 (Bioblitz Species Inventory, City of Fort Collins Natural Areas Program, Colorado Natural Heritage Program, Colorado State University Herbarium, Denver Botanic Gardens, and Natural Resources Conservation Service), RMOS and SPNA land managers could determine whether to redirect or prevent future public trail development, and whether to reduce or remove cattle grazing in the vicinity of these populations. Additionally, they could input these distribution data into an SDM or ENM to identify other potential population locations based on habitat requirements, or predict how these populations' ranges may change throughout time. This type of information could ultimately help direct important conservation-based decision making.

Likewise, in the context of weedy or invasive species, such as *Cirsium flodmanii* and *Linaria dalmatica*, the distribution data I generated has many applications for future management tactics. Studies have shown that, as a whole, the introduction of invasive non-native species is one of the greatest causes of native species endangerment (Wilcove *et al.*, 1998; Gray, 2005). As such, since 2008, Larimer County Weed Manager and associated partners in Colorado State University's Bioagricultural Sciences and Pest Management Department have been releasing a stem-boring weevil, *Mecinus janthinus*, to act as biocontrol agent and help mitigate the spread of *L. dalmatica* and ultimately reduce its overall abundance (Casey Cisneros, Larimer County Weed Manager, pers. comm., October 21, 2013; Janet Hardin, Research Associate in Department of Bioagricultural Sciences and Pest Management at Colorado State University, pers. comm., November 20, 2013). Thus, Larimer County and CSU researchers can look to my results to help ascertain the effectiveness of *M. janthinus* as a biocontrol agent on *L. dalmatica*,

predict which areas are of highest risk for *L. dalmatica* invasion and identify additional *M. janthinus* release sites.

Similar information can be gleaned from the data I generated for *C. flodmanii*. Although it is much less aggressive than *L. dalmatica*, *C. flodmanii* is still weedy in nature, and therefore managers will seek to control its range. Officials can monitor population growth or decline in the locations I documented, predict which nearby areas might be prone to invasion by *C. flodmanii*, and predict future distribution patterns of the species.

In conclusion, unbiased species distribution data, such as what I generated for eight species of interest at RMOS and SPNA, has many useful applications in a conservation management framework. It can be used to guide land managers in identifying areas of highest conservation value and provide insight into invasive species ranges and mitigation tactics. RMOS and SPNA were both purchased with the intention of preserving and protecting the land and its native species. The data I generated, therefore, will be beneficial for upholding their intentions and maintaining the pristine nature of these lands.

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CHAPTER III

THE MOST COMMON PLANTS OF RED MOUNTAIN OPEN SPACE AND SOAPSTONE PRAIRIE NATURAL AREA

INTRODUCTION

“The next generation of citizens will have to develop some botanical skills if we are to meet the threat of a degenerating environment. Understanding botany, for after all, our lives ultimately depend upon plants, will have to be regarded as a life-and-death matter.”

- William A. Weber, *Colorado Flora: Eastern Slope*, 3rd Edition, 2001, pg. xii -

Amateur scientists have been shown to bring forth novel problem-solving concepts, that when combined with professionals' ideas, elicit a unique set of solutions otherwise unachievable by either group alone (Pearson and Shetterly, 2006). However, as biological sciences are laden with technical terminology and hard-to-pronounce scientific names, it can be quite difficult to pique the amount of interest required to shape such a novel-thinking mind (Stevenson *et al.*, 2003). Compounding this problem is a phenomenon two scientists have coined “aspect blindness,” which is commonly experienced by novice investigators; they struggle to recognize how one taxonomic species differs from another, and also have difficulty recalling taxa names or identifications at a later time (Law and Lynch, 1988). Despite these seemingly major hurdles however, amateurs have played a role in the development of nearly every branch of biological science (Pearson and Shetterly, 2006). Studies have shown that both the creation and availability of field guides have been driving factors in making this possible (Law and Lynch, 1988; Vuilleumier, 1997; Vuilleumier, 2003; Pearson and Shetterly, 2006).

The best field guides provide detailed visual illustrations, typically in the form of photographs or drawings, and a short written description of important diagnostic characters specific to each taxon (Law and Lynch, 1988; Stevenson *et al.*, 2003; Leggett and Kirchoff, 2011). Both of these components have been shown to assist amateur scientists in overcoming “aspect blindness” by providing them with a list of taxa-differentiating characters and a means to visually compare those differences (Law and Lynch, 1988; Vuilleumier, 1997). In addition, Vuilleumier (2003) noted that once field guides become publically accessible, they inspire not only amateurs, but also professionals, to explore the highlighted geographic region and take a closer look at the organisms that occur there. This, Vuilleumier (2003) claims, has “revolutionized” ornithology in the Neotropical regions. This pattern is not restricted to bird field guides either; Pearson and Shetterly (2006) concluded that field guides will most likely play a role in the advancement of future entomological studies, and Hawthorne and Lawrence (2013) found that plant field guides have greatly assisted in managing resources and conserving biodiversity. Field guides, therefore, are one of the primary links that connect novice enthusiasts to nature. They allow amateurs to identify different taxa in nature, which in turn creates a general understanding of the importance of conserving the land and its species. It is through this process that novel-thinking minds are shaped; the exact type of minds necessary to help tackle such problems as the loss of biodiversity in our deteriorating environment.

In an attempt to establish this type of connection and respect for two recently opened recreation areas in northern Larimer County, Colorado, Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA), I created a field guide documenting the 76 most common plants found at both of these locales. Together, RMOS and SPNA cover 33,708 acres of habitat in both the foothills and plains, which serves as an important migration corridor for many

species of mammals, birds, fungi, insects and plants (Armstrong, 1972; Fitzgerald *et al.*, 1994; Rocky Mountain Bird Observatory Report, 2007; Larimer County Parks and Open Land Development, 2007; City of Fort Collins Natural Areas Program, 2009). After being purchased by Larimer County and The City of Fort Collins, respectively, RMOS and SPNA were both opened to public recreation in 2009, providing more than 45 miles of trails for hiking, mountain biking and/or horse-back riding. The trails are generally widespread throughout both properties (Fig. 3.1) allowing the public access to a diversity of habitats, including shrublands, grasslands, canyons, and riparian areas. As such, the number of plant species visible from the public trail system is equally as diverse.

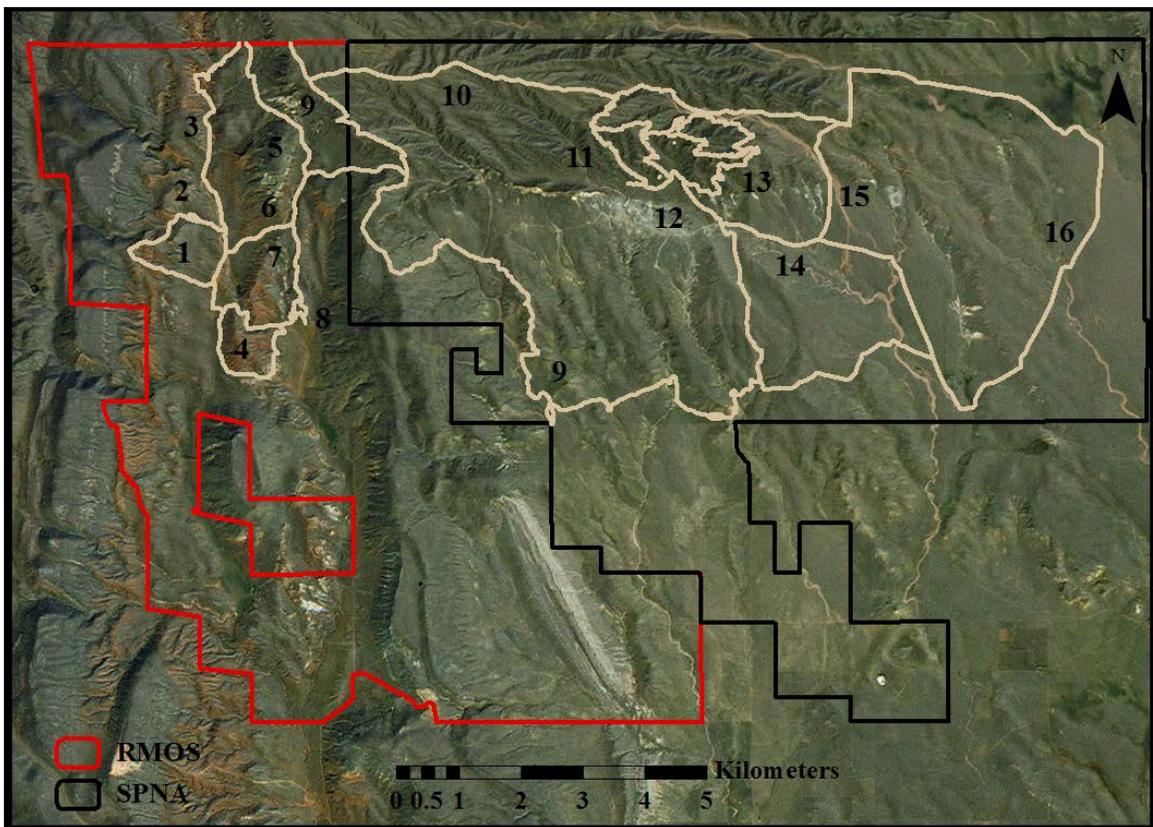


Figure 3.1. Map of Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA) displaying public trails within the sites. The trails are named as follows: 1: K-Lynn Cameron Trail, 2: Stone Circle Trail, 3: Ruby Wash Trail, 4: Bent Rock Trail, 5: Salt Lick Trail, 6: Big Hole Wash Trail, 7: Sinking Sun Trail, 8: Rising Sun Trail, 9: Cheyenne Rim Trail, 10: Canyon Trail, 11: Towhee Loop, 12: Lindenmeier Trail, 13: Mahogany Loop, 14: Pronghorn Loop, 15: Sand Wash Trail, 16: Plover Trail.

My major goal in creating a field guide for these regions is to create a public connection to this pristine land and the plants that occur there. Therefore, the guide focuses on the most common species found along the public trails and is geared toward novice plant enthusiasts with no prior botanical knowledge. However, those with intermediate-level botanical skills may still consider it a valuable resource, as I provide scientific names, labeled photographs and a list of diagnostic characters useful for identifying each plant. My intent is to make it freely available to the public in an electronic format, so that it may be downloaded by all who are interested.

MATERIALS AND METHODS

Species selection

Between April-September 2012 and 2013, I frequently travelled on the public trails within these sites, as part of a larger botanical inventory project (see Chapter I). I hiked each trail minimum of one time, but on average two to three times throughout the various seasons of my field work. While hiking, I noted the most common species that occur within eyesight of the trails. I then identified the specimens in the field with a technical dichotomous key (Weber and Wittmann, 2001), or collected a representative specimen as part of my larger inventory project, which I then identified at a later date. I photographed each species using a Canon PowerShot SX200 IS camera, trying to capture the overall habit of the plant as well as macro-level close-ups of important diagnostic characters. At the completion of my fieldwork, I compiled a list of the 76 most common species, or genera¹, that the public would likely encounter while visiting either of these locations (Table 3.1).

¹ Certain genera have numerous, morphologically similar species which require technical botanical skills to differentiate. When such a genus had several common species that occurred at either RMOS or SPNA, I chose to include this as simply a genus entry (*Genus* spp.), rather than one specific species.

Table 3.1. The most common species or genera found along the public trails at Red Mountain Open Space and Soapstone Prairie Natural Area. An * denotes a non-native species, or at least one non-native species within the genus (for genera entries only).

Family	Scientific name	Common name
Agavaceae	<i>Leucocrinum montanum</i>	Common Sand Lily
	<i>Yucca glauca</i>	Great Plains Yucca
Alliaceae	<i>Allium</i> spp.	Onion
Anacardiaceae	<i>Rhus trilobata</i> var. <i>trilobata</i>	Skunkbrush Sumac
Apiaceae	<i>Harbouria trachypleura</i>	Whiskbroom Parsley
Asteraceae	<i>Achillea millefolium</i>	Common Yarrow
	<i>Artemisia</i> spp.	Sagebrush
	<i>Cirsium</i> spp.*	Thistle
	<i>Ericameria nauseosa</i>	Rubber Rabbitbrush
	<i>Erigeron</i> spp.	Fleabane
	<i>Gaillardia aristata</i>	Blanketflower
	<i>Grindelia</i> spp.	Gumweed
	<i>Gutierrezia sarothrae</i>	Broom Snakeweed
	<i>Helianthus</i> spp.	Sunflower
	<i>Heterotheca villosa</i>	Hairy False Goldenaster
	<i>Liatris punctata</i>	Dotted Blazing Star
	<i>Lygodesmia juncea</i>	Rush Skeletonweed
	<i>Senecio</i> spp.	Ragwort
	<i>Solidago</i> spp.	Goldenrod
	<i>Symphyotrichum</i> spp.	Aster
	<i>Tetraeneuris acualis</i>	Stemless Four-Nerve Daisy
		<i>Townsendia grandiflora</i>
	<i>Townsendia hookeri</i>	Hooker's Easter Daisy
Boraginaceae	<i>Mertensia lanceolata</i> var. <i>lanceolata</i>	Prairie Bluebells
	<i>Oreocarya</i> spp.	Cryptantha
Brassicaceae	<i>Erysimum</i> spp.	Wallflower
Cactaceae	<i>Opuntia polyacantha</i> var. <i>polyacantha</i>	Starvation Pricklypear
Campanulaceae	<i>Campanula rotundifolia</i>	Bluebell of Scotland
Capparaceae	<i>Polanisia dodecandra</i> ssp. <i>trachysperma</i>	Red-whisker Clammyweed
	<i>Symphoricarpos occidentalis</i>	Wolfberry
Caprifoliaceae	<i>Krascheninnikovia lanata</i>	Winterfat
Cupressaceae	<i>Juniperus scopulorum</i>	Rocky Mountain Juniper
Fabaceae	<i>Astragalus drummondii</i>	Drummond's Milkvetch
	<i>Astragalus</i> spp.	Milkvetch, Purple spp.
	<i>Dalea</i> spp.	Prairie Clover
	<i>Lupinus</i> spp.	Lupine

Table 3.1 continued.

Fabaceae	<i>Oxytropis lambertii</i>	Purple Locoweed
cont'd	<i>Oxytropis sericea</i> var. <i>sericea</i>	White Locoweed
	<i>Thermopsis rhombifolia</i>	Goldenbanner
Gentianaceae	<i>Frasera speciosa</i>	Elkweed
Geraniaceae	<i>Geranium caespitosum</i> var. <i>caespitosum</i>	Rocky Mountain Geranium
Grossulariaceae	<i>Ribes aureum</i>	Golden Currant
	<i>Ribes cereum</i>	Wax Currant
Lamiaceae	<i>Monarda fistulosa</i> var. <i>menthifolia</i>	Wild Bergamot
Linaceae	<i>Linum lewisii</i>	Lewis Flax
Loasaceae	<i>Mentzelia</i> spp.	Blazingstar
Malvaceae	<i>Sphaeralcea coccinea</i>	Scarlet Globemallow
Onagraceae	<i>Oenothera</i> spp.	Evening Primrose
Orobanchaceae	<i>Castilleja</i> spp.	Indian Paintbrush
Papaveraceae	<i>Argemone hispida</i>	Rough Prickly-Poppy
Pinaceae	<i>Pinus ponderosa</i> var. <i>scopulorum</i>	Ponderosa Pine
Poaceae	<i>Achnatherum hymenoides</i>	Indian Ricegrass
	<i>Agropyron cristatum</i>	Crested Wheatgrass
	<i>Bouteloua</i> spp.	Grama
	<i>Bromus</i> spp.	Brome
	<i>Buchloë dactyloides</i>	Buffalograss
	<i>Elymus</i> spp.	Wildrye
	<i>Hesperostipa comata</i>	Needle and Thread
	<i>Koeleria macrantha</i>	Junegrass
	<i>Muhlenbergia</i> spp.	Muhly
	<i>Nassella viridula</i>	Green Needlegrass
	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	Little Bluestem
	<i>Sporobolus</i> spp.	Dropseed
Polygonaceae	<i>Eriogonum brevicaule</i> var. <i>brevicaule</i>	Shortstem Buckwheat
	<i>Eriogonum effusum</i>	Spreading Buckwheat
	<i>Eriogonum flavum</i> var. <i>flavum</i>	Golden Buckwheat
Ranunculaceae	<i>Delphinium</i> spp.	Larkspur
Rosaceae	<i>Cercocarpus montanus</i>	Mountain Mahogany
	<i>Potentilla</i> spp.	Cinquefoil
	<i>Prunus virginiana</i> var. <i>melanocarpa</i>	Chokecherry
	<i>Rosa blanda</i>	Smooth Rose
Sapindaceae	<i>Acer glabrum</i> var. <i>glabrum</i>	Rocky Mountain Maple
Solanaceae	<i>Quincula lobata</i>	Purple Ground Cherry
Violaceae	<i>Viola nuttallii</i>	Nuttall's Violet

Despite the fact that each location is separately owned, RMOS and SPNA are located adjacent to one another, share many ecological similarities and are connected by several of the public trails (Fig. 3.1). For these three reasons, I chose to treat both areas as one collective region while generating this list. This, in effect, will increase the usability of the guide as it may be utilized at both locations. However, by combining the areas in this manner, I generalized the common species between the two locations; although RMOS and SPNA are quite botanically similar, they also have many distinct differences. For instance, *Pinus ponderosa* var. *scopulorum* is fairly prevalent in the northern and western portions of RMOS, but is only found in one main location in the southern portion of SPNA. Therefore, it is important to note that this list is not necessarily representative of the common species that you would find at each area individually, but rather the entire area encompassed by both locations.

Guide creation

I identified each specimen to species level, or infraspecific level if applicable, using technical dichotomous keys (Weber, 1976; Wingate, 1994; Dorn, 2001; Weber and Wittman, 2001, 2012; Shaw, 2008; Ackerfield, 2013). I then verified each specimen via comparison with Colorado State University Herbarium's collection. Upon verification, I sorted the ~4500 photographs that I took during my field work based on the list of common species I generated (Table 3.1). I selected ~200 of the highest quality photographs that illustrate important characters useful for identifying each species. I cropped and edited all of the photographs using Microsoft Office 2010 programs and then arranged the pictures inside one half of a 4.23" wide x 3.15" tall border species card box (Fig. 3.2). In the other half of the species card box, I included a heading which lists the family, scientific name and common name, as well as a brief written description

of several diagnostic plant characters to aid in the identification process. I followed the nomenclature used in *The Flora of Colorado* (Ackerfield, 2013) with respect to family, scientific and common names. I compiled the species' description information from a variety of technical keys, field-based floristic guides and government agency websites (Weber, 1976; Wingate, 1994; Guennel, 1995; Kershaw *et al.*, 1998; Kershaw, 2000; Dorn, 2001; Harris and Harris, 2001; Weber and Wittman, 2001, 2012; Mammoser and Tekiela, 2007; Shaw, 2008; Ackerfield, 2013; Culver and Lemly, 2013; USDA NRCS, 2014).

<p>Family <i>Scientific name</i> Common name</p> <p>Habit: Growth form Height: Maximum height Flowers: Color, shape, size, arrangement No. Petals: # of petals, fusion information Leaves: Location; shape, size, surface characteristics Blooms: Range of bloom time Common species: Names of specific species that occur at the sites (only for genus cards)</p>	<p>Diagnostic photograph(s)</p>
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Figure 3.2. A generic template of the species descriptions card format. Note that variation amongst the cards exists depending on which information is most helpful to the user.

I attempted to eliminate as much technical terminology as possible, while still maintaining a botanically accurate description. When it was not possible to do so, I resorted to using the technical term and the labeling the feature to which it is referring on the accompanying photograph(s). Additionally, when I encountered multiple species within one genus that are

morphologically very similar and therefore require advanced skills to differentiate, I created genus cards rather than individual species cards. These cards provide the reader with sufficient information to identify a specimen to genus level only, but I supply a list of the actual species they may encounter at the end of the written description (Fig. 3.2), along with labeled photograph(s) where applicable. To compensate for this lack of detail in the genus cards, I also include a list of supplementary literature at the end of the guide.

Once I composed all of the written descriptions and resized all of the photographs to fit in the allotted space of the cards, I organized the cards by habit type: trees and shrubs (including sub-shrubs), flowering herbaceous plants and grasses. Due to the number of flowering herbaceous plants, I further divided this section into spring-summer flowering species and summer-fall flowering species, based on when each species, or genus, typically begins to bloom. Lastly, I created an alphabetical index of family names (listed in bold), scientific names (listed in italics) and common names, with corresponding page numbers, to assist the reader in easily locating specific cards. The completed guide, as follows, will be freely available for public download in a PDF format on both The City of Fort Collins Soapstone Prairie Natural Area Website (www.fcgov.com/naturalareas/finder/soapstone) and Larimer County Red Mountain Open Space Website (www.larimer.org/naturalresources/red_mountain.cfm).

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CHAPTER IV

VOLUNTEER CONTRIBUTIONS TO AN UPCOMING FIELD GUIDE:

FOOTHILLS PLANT AND FLOWER GUIDE

INTRODUCTION

As discussed in Chapter III, field guides are not only an effective means of connecting the public to nature, but they have also been shown to assist in resource management and the conservation of biodiversity (Law and Lynch, 1988; Vuilleumier, 1997, 2003; Pearson and Shetterly, 2006; Hawthorne and Lawrence, 2013). Despite this ability to aid amateurs and professionals in the identification and management of species and biodiversity as a whole, field guides are not without their flaws. For instance, the taxon focus of approximately 70% of commercially available field guides is birds, which consist of roughly 10,000 species (Stevenson *et al.*, 2003; Hawthorne and Lawrence, 2013). Plants, on the other hand, which contain an estimated 200,000 – 400,000 species, are the focus of only 3-8% of the commercial field guide market (Govaerts, 2001; Stevenson *et al.*, 2003; Joppa *et al.*, 2010). In addition to taxon biases, commercial field guides typically cover broad geographic ranges, and as a result, include a large number of species (Stevenson *et al.*, 2003). For instance, *Plants of the Rocky Mountains* (Kershaw *et al.*, 1998) covers the flora of 2 countries and 11 states. While this tactic increases the marketability of the guide, it has a tendency to either overwhelm the user by providing too much information (i.e. too many species to choose from), or underwhelm them by providing too little information (i.e. certain species get overlooked due to the expansiveness of the range being covered) (Stevenson *et al.*, 2003; Hawthorne and Lawrence, 2013).

An obvious solution to these aforementioned problems then, is to simply publish more plant-based field guides with a focus on smaller geographic ranges. As such, in late 2012, Rob Novak and Heather Young, two Larimer County officials, set out to create a plant field guide specific to the foothills of Larimer County, Colorado. To keep production costs at a minimum without sacrificing quality, one common issue with smaller-scale field guides (Stevenson *et al.*, 2003), Novak and Young enlisted the help of a group of volunteers ranging from plant-enthusiasts to professionals to help construct the *Foothills Plant and Flower Guide*.

Larimer County is situated in north-central Colorado on the eastern slope of the Rocky Mountains, just south of the Colorado/Wyoming border (Fig. 4.1). In total, it spans roughly 6,800 km² of predominantly foothills ecosystems, which transition to short-grass prairie on the

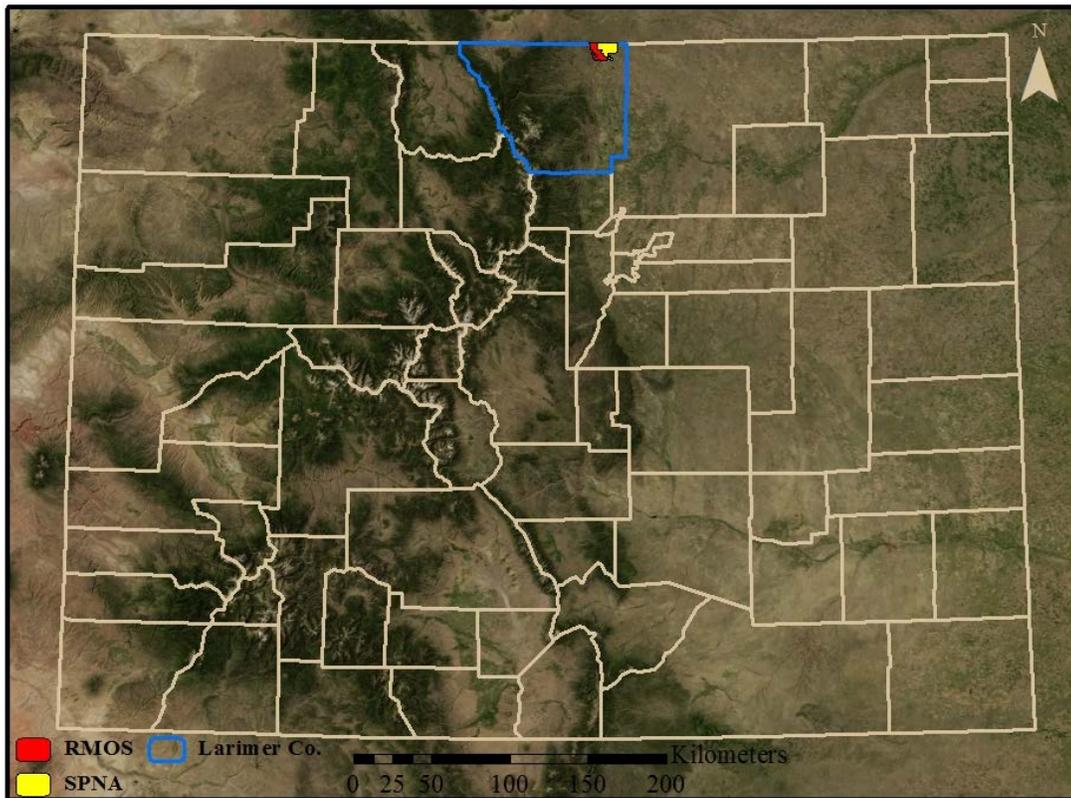


Figure 4.1. Map of Colorado counties, highlighting the locations of Larimer County, Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA).

eastern reaches. Given such topographical variation, Larimer County is quite botanically diverse, with over 1,500 documented vascular plant species, including 1,380 native taxa, 96 rare species, and 11 endemics (Colorado PINII Data, 2014). Together, the City of Fort Collins and Larimer County Organizations have put great emphasis on preserving the land and biodiversity present across the county; there are over 50 open spaces, natural areas and parks, which offer roughly 175 miles of publically accessible trails (City of Fort Collins, 2014; Larimer County, 2014). The *Foothills Plant and Flower Guide* will be an informative tool for recreationists attempting to identify the flora present at many of these preserved locales.

The main purpose of the *Foothills Plant and Flower Guide* is to be an affordable, user-friendly plant identification aid for novice to intermediate-level plant enthusiasts recreating in Larimer County. As such, it covers nearly 100 of the most common plant taxa found in the foothills between 5000'-7000' in elevation. Each taxon entry includes high-quality photographs of diagnostic features of the given plant, along with a written description of the most important characters used in its identification. Additionally, each written description includes a brief 'Did You Know?' section, in which the reader is presented with an interesting fact about the plant, and an 'ID Hints' section that provides the reader with identification tips, such as how to differentiate that specific taxon from other closely related taxa. By combining these features into a compact format, which covers a relatively small geographic range, focuses on plants, and is set to be commercially available at an affordable cost, the *Foothills Plant and Flower Guide* will likely fill an unoccupied niche in the field-guide market.

MATERIALS AND METHODS

Contributors

The group of Larimer County officials and volunteers who are working together to create the *Foothills Plant and Flower Guide*, along with each individual's primary role in the project, and affiliation (if applicable) are as follows: Rob Novak, guide production, Larimer County Natural Resources Education Coordinator; Heather Young, product testing and usability, Larimer County Natural Resources Education Coordinator; Lisa Matthews, species selection and guide glossary; Linda Bilsing, primary editor, product testing and usability; Janet Sitas, image acquisition; Paul Alaback, content generation (descriptions and introduction), Professor Emeritus of Forest Ecology at The University of Montana; Jane Thompson, production; Jenna McAleer, content generation (descriptions and introduction), Colorado State University. Although each contributor is in charge of his/her primary role in the project, important decisions regarding the content, layout, editing, etc. are made via group consensus during monthly meetings.

Guide Creation, Organization and Publication

The *Foothills Plant and Flower Guide* team formed in January 2012; however, I did not personally join the team until November 2012. During the time prior to my involvement, the team generated a preliminary list of species to include and determined the overall format of the guide, including the dimensions of the final product, content organization, the specific font type and size, subheadings to be included in the written descriptions, and the source(s) from which to reference nomenclature. After I joined the team, we collaborated to finalize the list of species, fine-tune the organization of the guide and redistribute the primary roles and workload of each contributor.

The guide includes 98 taxa entries (Table 4.1), which are divided into the following three categories: 'Trees/Shrubs,' 'Grasses' and 'Wildflowers.' The 17 taxa covered in the 'Trees/Shrubs' section are alphabetized first by family, then by scientific species name. Each entry within this section describes only one species, and as such, is referred to as a 'species' card (Table 4.1). The 10 'Grasses' taxa, also solely comprised of 'species' cards, are organized alphabetically by scientific species name only, as they all are taxonomically placed in the same family (Poaceae). Because the 'Wildflowers' section contains distinctly more entries (71) than the previous two sections, the taxa within this category are subdivided first by flower color (blue/purple, red/pink, orange/yellow, or white), and then by flower type (distinct petals (further divided into 3 or 6, 4, 5, or many), fused petals (further divided into pea-type, two-lipped or tubular/cup-shaped), or small flowers arranged in clusters or heads (further divided into composites, umbels or other)). Within this section, there are not only 'species' cards, as in the 'Trees/Shrubs' and 'Grasses' sections, but there are also 'genus' and 'comparison' cards (Table 4.1). 'Genus' cards describe more than one species, each which closely resemble one another and often require advanced skill to discern. A list of several common species is included in the written description of these cards; however, these cards allow the user to identify taxa to genus-level only. 'Comparison' cards are used to compare two species, or two closely related genera, which are commonly mistaken for one another, yet have distinct morphological differences that an amateur eye could identify if provided with the appropriate knowledge. These cards provide a direct comparison between similar-looking taxa, and with the exception of one or two entries, allow the user to identify taxa to species level.

Table 4.1. List of the 98 taxa covered in the *Foothills Plant and Flower Guide*, including the family, scientific name and common name(s), as provided in Weber and Wittmann (2001). (s) denotes a 'species' card, (g) denotes a 'genus' card, (c) denotes a 'comparison' card, and * signifies entries for which I, personally, compiled the written descriptions.

Family	Scientific Name	Common Name
Agavaceae	<i>Yucca glauca</i> (s)	Narrow Leaved Yucca, Spanish Bayonet
Alliaceae	<i>Allium</i> spp. (g) <i>Allium textile</i> * (s)	Pink Onion Prairie Wild Onion
Alsinaeae	<i>Cerastium strictum</i> * (s)	Mouse-ear Chickweed, Field Chickweed
Anacardiaceae	<i>Rhus aromatica</i> (s) <i>Toxicodendron rydbergii</i> (s)	Three-leafed Sumac, Skunkbrush Poison Ivy, Western Poison Ivy
Apiaceae	<i>Conium maculatum</i> * (s) <i>Harbouria trachypleura</i> & <i>Musineon divaricatum</i> * (c) <i>Heracleum sphondylium</i> * (s) <i>Lomatium orientale</i> * (s)	Poison Hemlock Whiskbroom Parsley & Musineon Cow Parsnip Salt & Pepper
Asclepiadaceae	<i>Asclepias speciosa</i> (s)	Showy Milkweed
Asteraceae	<i>Achillea lanulosa</i> * (s) <i>Agoseris glauca</i> & <i>Nothocalais cuspidata</i> (c) <i>Almutaster</i> spp., <i>Symphyotrichum</i> spp., <i>Virgulaster</i> spp., & <i>Virgulus</i> spp.* (g) <i>Anaphalis margaritacea</i> & <i>Antennaria</i> spp.* (c) <i>Arnica</i> spp. (g) <i>Artemisia frigida</i> & <i>A. ludoviciana</i> (c) <i>Aster</i> spp., <i>Symphyotrichum</i> spp., <i>Virgulaster</i> spp., & <i>Virgulus</i> spp.* (g) <i>Chrysothamnus nauseosus</i> (s) <i>Cirsium undulatum</i> (s) <i>Erigeron</i> spp.* (g) <i>Erigeron</i> spp.* (g) <i>Grindelia squarrosa</i> * (s) <i>Helianthella uniflora</i> & <i>Heliomeris multiflora</i> * (c) <i>Helianthus</i> spp.* (g) <i>Heterotheca</i> spp.* (g) <i>Liatris punctata</i> * (s) <i>Podospermum laciniatum</i> & <i>Tragopogon dubius</i> * (c) <i>Ratibida columnifera</i> * (s)	Common Yarrow, Milfoil False Dandelion & Wavy-leaved Dandelion White Aster Pearly Everlasting & Pussytoes Arnica Fringed Sage & White Sage Blue/Purple Aster Rabbitbrush Wavy-leaved Thistle, Gray Thistle Blue/Purple Fleabane/Daisy White Fleabane/Daisy Gumweed, Curlycup Gumweed Little Sunflower & Goldeneye Sunflower Golden Aster Kansas Gayfeather, Dotted Blazing Star False Salsify & Yellow Salsify Prairie Coneflower, Mexican Hat

Table 4.1 continued.

Asteraceae continued	<i>Rudbeckia hirta</i> * _(s) <i>Senecio</i> spp.* _(g) <i>Solidago</i> spp.* _(g) <i>Townsendia hookeri</i> & <i>T. grandiflora</i> _(c) <i>Virgulus ericoides</i> & <i>V. falcatus</i> _(c)	Black-eyed Susan Ragwort, Groundsel, Butterweed Goldenrod Easter Daisy & Showy Easter Daisy Many Flowered Aster & White Prairie Aster
Boraginaceae	<i>Lithospermum incisum</i> * _(s) <i>Oreocarya virgata</i> _(s)	Fringed Puccoon, Narrowleaf Stoneseed Miner's Candle
Brassicaceae	<i>Erysimum asperum</i> & <i>E. capitatum</i> _(c) <i>Physaria bellii</i> & <i>P. vitulifera</i> * _(c)	Plains Wallflower & Western Wallflower Bell's Twinpod & Fiddleleaf Twinpod
Cactaceae	<i>Opuntia macrorhiza</i> & <i>O. polyacantha</i> _(c)	Prickly Pear & Plains Cactus
Calochortaceae	<i>Calochortus gunnisonii</i> * _(s)	Mariposa Lily, Sege Lily
Campanulaceae	<i>Campanula rotundifolia</i> * _(s)	Common Harebell
Capparaceae	<i>Cleome serrulata</i> _(s)	Rocky Mountain Bee Plant, Spider Flower
Commelinaceae	<i>Tradescantia occidentalis</i> _(s)	Western Spiderwort, Western Dayflower
Crassulaceae	<i>Amerosedum lanceolatum</i> _(s)	Yellow Stonecrop
Cupressaceae	<i>Juniperus communis</i> & <i>Sabina</i> <i>scopulorum</i> _(c)	Common Juniper & Rocky Mountain Juniper
Fabaceae	<i>Astragalus</i> spp.* _(g) <i>Astragalus</i> spp.* _(g) <i>Dalea purpurea</i> * _(s) <i>Lupinus argenteus</i> * _(s) <i>Oxytropis lambertii</i> _(s) <i>Oxytropis sericea</i> _(s) <i>Thermopsis divaricarpa</i> * _(s) <i>Vicia</i> spp. _(g)	Blue/Purple Milkvetch White Milkvetch Purple Prairie Clover Common Lupine, Silvery Lupine Colorado Locoweed White Locoweed, Rocky Mountain Loco Golden Banner, Golden Pea Vetch
Geraniaceae	<i>Geranium caespitosum</i> _(s)	Wild Geranium
Grossulariaceae	<i>Ribes cereum</i> _(s)	Wax Currant
Helleboraceae	<i>Aquilegia coerulea</i> * _(s) <i>Delphinium carolinianum</i> ssp. <i>virescens</i> * _(s) <i>Delphinium</i> spp.* _(g)	Colorado Columbine, Blue Columbine Pale Larkspur, Carolina Larkspur Blue/Purple Larkspur
Iridaceae	<i>Iris missouriensis</i> * _(s)	Wild Iris, Blue Flag
Lamiaceae	<i>Monarda fistulosa</i> * _(s) <i>Scutellaria brittonii</i> * _(s)	Bee Balm, Horsemint Skullcap
Linaceae	<i>Adenolinum lewisii</i> * _(s)	Wild Blue Flax, Prairie Flax

Table 4.1 continued.

Malvaceae	<i>Sphaeralcea coccinea</i> * ^(s)	Copper Mallow, Scarlet Globemallow
Melanthiaceae	<i>Toxicoscordion venenosum</i> ^(s)	Death Camas
Onagraceae	<i>Gaura coccinea</i> & <i>G. mollis</i> ^(c)	Scarlet Gaura & Velvetweed
	<i>Oenothera</i> spp.* ^(g)	Yellow Evening Primrose
	<i>Oenothera</i> spp. ^(g)	White Evening Primrose
Pinaceae	<i>Pinus ponderosa</i> ^(s)	Ponderosa Pine
Poaceae	<i>Agropyron desertorum</i> * ^(s)	Crested Wheatgrass
	<i>Bouteloua curtipendula</i> * ^(s)	Side-oats Grama
	<i>Bromopsis inermis</i> * ^(s)	Smooth Brome
	<i>Chondrosum gracile</i> * ^(s)	Blue Grama
	<i>Elymus canadensis</i> * ^(s)	Canada Wildrye
	<i>Hesperostipa comata</i> * ^(s)	Needle-and-Thread Grass
	<i>Koeleria macrantha</i> * ^(s)	Junegrass
	<i>Panicum virgatum</i> * ^(s)	Switchgrass
	<i>Pascopyrum smithii</i> * ^(s)	Native Western Wheatgrass
	<i>Sporobolus cryptandrus</i> * ^(s)	Sand Dropseed
Polemoniaceae	<i>Ipomopsis aggregata</i> ^(s)	Scarlet Gilia, Skyrocket
Polygonaceae	<i>Eriogonum umbellatum</i> ^(s)	Sulphur Flower
Portulacaceae	<i>Claytonia rosea</i> ^(s)	Spring Beauty
Primulaceae	<i>Dodecatheon pulchellum</i> ^(s)	Shooting Star
Ranunculaceae	<i>Clematis ligusticifolia</i> ^(s)	Virgin's Bower, White Clematis
	<i>Ranunculus</i> spp.* ^(g)	Buttercup
Rosaceae	<i>Cercocarpus montanus</i> ^(s)	Mountain Mahogany
	<i>Drymocallis</i> spp. & <i>Potentilla</i> spp. ^(g)	Cinquefoil
	<i>Oreobatus deliciosus</i> ^(s)	Boulder Raspberry
	<i>Padus virginiana</i> ^(s)	Chokecherry, Western Chokecherry
	<i>Pentaphylloides fruticosa</i> ^(s)	Shrubby Cinquefoil
	<i>Prunus americana</i> ^(s)	Wild Plum
	<i>Rosa woodsii</i> ^(s)	Woods Rose
Rubiaceae	<i>Galium septentrionale</i> * ^(s)	Northern Bedstraw
Salicaceae	<i>Populus deltoides</i> ^(s)	Plains Cottonwood
	<i>Salix exigua</i> ^(s)	Sandbar Willow, Coyote Willow
Saxifragaceae	<i>Micranthes rhomboidea</i> * ^(s)	Snowball Saxifrage, Diamond-Leaf Saxifrage
Scrophulariaceae	<i>Castilleja sessiliflora</i> * ^(s)	Prairie Paintbrush, Plains Paintbrush
	<i>Castilleja</i> spp. ^(g)	Red Paintbrush
Solanaceae	<i>Physalis virginiana</i> ^(s)	Smooth Ground Cherry, Virginia Ground Cherry
Violaceae	<i>Viola nuttallii</i> * ^(s)	Nuttall's Violet, Yellow Prairie Violet

‘Trees/Shrubs’ and ‘Wildflowers’ entries (species, genus or comparison) consist of two cards, each 5” wide x 3” tall. The first card contains one to several photographs which illustrate important diagnostic characters. The photographs were pooled from individual team members’ personal collections, or from credible outside sources, and as such, each photograph has an attached citation. The second card of each entry contains the written taxon description (Fig. 4.2). This card includes the taxon’s common name, scientific name and family grouping as denoted in Weber and Wittmann’s *Colorado Flora: Eastern Slope*, 3rd Ed. (2001). Additionally, there are general subheadings, which remain consistent across each major section, and provide the reader with a short description, or interesting fact about that specific character or taxon. ‘Grasses’ entries are formatted in a similar manner with illustrative photographs and written descriptions, however, these entries are condensed to fit into one 5” wide x 3” tall card (Fig 4.3). The title box and a small tab along the bottom margin of each description card are color-coded to orient the user with what section they are in. All ‘Trees/Shrubs’ cards are denoted with a brown title box and tab, all ‘Grasses’ cards are labeled with green, and ‘Wildflower’s cards are labeled according to their assigned flower color group (blue/purple, red/pink, orange/yellow, or white).

Along with the 98 taxa entries, the guide also contains an introduction, a glossary, an index, and a list of suggested readings/additional resources. The 14-page introduction includes the following information: goals of the guide, major contributors, the importance of protected areas in Larimer County, a brief overview of ecological zones and habitats present in the foothills of the Rocky Mountains, the importance of dry grasslands and riparian habitats, and an overview of how the guide is organized and tips for how to use it to identify a plant. The 8-page glossary contains definitions and/or water-color illustrations of technical terminology used within the guide. The 4-page index lists all entries, both scientific and common names, and their

Common Name(s)	
<i>Scientific Name</i>	Bloom: Flowering Season(s)
<p>Family: Common (Scientific)</p> <p>General: Habit, size, duration*, status* (* only listed if NOT a native perennial)</p> <p>Flowers/Fruit: Number of petals, petal color; flower size, type, and arrangement</p> <p>Leaves: Arrangement, shape, margins, size, color, surface characteristics</p> <p>Habitat: Type(s) of location where taxon typically grows.</p>	<p>ID Hints: Tip(s) to more easily identify taxon in general, or how to differentiate it from other taxa that closely resemble it.</p> <p>Did You Know? Interesting fact about the taxon, common species within the genus (listed on genus cards only), and/or additional scientific or common names.</p>

Figure 4.2. ‘Wildflowers’ written description template with group approved fonts, layout and subheadings, and blue/purple-colored title box and tab.

Common Name(s)	
<i>Scientific Name</i>	Bloom: Flowering Season
Grass Picture(s)	<p>General: Habit, size</p> <p>Flowers: Description, arrangement</p> <p>Leaves: Arrangement, shape, size, margins, surface characteristics</p> <p>Habitat: Type(s) of location where taxon typically grows.</p>
<p>ID Hints: Tip(s) to more easily identify taxon in general, or how to differentiate it from other taxa that closely resemble it.</p> <p>Did You Know? Interesting fact about the taxon along with additional scientific or common names (if applicable).</p>	

Figure 4.3. ‘Grasses’ written description template with group approved fonts, layout and subheadings, and green-colored title box and tab.

glossary contains definitions and/or water-color illustrations of technical terminology used within the guide. The 4-page index lists all entries, both scientific and common names, and their associated page numbers. The list of suggested readings/additional resources is formatted to fit on one page. There will also be a map of all Larimer County Open Spaces and Natural Areas on the inside cover of the guide.

Upon completion of all components (projected date: June 2014), the guide will be sent to a group of pre-selected botanical professionals for outside review. After receiving their approval, the guide will officially be published (projected date: September 2014) and be publically-available through the Colorado Native Plant Society and the Friends of Larimer County. The guide will be priced with a modest fee to help recover any costs accrued during its production.

Personal Contribution

As mentioned in the ‘*Contributors*’ section of Materials and Methods, my personal role in the production of the *Foothills Plant and Flower Guide* was content generation (descriptions and introduction). I was primarily responsible for writing two pages of the guide’s Introduction (Fig 4.4), specifically describing how the guide is organized and how to use it to identify a plant, along with generating content for roughly one-half of the 98 taxa entries (54 total cards: 36 species, 13 genera and 5 comparisons) (Table 4.1; Fig. 4.5). I compiled the taxa description information from a variety of technical keys, field-based floristic guides and government agency websites (Weber, 1976; Wingate, 1994; Guennel, 1995; Kershaw *et al.*, 1998; Kershaw, 2000; Dorn, 2001; Harris and Harris, 2001; Weber and Wittman, 2001, 2012; Mammoser and Tekiela, 2007; Shaw, 2008; Ackerfield, 2013; USDA NRCS, 2014). After completing my assigned contributions, Bilsing performed the primary editing, followed by a general group editing session. Therefore, my work reflects the team’s comments and contributions, and adheres to their specific guidelines. In

addition to my primary contributions, I also provided over 100 photographs for the guide, and made significant edits to both the glossary and Alaback's taxa descriptions.

How to Use This Guide

This guide includes the most common, showy species of plants found in Larimer County at elevations between 5000 and 7000 feet. To use this guide, turn to the appropriate section using the colored headers and tabs:

Grasses: green

Shrubs/Trees: brown



Plants within these two sections are further organized alphabetically by genus name.

Wildflowers: blue/purple, red/pink, orange/yellow, and white

Wildflower species are further organized by flower type:

- Separate petals (further divided by # of petals)
- Fused petals (further divided into pea-like, two-lipped and tubular/cup-shaped),
- Small flowers arranged in heads or clusters (further divided into composites, umbels and other)

Similar species that may be confused are compared side-by-side for easier identification.

Look at the photographs, read the descriptions, and use the ID Hints section for the key characteristics that differentiate each species. Note, however, much variation exists in nature and the descriptions serve only as a guideline. In some cases, plants may bloom at a different time, grow to a different height, or have different colored flowers. If you don't find what you're looking for, look in a different colored section. If you still don't find it, consult one of our suggested references

Common names vary widely across plant guides. This guide uses common names (in bold) and scientific names (in italics) from *Colorado Flora: Eastern Slope* 3rd ed. (Weber & Wittmann, 2001).

All plants are native perennials unless otherwise specified.

A note about plant families: As you become more familiar with identifying plants, note the listed families. Most plants within a family possess some similar characteristics. For example, plants in the Pea (Fabaceae) family generally have alternate, compound leaves, pod fruits.

Figure 4.4. Personal contribution to *Foothills Plant and Flower Guide* introduction.

Prairie Wild Onion	
<i>Allium textile</i>	Bloom: Late Spring, Summer
<p>Family: Onion (Alliaceae)</p> <p>General: Erect, up to 12" tall</p> <p>Flowers/Fruit: Small, white, erect flowers, to ¼" long, clustered in terminal umbels; see also Pink Onion Group</p> <p>Leaves: Basal, linear, to 10" long, green and grass-like</p> <p>Habitat: Dry grasslands, rocky, open areas</p>	<p>ID Hints: Prairie wild onion emits a strong onion-like odor. It typically has 2 basal leaves per flower stalk, and up to 40 flowers per umbel. When not in flower, this and other <i>Allium</i> species closely resemble death camas (<i>Toxicoscordion venenosum</i>), which is highly poisonous.</p> <p>Did You Know? In Latin, the genus name <i>Allium</i> means garlic, and the species name <i>textile</i> refers to the fibers that surround the underground bulb.</p>
	

Figure 4.5. Personal contribution to *Foothills Plant and Flower Guide* description content.

Mouse-ear Chickweed, Field Chickweed	
<i>Cerastium strictum</i>	Bloom: Late Spring, Summer
<p>Family: Chickweed (Alsiniaceae)</p> <p>General: Erect, up to 12" tall, often clumped and mat-forming</p> <p>Flowers/Fruit: Flowers to ¾" wide, with 5 white petals, each with a yellow center and a deeply notched tip, arranged in loose clusters</p> <p>Leaves: Opposite, linear, to 1" long, covered in velvety hair</p> <p>Habitat: Meadows, rocky, open areas, woods</p>	<p>ID Hints: Due to the deeply notched petals, at first glance the flowers appear to have 10 petals, rather than just 5. Each open cluster consists of 5 or more flowers.</p> <p>Did You Know? <i>Cerastium</i> species have the common name chickweed because they were once used as feed for domestic chickens. Members of the chickweed family are often grouped into the pink family (Caryophyllaceae).</p>
	

Figure 4.5 continued.

Poison Hemlock	
<i>Conium maculatum</i>	Bloom: Summer
<p>Family: Carrot (Apiaceae)</p> <p>General: Erect, up to 10' tall, introduced biennial</p> <p>Flowers/Fruit: Tiny white flowers arranged in compound umbels to 6" wide</p> <p>Leaves: Alternate or basal, to 12" long with toothed margins, pinnately divided into lace-like leaflets</p> <p>Habitat: Wet meadows, riparian, disturbed areas</p>	<p>ID Hints: Hollow stems are covered in purple blotches, particularly near the base. Plants produce a musty odor, especially when disturbed.</p> <p>Did You Know? Just as the common name suggests, poison hemlock is highly toxic; it led to the death of the Greek philosopher Socrates. Easily mistaken for other non-toxic, edible members of this family, such as wild carrot or parsley, extreme caution must be taken.</p>
	

Figure 4.5 continued.

Whiskbroom Parsley & Musineon	
<i>Harbouria trachypleura & Musineon divaricatum</i>	Bloom: Spring
<p>Family: Carrot (Apiaceae)</p> <p>General: Erect; whiskbroom parsley: up to 24" tall; musineon: up to 12" tall</p> <p>Flowers/Fruit: Tiny yellow flowers clustered into compound umbels</p> <p>Leaves: Basal, pinnately divided; whiskbroom parsley: linear, stiff leaflets; musineon: non-stiff leaflets which are widest in the middle or base</p> <p>Habitat: Rocky, open areas, dry grassland, sagebrush, canyons, woods</p>	<p>ID Hints: Musineon has much smaller umbels (to 1" wide) and is shorter in stature than whiskbroom parsley (umbels to 4" wide). Also, musineon only has basal leaves while whiskbroom parsley often has one to several alternate stem leaves.</p> <p>Did You Know? Both of these species bloom very early in the spring and have long-lasting flowers. Musineon also goes by the common names leafy and slender wild parsley.</p>
	

Figure 4.5 continued.

Cow Parsnip	
<i>Heracleum sphondylium</i>	Bloom: Late Spring, Summer
<p>Family: Carrot (Apiaceae)</p> <p>General: Erect, up to 8' tall</p> <p>Flowers/Fruit: Tiny white flowers arranged in compound umbels to 12" wide</p> <p>Leaves: Alternate, ternately or pinnately compound into large, broad leaflets with toothed margins</p> <p>Habitat: Wet meadows, wetlands, riparian</p>	<p>ID Hints: Large maple-like leaves, huge flat-topped flower clusters, hairy grooved stems, and moist habitat help distinguish cow parsnip.</p> <p>Did You Know? This species is often mistaken for poison hemlock (<i>Conium maculatum</i>). Although they appear similar at first, closer inspection reveals distinct differences: poison hemlock has lacy, fern-like leaves, hairless purple blotched stems and smaller flower clusters. Also known as <i>Heracleum maximum</i>.</p>
	

Figure 4.5 continued.

Salt & Pepper	
<i>Lomatium orientale</i>	Bloom: Spring, Summer
<p>Family: Carrot (Apiaceae)</p> <p>General: Erect, up to 12" tall</p> <p>Flowers/Fruit: Tiny white flowers with red anthers, arranged in compound umbels on short, leafless stems</p> <p>Leaves: Basal, to 5" long, highly dissected into narrow gray-green leaflets</p> <p>Habitat: Rocky, open areas, dry grasslands</p>	<p>ID Hints: Muted colors make this plant easy to overlook. Get close with a magnifying glass to see the red anthers.</p> <p>Did You Know? The common name salt & pepper refers to the color contrast between the white petals and dark red anthers present on each flower. This plant is one of the earliest to bloom in spring and also goes by the common name northern Idaho biscuitroot and the scientific name <i>Cogswellia orientalis</i>.</p>
	

Figure 4.5 continued.

Common Yarrow, Milfoil	
<i>Achillea lanulosa</i>	Bloom: Late Spring, Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: Creamy white to light pink ray flowers; creamy white to yellow central disk flowers</p> <p>Leaves: Alternate and basal, lanceolate, 3-8" long, pinnately dissected 1-2 times into lacy, fern-like leaflets</p> <p>Habitat: Meadows, woods, open, dry areas, sagebrush, riparian</p>	<p>ID Hints: Reddish stems with soft, feathery, fragrant leaves. Basal leaves typically larger than stem leaves. Tiny composite flowers arranged in terminal flat-topped, umbel-like clusters.</p> <p>Did You Know? Common yarrow provides an important food source for large mammals, such as deer and bighorn sheep, as well as many bird species. It is very difficult to distinguish from the introduced species, <i>A. millefolium</i>.</p>
	

Figure 4.5 continued.

Pearly Everlasting & Pussytoes	
<i>Anaphalis margaritacea & Antennaria</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect; pearly everlasting: up to 3' tall; pussytoes: up to 2' tall</p> <p>Flowers/Fruit: White to yellowish disk flowers in rounded, terminal clusters; no ray flowers present</p> <p>Leaves: Basal and alternate, ovate to lanceolate, to 4" long, gray-green</p> <p>Habitat: Wet meadows, woods, rocky, open areas, dry grasslands, riparian</p>	<p>ID Hints: Pearly everlasting typically has large stem leaves and small, withering basal leaves, whereas pussytoes predominantly has basal leaves and relatively few, small stem leaves. Both have woolly stems and pearly white to pinkish papery bracts that surround the disk flowers.</p> <p>Did You Know? Small-leaved pussytoes (<i>Antennaria parvifolia</i>) and showy pussytoes (<i>A. pulcherrima</i>) are two common species of pussytoes here in Colorado.</p>
	

Figure 4.5 continued.

Blue/Purple Aster Group	
<i>Aster</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: Pale lavender to blue ray flowers; yellow central disk flowers; heads several to many, to 1" wide; see also White Aster Group</p> <p>Leaves: Alternate, linear to lanceolate to spatulate, to 3" long, clasping the stem</p> <p>Habitat: Meadows, dry grasslands, rocky, open areas, riparian, woods</p>	<p>ID Hints: Numerous ray flowers surround yellow disk flowers, grouped in small heads. Leafy, branched slender stems. Bracts overlap like shingles, unlike <i>Erigeron</i>, which has bracts of roughly the same length.</p> <p>Did You Know? Asters are also classified under <i>Virgulus</i>, <i>Virgulaster</i> and <i>Symphyotrichum</i>. Three very common and similar species found in the foothills include <i>Virgulaster ascendens</i>, <i>A. laevis</i>, and <i>A. spatulatus</i>. Look for asters particularly in the fall.</p>

Figure 4.5 continued.

White Aster Group	
<i>Aster</i> spp.	Bloom: Late Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: Numerous white ray flowers surround yellow central disk flowers; heads several, to 1" wide; see also Blue/Purple Aster Group</p> <p>Leaves: Alternate, linear to lanceolate to spatulate, to 3" long, clasping the stem</p> <p>Habitat: Meadows, dry grasslands, rocky, open areas, riparian, woods</p>	<p>ID Hints: Two or more rows of overlapping bracts surround each flower head. This differentiates these species from the closely related fleabanes (<i>Erigeron</i> spp.), which have bracts of roughly equal length in one row.</p> <p>Did You Know? Asters are also classified under <i>Almutaster</i>, <i>Virgulus</i>, <i>Virgulaster</i>, and <i>Symphyotrichum</i>. Four commonly seen asters in the foothills include <i>Aster porteri</i>, <i>Virgulus ericoides</i>, <i>V. falcatum</i>, and <i>V. spatulatum</i></p>

Figure 4.5 continued.

Blue/Purple Fleabane/Daisy Group	
<i>Erigeron</i> spp.	Bloom: Late Spring, Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall, biennial or perennial</p> <p>Flowers/Fruit: Numerous narrow blue-purple ray flowers; yellow central disk flowers; see also White Fleabane/Daisy Group</p> <p>Leaves: Basal and alternate, linear to lanceolate to spatulate, to 2" long</p> <p>Habitat: Dry meadows, rocky, open areas, woods</p>	<p>ID Hints: Fleabanes and asters are easily mistaken; they both can have numerous ray flowers and yellow disk flowers. However, the ray flowers on fleabanes are often much narrower and more numerous. Also, the bracts are roughly equal in length, whereas aster bracts overlap like shingles. <i>Erigeron</i> leaves are often hairy.</p> <p>Did You Know? Nearly 50 different species of <i>Erigeron</i> grow in Colorado. Many look similar and require advanced skills to identify.</p>

Figure 4.5 continued.

White Fleabane/Daisy Group	
<i>Erigeron</i> spp.	Bloom: Late Spring, Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall, biennial or perennial</p> <p>Flowers/Fruit: Numerous narrow, white to light pink ray flowers; yellow central disk flowers; see also Blue/Purple Fleabane/Daisy Group</p> <p>Leaves: Basal and alternate, linear to lanceolate to spatulate, to 2" long</p> <p>Habitat: Dry meadows, rocky, open areas, woods</p>	<p>ID Hints: Fleabanes and asters are easily mistaken; they both can have numerous ray flowers and yellow disk flowers. However, the ray flowers on fleabanes are often much narrower and more numerous. Also, the bracts are roughly equal in length, whereas aster bracts overlap like shingles. <i>Erigeron</i> leaves are often hairy.</p> <p>Did You Know? Nearly 50 different species of fleabane occur in Colorado. Three common species include <i>E. compositus</i>, <i>E. divergens</i> and <i>E. flagellaris</i>.</p>

Figure 4.5 continued.

Gumweed, Curlycup Gumweed	
<i>Grindelia squarrosa</i>	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall, biennial or short-lived perennial</p> <p>Flowers/Fruit: Many yellow ray flowers surround yellow central disk flowers; each flower head to 1 ½" wide, arranged in flat-topped clusters</p> <p>Leaves: Alternate, oval to lanceolate with toothed margins, to 2 ½" long</p> <p>Habitat: Rocky, open areas, dry grassland, riparian</p>	<p>ID Hints: Each flower head is surrounded by several rows of sticky green bracts with downward pointing hooked tips.</p> <p>Did You Know? Resin-secreting glands are what make the bracts of each flower head gummy, and hence where the common names are derived from. Although a common rangeland plant, cattle do not eat gumweed because it emits a bitter taste.</p>

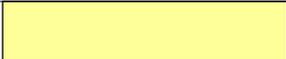


Figure 4.5 continued.

Little Sunflower & Goldeneye	
<i>Helianthella uniflora & Heliomeris multiflora</i>	Bloom: Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, 1-4' tall</p> <p>Flowers/Fruit: Yellow ray flowers surround yellow to brownish-purple central disk flowers (little sunflower), or yellow disk flowers (goldeneye)</p> <p>Leaves: Mainly opposite, sometimes alternate, lanceolate, to 6" long, bristly feeling to the touch</p> <p>Habitat: Woods, rocky, open areas, dry grasslands, sagebrush, cottonwood</p>	<p>ID Hints: Little sunflower typically has 1 larger flower head (to 2 ½" wide) per stem, whereas goldeneye commonly has 2 or more smaller flower heads (1-2" wide) per stem.</p> <p>Did You Know? These two species are often mistaken for true sunflowers (<i>Helianthus</i> spp.). However, the flower heads of little sunflower and goldeneye are generally smaller than sunflowers, and their leaf margins are usually entire, rather than toothed.</p>

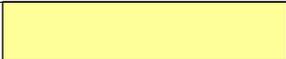


Figure 4.5 continued.

Sunflower	
<i>Helianthus</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, 1-10' tall, annual or perennial</p> <p>Flowers/Fruit: Flower heads 2-6" wide, comprised of bright yellow ray flowers and dark purple disk flowers</p> <p>Leaves: Basal, alternate and/or opposite, lanceolate to egg-shaped, 2-8" long, rough to the touch</p> <p>Habitat: Wet meadows, rocky, open areas, dry grassland, riparian</p>	<p>ID Hints: Typical sunflower-shaped flower heads sit atop stiff, often reddish, rough stems that have leaves with toothed margins. The leaf arrangement can be quite variable; sometimes you find both opposite and alternate leaves on the same plant.</p> <p>Did You Know? Some of the most abundant species in the foothills include annual sunflower (<i>H. annuus</i>), prairie sunflower (<i>H. petiolaris</i>), Nuttall's sunflower (<i>H. nuttallii</i>), and low sunflower (<i>H. pumilus</i>).</p>



Figure 4.5 continued.

Golden Aster	
<i>Heterotheca</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 2' tall, clump-forming</p> <p>Flowers/Fruit: Small flower heads, to 1" wide, comprised of golden yellow ray flowers and yellow to orange central disk flowers</p> <p>Leaves: Alternate, oblong to elliptic, to 2" long and 1/2" wide, hairy</p> <p>Habitat: Woods, rocky, open areas, dry grassland, canyons</p>	<p>ID Hints: Grayish hairy stems, covered with numerous greenish-gray hairy leaves, support one to many small, yellow composite flowers.</p> <p>Did You Know? <i>Heterotheca</i> species, such as golden aster (<i>H. canescens</i>) and hairy golden aster (<i>H. villosa</i>), are very common in the foothills. They are often difficult to identify to species level due to extremely variable leaf and stem characteristics. Also known as <i>Chrysopsis</i>.</p>

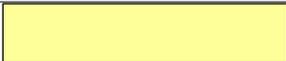


Figure 4.5 continued.

Kansas Gayfeather, Dotted Blazing Star	
<i>Liatris punctata</i>	Bloom: Late Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 2½' tall</p> <p>Flowers/Fruit: Pinkish-purple disk flowers clustered in a terminal spike; no ray flowers present</p> <p>Leaves: Alternate, narrow, to ¼" wide and 6" long, dark green</p> <p>Habitat: Rocky, open areas, dry grasslands</p>	<p>ID Hints: Shiny, glandular dots cover the upward arching leaves. Each small head contains 4-6 disk flowers, but no strap-like ray flowers.</p> <p>Did You Know? Kansas gayfeather plants can have a taproot as deep as 7-16', depending on the soil type. This makes it extremely drought tolerant. This popular garden plant is common throughout the Great Plains.</p>



Figure 4.5 continued.

False Salsify & Yellow Salsify	
<i>Podospermum laciniatum</i> & <i>Tragopogon dubius</i>	Bloom: Spring, Summer
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 3' tall, non-native, annual, biennial, or perennial</p> <p>Flowers/Fruit: Pale yellow ray flowers surrounded by long, green to brown bracts, no disk flowers present</p> <p>Leaves: Basal and alternate, grass-like; false salsify: to 4" long; yellow salsify: to 12" long</p> <p>Habitat: Rocky, open areas, dry grassland</p>	<p>ID Hints: False salsify's lower leaves are typically pinnately dissected, while yellow salsify's leaves are all entire. Both species somewhat resemble the common dandelion, especially when in seed, as they produce a large tuft of white to brown feathery bristles.</p> <p>Did You Know? These flowers typically open at dawn and close by noon, making them easy to overlook. False salsify is also known as <i>Scorzonera laciniata</i>.</p>



Figure 4.5 continued.

Prairie Coneflower, Mexican Hat

Ratibida columnifera

Family: Sunflower (Asteraceae)

General: Erect, up to 3' tall, one to several slender stems

Flowers/Fruit: Yellow drooping ray flowers surround a dark brown to purplish 'cone' of central ray flowers

Leaves: Alternate, to 6" long, pinnately dissected into thin, linear leaflets

Habitat: Meadows, rocky, open areas, dry grassland

ID Hints: Every part of this plant is distinctive, which makes for easy identification: hairy, thinly dissected leaves, drooping ray flowers and an elongated 'cone' of darker colored disk flowers.

Did You Know? This wildflower truly does resemble a traditional Mexican hat, with its tall center and 'brim' of ray flowers. Also known as *Rudbeckia columnifera* and *Lepachys columnaris*.

Figure 4.5 continued.

Black-eyed Susan

Rudbeckia hirta

Bloom: Summer

Family: Sunflower (Asteraceae)

General: Erect, up to 3' tall, hairy, biennial or short-lived perennial

Flowers/Fruit: Yellow to orange ray flowers surround dark brown to purple central disk flowers; flower heads to 3" wide, solitary or in open clusters

Leaves: Alternate, lanceolate to ovate, to 10" long, bristly

Habitat: Meadows, rocky, open areas, dry grassland

ID Hints: Bright yellow ray flowers and dark brownish disk flowers make up each flower head, which sit atop hairy, slender, leafy stems.

Did You Know? Many small mammals and birds rely on this species as a source of food, as each flower head produces anywhere from 250-500 seeds. The species name *hirta* means hairy, which is in reference to the hairy stems and leaves.

Figure 4.5 continued.

Ragwort, Groundsel, Butterweed	
<i>Senecio</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, up to 4' tall, annual, biennial, or perennial</p> <p>Flowers/Fruit: Yellow ray flowers, to 1" long, surround central yellow disk flowers; flower heads to 3" wide</p> <p>Leaves: Basal and alternate, linear to lanceolate, entire to pinnately divided</p> <p>Habitat: Wet meadows, rocky, open areas, dry grassland, sagebrush, woods mountain mahogany, riparian</p>	<p>ID Hints: Each flower head is surrounded by one row of green bracts, which are frequently black-tipped.</p> <p>Did You Know? There are approximately 50 species of <i>Senecio</i> in Colorado alone! Two common species in the foothills include lambstongue ragwort (<i>S. integerrimus</i>), with cobwebby hairy on the young leaves and stems, and broom senecio (<i>S. spartioides</i>), with hairless, linear leaves.</p>

Figure 4.5 continued.

Goldenrod	
<i>Solidago</i> spp.	Bloom: Summer, Fall
<p>Family: Sunflower (Asteraceae)</p> <p>General: Erect, 1-6' tall, clumped</p> <p>Flowers/Fruit: Yellow ray flowers surround yellow central disk flowers; flower heads up to 1/2" wide, clustered on arching stems</p> <p>Leaves: Basal and alternate, lance-shaped, entire to toothed margins</p> <p>Habitat: Wet meadows, woods, rocky, open areas, dry grasslands, riparian, wetlands</p>	<p>ID Hints: Terminal, arching flower stems to 9" long, with numerous small, yellow flowers clustered on one side of the stem.</p> <p>Did You Know? Smooth goldenrod (<i>S. missouriensis</i>), one of the shortest species of goldenrod in the foothills (up to 20" tall), is primarily found in drier sites, while Canada goldenrod (<i>S. canadensis</i>) and giant goldenrod (<i>S. gigantea</i>) are much taller and frequently occur in moister sites.</p>

Figure 4.5 continued.

Fringed Puccoon, Narrowleaf Stoneseed	
<i>Lithospermum incisum</i>	Bloom: Spring, Summer
<p>Family: Borage (Boraginaceae)</p> <p>General: Erect, up to 2' tall, clumped</p> <p>Flowers/Fruit: Lemon yellow to orange tubular flowers to 1 1/2" long and 3/4" wide, with 5 flattened, fringed lobes; flowers clustered at the ends of stems</p> <p>Leaves: Alternate, linear to narrowly lanceolate, to 3" long, firm, and hairy</p> <p>Habitat: Woods, rocky, open areas, dry grasslands</p>	<p>ID Hints: Bright yellow tubular flowers with 5 distinctively crinkled petal lobes.</p> <p>Did You Know? Fringed puccoon's showy yellow flowers actually contribute very little to the plant's reproduction. Instead, seeds are primarily formed from small, unopened flowers that are produced later in the season. The common name stoneseed is in reference to the hard fruits (nutlets) that encase the seeds.</p>

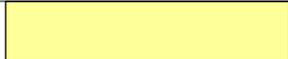


Figure 4.5 continued.

Bell's Twinpod & Fiddleleaf Twinpod	
<i>Physaria bellii</i> & <i>P. vitulifera</i>	Bloom: Spring, Summer
<p>Family: Mustard (Brassicaceae)</p> <p>General: Bell's twinpod: erect to spreading, 2-5" tall; fiddleleaf twinpod: erect, 4-8" tall; both densely hairy</p> <p>Flowers/Fruit: Bright yellow, 4-petaled flowers in rounded clusters</p> <p>Leaves: Basal and alternate; Bell's twinpod: obovate, to 1" long; fiddleleaf twinpod: fiddle-shaped, to 3" long</p> <p>Habitat: Rocky, open areas, canyons</p>	<p>ID Hints: Yellow petals in a cross-shaped pattern, dense basal rosette of silvery hairy leaves, and fruits consisting of 2 (twin) inflated pods distinguish these plants.</p> <p>Did You Know? Although both of these species are common in the foothills, they have very limited distributions worldwide. Bell's twinpod, also known as Front Range twinpod, only occurs in 3 counties in Colorado, while fiddleleaf twinpod only grows in Colorado and Wyoming.</p>

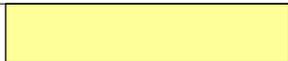


Figure 4.5 continued.

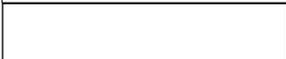
Mariposa Lily, Segó Lily	
<i>Calochortus gunnisonii</i>	Bloom: Late Spring, Summer
<p>Family: Mariposa (Calochortaceae)</p> <p>General: Erect, up to 18" tall</p> <p>Flowers/Fruit: White to cream colored flowers with a narrow, purple stripe and fringe of yellow hairs in the center, to 2" across, solitary or in a loose cluster of 2-5 flowers</p> <p>Leaves: Basal and alternate, linear, to 12" long and ½" wide, green, grass-like</p> <p>Habitat: Meadows, grasslands, aspen groves</p>	<p>ID Hints: Showy, bowl-shaped flowers sit atop thin stalks. Each flower consists of 3 broad inner tepals and 3 pointed, narrow outer tepals.</p> <p>Did You Know? The genus name, <i>Calochortus</i>, is Greek for 'beautiful grass,' referring to its showy flowers and thin, grass-like foliage. Mariposa is Spanish for butterfly, referring to the lightweight tepals, which resemble butterfly wings. Mariposa lily is also frequently placed in the lily family (Liliaceae).</p>
	

Figure 4.5 continued.

Common Harebell	
<i>Campanula rotundifolia</i>	Bloom: Summer
<p>Family: Bellflower (Campanulaceae)</p> <p>General: Erect, up to 2' tall</p> <p>Flowers/Fruit: Blue-violet, nodding, bell-shaped flowers, ¼ - 1" long; petals fused and flared at the tips</p> <p>Leaves: Alternate, stem leaves narrow to 2½" long, basal leaves round</p> <p>Habitat: Wet meadows, woods, rocky, open areas</p>	<p>ID Hints: Delicate stems support either one flower or several, arranged in a loose cluster. Basal leaves are often absent at time of flowering. Typically forms small patches.</p> <p>Did You Know? <i>Campanula</i> is Latin for 'bell-shaped.' Strong insects, such as bees, are required to pollinate these difficult to reach drooping flowers. Grows all across the northern U.S., from desert to rainforest.</p>
	

Figure 4.5 continued.

Blue/Purple Milkvetch Group	
<i>Astragalus</i> spp.	Bloom: Spring, Summer
<p>Family: Pea (Fabaceae)</p> <p>General: Erect to spreading, up to 3' tall, hairy, annual or perennial</p> <p>Flowers/Fruit: Purple to blue flowers, often bicolored, clustered in terminal racemes, fruit a legume; see also White Milkvetch Group</p> <p>Leaves: Alternate, odd-pinnately compound, usually 11 or more leaflets</p> <p>Habitat: Wet meadows, rocky, open areas, dry grasslands, woods, riparian</p>	<p>ID Hints: Milkvetches look very similar to locoweeds (<i>Oxytropis</i> spp.), except that the keel petal of milkvetches is not sharply pointed. The common species of milkvetch in our area are often densely woolly and the flower stems are usually leafy.</p> <p>Did You Know? <i>Astragalus</i> is the largest genus in the world! Roughly 100 species grow in Colorado alone. They frequently hybridize, so they can be extremely variable and confusing!</p>

Figure 4.5 continued.

White Milkvetch Group	
<i>Astragalus</i> spp.	Bloom: Spring, Summer
<p>Family: Pea (Fabaceae)</p> <p>General: Erect to spreading, up to 3' tall, hairy, annual or perennial</p> <p>Flowers/Fruit: White to cream pea flowers, to 1" long, clustered in terminal racemes, fruit a legume; see also Blue/Purple Milkvetch Group</p> <p>Leaves: Alternate, odd-pinnately compound, usually 11 or more leaflets</p> <p>Habitat: Wet meadows, rocky, open areas, dry grasslands, woods, riparian</p>	<p>ID Hints: Milkvetches look very similar to locoweeds (<i>Oxytropis</i> spp.), except that the keel petal of milkvetches is not sharply pointed. The common species of milkvetch in our area are often densely woolly and the flower stems are usually leafy.</p> <p>Did You Know? Roughly 100 species of milkvetch occur in Colorado. Four common species seen along the Front Range include <i>A. adsurgens</i>, <i>A. bisulcatus</i>, <i>A. drummondii</i>, and <i>A. racemosus</i>.</p>

Figure 4.5 continued.

Purple Prairie Clover	
<i>Dalea purpurea</i>	Bloom: Late Spring, Summer
<p>Family: Pea (Fabaceae)</p> <p>General: Erect, up to 2' tall</p> <p>Flowers/Fruit: Numerous tiny (1/4") pinkish-purple flowers in a cone-shaped, terminal spike 1-1 1/2" long</p> <p>Leaves: Alternate, pinnately divided into 3 or 5 narrow leaflets</p> <p>Habitat: Woods, rocky, open areas, dry grasslands</p>	<p>ID Hints: Look closely to see shiny, translucent glands dotting the leaves. Golden orange stamens protrude distinctly from the purple flowers. The stems appear wiry and often have a yellowish cast.</p> <p>Did You Know? Purple prairie clover provides excellent wildlife food because of its high protein content. It is also an important source of food for native bumblebees and honeybees.</p>

Figure 4.5 continued.

Common Lupine, Silvery Lupine	
<i>Lupinus argenteus</i>	Bloom: Summer
<p>Family: Pea (Fabaceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: White, blue or purple pea flowers, to 1/2" long, in dense to open terminal racemes to 8" long, fruit a hairy legume to 1" long</p> <p>Leaves: Alternate, palmately compound with 5 or more leaflets, silvery green</p> <p>Habitat: Wet meadows, woods, rocky, open areas, dry grasslands</p>	<p>ID Hints: Lupines are distinguished by palmately compound leaves on an obvious stem with terminal racemes of pea flowers.</p> <p>Did You Know? The flowers and seeds of common lupine are toxic to humans and certain livestock. However, they serve as an important food supply for several species of butterflies. There are many species of lupines, many of which hybridize, making them sometimes difficult to identify.</p>

Figure 4.5 continued.

Golden Banner, Golden Pea	
<i>Thermopsis divaricarpa</i>	Bloom: Spring, Summer
<p>Family: Pea (Fabaceae)</p> <p>General: Erect, up to 3' tall, forms large patches</p> <p>Flowers/Fruit: Bright yellow, pea flowers, to 1" long, arranged in terminal clusters</p> <p>Leaves: Alternate, ternately compound with oval-shaped leaflets</p> <p>Habitat: Rocky, open areas, dry grassland, riparian, canyons</p>	<p>ID Hints: Large, bright yellow, pea flowers make this wildflower hard to overlook. At the base of each leaf are 2 egg-shaped, modified leaves called stipules; these often give the appearance of 5 leaflets, rather than 3.</p> <p>Did You Know? Golden banner is toxic to livestock and may cause birth defects if ingested by pregnant cows. Prairie golden banner (<i>T. rhombifolia</i>) is a very similar species, blooming early in spring on the plains.</p>



Figure 4.5 continued.

Colorado Columbine, Blue Columbine	
<i>Aquilegia coerulea</i>	Bloom: Summer
<p>Family: Hellebore (Helleboraceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: 5 showy bluish-white sepals, white to blue spurred petals, to 3" across</p> <p>Leaves: Alternate, divided 2-3 times in 3's, each leaflet 3/4 - 2" long</p> <p>Habitat: Wet meadows, riparian, woods</p>	<p>ID Hints: Very distinctive flowers that mature into clusters of 1" long, hairy seed pods. Light blue-green leaves are mostly basal; stem leaves, when present, are much smaller, which distinguishes this species from meadow rue.</p> <p>Did You Know? This is the Colorado state flower. The long, backward pointing spurs contain nectar that only hummingbirds and insects with long tongues can reach.</p>



Figure 4.5 continued.

Pale Larkspur, Carolina Larkspur <i>Delphinium carolinianum</i> ssp. <i>virescens</i> Bloom: Late Spring, Summer	
<p>Family: Hellebore (Helleboraceae)</p> <p>General: Erect, up to 3' tall</p> <p>Flowers/Fruit: Whitish-cream flowers, to 1" wide, with a backward pointing spur, clustered in a terminal raceme to 10" long; see also Blue/Purple Larkspur Group</p> <p>Leaves: Basal and alternate, palmately lobed with narrow leaflets</p> <p>Habitat: Woods, rocky, open areas, dry grasslands</p>	<p>ID Hints: Pale larkspur has leafy stems and unique-looking flowers that consist of 5 petal-like sepals, the upper of which is spurred, and 4 true petals.</p> <p>Did You Know? Almost all parts of the plant are poisonous to humans, as well as certain wildlife and livestock. This and other <i>Delphinium</i> species are sometimes classified in the buttercup family (Ranunculaceae). Also known as <i>D. virescens</i>.</p>
	

Figure 4.5 continued.

Blue/Purple Larkspur Group <i>Delphinium</i> spp. Bloom: Late Spring, Summer	
<p>Family: Hellebore (Helleboraceae)</p> <p>General: Erect, up to 2 1/2' tall</p> <p>Flowers/Fruit: Blue-purple petals with one backward pointing spur; see also white species <i>D. carolinianum</i></p> <p>Leaves: Basal and alternate, palmately lobed with narrow leaflets</p> <p>Habitat: Meadows, sagebrush, rocky, open areas</p>	<p>ID Hints: Larkspur flowers have 5 petal-like sepals, the upper of which is spurred, and 4 true petals. Numerous flowers are arranged in open racemes.</p> <p>Did You Know? <i>D. geyeri</i> and <i>D. nuttallianum</i> are two fairly common larkspur species located in the foothills. Almost all parts of the plant are poisonous to humans, as well as certain wildlife and livestock. Sometimes classified in the buttercup family (Ranunculaceae).</p>
	

Figure 4.5 continued.

Wild Iris, Blue Flag	
<i>Iris missouriensis</i>	Bloom: Late Spring, Summer
<p>Family: Iris (Iridaceae)</p> <p>General: Erect, up to 2' tall, spreads into dense clumps</p> <p>Flowers/Fruit: Large, lilac-purple flowers with a yellow center, 2-4" wide</p> <p>Leaves: Mostly basal, sword-shaped, 8 to 15" long, light gray-green</p> <p>Habitat: Wet meadows, riparian, aspen forests</p>	<p>ID Hints: Very delicate and showy flowers. The outer 3 tepals often curve downward, while the inner 3 are held upright.</p> <p>Did You Know? The fine, silky fibers found along the leaf margins are incredibly strong and have been used to make fishing nets, string and snares for catching wild game. The vertical orientation of the leaves minimizes solar heating, which conserves moisture.</p>

Figure 4.5 continued.

Bee Balm, Horsemint	
<i>Monarda fistulosa</i>	Bloom: Summer
<p>Family: Mint (Lamiaceae)</p> <p>General: Erect, up to 4' tall</p> <p>Flowers/Fruit: Rose-purple, 1-1½" long flowers in a terminal head</p> <p>Leaves: Opposite, lanceolate, to 3½" long, gray-green</p> <p>Habitat: Wet meadows, riparian, canyons, woods</p>	<p>ID Hints: The very showy flower cluster sits atop a square, hairy, unbranched stem. The flowers may appear "messy", like uncombed hair. The leaves have a very minty fragrance.</p> <p>Did You Know? The nectar inside bee balm flowers attracts butterflies, hummingbirds and bees. The aromatic leaves are frequently used in perfumes and potpourris. You can usually smell this plant 6' or more away.</p>

Figure 4.5 continued.

Skullcap	
<i>Scutellaria brittonii</i>	Bloom: Spring, Summer
<p>Family: Mint (Lamiaceae)</p> <p>General: Erect, up to 8" tall</p> <p>Flowers/Fruit: Dark blue-violet, to 1 ½" long; the upper sepals and petals form a rounded, helmet-like lobe</p> <p>Leaves: Opposite, somewhat firm, narrow to oval-shaped, 1-3" long</p> <p>Habitat: Meadows, woods, rocky, open areas, ponderosa pine</p>	<p>ID Hints: Skullcap flowers are found in pairs in the leaf axils. They consist of a larger lower lip and a smaller upper lip. Although somewhat small overall, the prominent helmet-like shape of the upper sepals and petals stands out, even from a distance.</p> <p>Did You Know? Skullcap, like other members of the mint family, has a square stem. The common name skullcap is in reference to the flowers' distinctive helmet-like appearance.</p>

Figure 4.5 continued.

Wild Blue Flax, Prairie Flax	
<i>Adenolinum lewisii</i>	Bloom: Spring, Summer
<p>Family: Flax (Linaceae)</p> <p>General: Erect to spreading, up to 2' tall in clusters of stems, or bunches</p> <p>Flowers/Fruit: 5 separate, pale blue petals with darker blue veins, to 1 ½" wide</p> <p>Leaves: Alternate, narrow, to ¾" long, slender stems very leafy when young</p> <p>Habitat: Rocky, open areas, dry grasslands, woods</p>	<p>ID Hints: Delicate, sky blue flowers with yellow centers on top of slender stems. This species is very difficult to distinguish from the introduced species, <i>A. perenne</i>, which has a more erect habit and darker blue flowers.</p> <p>Did You Know? The extremely fragile petals will drop with the slightest breeze. The stems were used as an ancient source of fiber. <i>Linum lewisii</i> is a commonly used synonym.</p>

Figure 4.5 continued.

Copper Mallow, Scarlet Globemallow	
<i>Sphaeralcea coccinea</i>	Bloom: Spring, Summer
<p>Family: Mallow (Malvaceae)</p> <p>General: Erect, up to 12" tall, grayish hairy stems, clump-forming</p> <p>Flowers/Fruit: Orange to pinkish-red flowers, to 3/4" wide, each petal with a shallow notch at the tip</p> <p>Leaves: Alternate, to 1 1/2" long and 2" wide, palmately lobed into 3 or 5 segments, grayish-green, hairy</p> <p>Habitat: Rocky, open areas, dry grassland, sagebrush</p>	<p>ID Hints: Bright orange to reddish flowers on grayish-green hairy stems and palmately lobed, hairy leaves.</p> <p>Did You Know? Marshmallows used to be made from the roots of a sister genus of copper mallow, however now they are made synthetically. This species, and other members of the mallow family, often have star-shaped hairs on their stems and leaves; however you need a hand lens or microscope to see them.</p>

Figure 4.5 continued.

Yellow Evening Primrose Group	
<i>Oenothera</i> spp.	Bloom: Late Spring, Summer
<p>Family: Evening Primrose (Onagraceae)</p> <p>General: Erect, 6-48" tall, clumped, biennial and perennial</p> <p>Flowers/Fruit: Rounded yellow petals, flowers to 2 1/2" wide; see also White Evening Primrose Group</p> <p>Leaves: Basal and alternate, linear to lanceolate, to 8" long, toothed margins</p> <p>Habitat: Wet meadows, woods, rocky, open areas, dry grassland, riparian</p>	<p>ID Hints: Showy, yellow, tubular flowers, each with 4 fragile petals, sit above a dense basal rosette of toothed leaves. Flowers often mature to pink.</p> <p>Did You Know? These flowers, although large and showy, are often overlooked because they remain closed during the day. The flowers open up at night, when night-flying moths pollinate them.</p>

Figure 4.5 continued.

Grass Picture(s)	Crested Wheatgrass <i>Agropyron desertorum</i> Bloom: Summer
	<p>General: Non-native, erect bunchgrass, 1-3' tall</p> <p>Flowers: 1-4" long bristly-looking terminal spike with closely overlapping spikelets</p> <p>Leaves: Basal and alternate, flat, to 8" long and 1/2" wide</p> <p>Habitat: Rocky, open areas, dry grasslands, roadside</p>
<p>ID Hints: Look for a dense bristly spike elevated above flat, relatively wide leaves.</p> <p>Did You Know? Although a non-native, crested wheatgrass is widespread in the foothills because it is often planted for its high livestock forage value and erosion control properties. Also known as <i>Agropyron cristatum</i>.</p>	

Figure 4.5 continued.

Grass Picture(s)	Side-oats Grama <i>Bouteloua curtipendula</i> Bloom: Summer
	<p>General: Erect, tufted to spreading, 8-36" tall</p> <p>Flowers: 4-12" long panicle with drooping spikelets of purplish flowers, often one-sided</p> <p>Leaves: Mostly basal, to 12" long and 1/3" wide, flat to slightly rolled inward</p> <p>Habitat: Woods, rocky, open areas, dry grasslands, sagebrush, mountain mahogany</p>
<p>ID Hints: Very distinctive one-sided inflorescence with many drooping spikelets.</p> <p>Did You Know? Side-oats grama is frequently used as an ornamental grass because of its unique looking inflorescence. Wildlife and livestock graze on this grass during the summer and fall.</p>	

Figure 4.5 continued.

Grass Picture(s)	Smooth Brome <i>Bromopsis inermis</i> Bloom: Summer
	<p>General: Erect non-native, 2-4' tall loose clumps</p> <p>Flowers: 2-8" long panicle with spikelets held on narrow to open branches</p> <p>Leaves: Alternate, flat, to 15" long and 1/2" wide, smooth to hairy</p> <p>Habitat: Wet meadows, rocky, open areas, dry grassland, roadside</p>
<p>ID Hints: The leaves of smooth brome are conspicuously imprinted with a "W" across the leaf blade, making for easy identification.</p> <p>Did You Know? Smooth brome is heavily planted as forage grass in pastures, and along roadsides for soil stability. Also known as <i>Bromus inermis</i>.</p>	

Figure 4.5 continued.

Grass Picture(s)	Blue Grama <i>Chondrosium gracile</i> Bloom: Summer
	<p>General: Erect, tufted to mat-forming, 8-24" tall</p> <p>Flowers: Panicle with 1-6 densely flowered branches, often one-sided</p> <p>Leaves: Mostly basal, to 10" long and 1/5" wide, flat to loosely rolled inward</p> <p>Habitat: Dry grassland, sagebrush</p>
<p>ID Hints: Each branch on a blue grama panicle resembles a dense eyelash.</p> <p>Did You Know? Blue grama is one of the dominant grass species of the shortgrass prairie and is also the state grass of Colorado. Also known as <i>Bouteloua gracilis</i>.</p>	

Figure 4.5 continued.

Grass Picture(s)	Canada Wild Rye <i>Elymus canadensis</i> Bloom: Summer
	General: Erect bunchgrass, 2½ - 5' tall Flowers: 3-10" long bristly spike, erect to nodding; spikelets with many long awns Leaves: Alternate, flat to folded, to 16" long and ¾" wide, with fine-toothed margins Habitat: Rocky, open areas, woods, riparian
ID Hints: Canada wild rye has very characteristic flower spikes that somewhat resemble bristly bottlebrushes.	
Did You Know? In addition to being decent forage for wildlife, <i>E. canadensis</i> provides nesting sites for many bird species.	

Figure 4.5 continued.

Grass Picture(s)	Needle-and-Thread Grass <i>Hesperostipa comata</i> Bloom: Summer
	General: Erect, densely tufted bunchgrass, up to 3½' tall Flowers: 4-15" long panicle, few spikelets, each with one terminally curled awn Leaves: Alternate, flat to inwardly rolled, to 16" long and less than ¼" wide Habitat: Dry grassland, woods, open areas
ID Hints: Each flower bears one curly awn, to 9" long, which remains persistent on the tip of the mature fruit as well.	
Did You Know? The common name refers to the hard, sharp-tipped fruits (needle) with their long, curly awn (thread). Also known as <i>Stipa comata</i> .	

Figure 4.5 continued.

Grass Picture(s)	Junegrass <i>Koeleria macrantha</i> Bloom: Spring
	<p>General: Erect bunchgrass, up to 6" tall, grows in small clumps</p> <p>Flowers: Many green flowers in dense spikes</p> <p>Leaves: Basal, narrow (to 1/10" wide), rolled or folded, hairy along margins</p> <p>Habitat: Rocky, meadows, dry grasslands, woods, valleys and foothills</p>
<p>ID Hints: Junegrass has prow-shaped leaf tips, similar to many turf-forming bluegrass species (such as lawngrass, <i>Poa</i> spp.).</p> <p>Did You Know? Junegrass is popular for water-wise gardens and dried flower arrangements. The flower spikes can persist for months if protected from winds.</p>	

Figure 4.5 continued.

Grass Picture(s)	Switchgrass <i>Panicum virgatum</i> Bloom: Summer
	<p>General: Erect bunchgrass, 3-5' tall</p> <p>Flowers: 4-20" long, open airy panicle with many tiny spikelets (less than 1/3" long)</p> <p>Leaves: Alternate, flat, to 24" long and 1/2" wide</p> <p>Habitat: Wet meadows, woods, grassland, riparian</p>
<p>ID Hints: The stems of switchgrass are often tan- to red-colored; this combined with its delicate looking panicle make it easily recognizable from a distance.</p> <p>Did You Know? Switchgrass is one of the dominant species of the tall grass prairie. Rabbits and pheasants will often nest within its dense cover.</p>	

Figure 4.5 continued.

Grass Picture(s)	Native Western Wheatgrass <i>Pascopyrum smithii</i> Bloom: Summer
	<p>General: Erect, spreading, up to 3½' tall</p> <p>Flowers: 2-7" long spike with closely spaced bluish-green spikelets, often with short awns</p> <p>Leaves: Alternate, flat to inwardly rolled, firm, to 10" long with obvious veins</p> <p>Habitat: Rocky, open areas, dry grassland</p>
<p>ID Hints: Look for blue-green, conspicuously veined leaves and similarly colored spikelets.</p> <p>Did You Know? Native western wheatgrass is one of the most common native grasses in the United States. Also known as <i>Agropyron smithii</i> and <i>Elymus smithii</i>.</p>	

Figure 4.5 continued.

Grass Picture(s)	Sand Dropseed <i>Sporobolus cryptandrus</i> Bloom: Summer
	<p>General: Erect bunchgrass, up to 36" tall</p> <p>Flowers: 6-15" long panicle with tiny gray to purplish spikelets</p> <p>Leaves: Alternate, flat, but often inwardly rolled near tip, to 10" long and ¼" wide</p> <p>Habitat: Rocky, open areas, dry grassland, sagebrush</p>
<p>ID Hints: When first beginning to flower, the inflorescence appears dense and spike-like; however, it matures into an open, pyramidal panicle.</p> <p>Did You Know? Sand dropseed is extremely drought tolerant. During the hot summer, leaves curl inward to reduce surface area and thereby reduce water loss.</p>	

Figure 4.5 continued.

Buttercup	
<i>Ranunculus</i> spp.	Bloom: Spring, Summer
<p>Family: Buttercup (Ranunculaceae)</p> <p>General: Erect to spreading, up to 2' tall, often producing roots along the stem if spreading</p> <p>Flowers/Fruit: 5 glossy, yellow petals, flowers ½ - 1" wide</p> <p>Leaves: Basal and alternate, shallowly 3-lobed to deeply divided into 3 leaflets, leaf shape and size variable</p> <p>Habitat: Wet meadows, woods, sagebrush, dry, open areas, riparian</p>	<p>ID Hints: Shiny yellow, saucer shaped flowers mature into a rounded cluster of numerous small fruits (achenes).</p> <p>Did You Know? Buttercups are all poisonous to some degree, although their levels of toxicity can vary greatly depending on species, habitat and individuals' sensitivity. Macoun's buttercup (<i>R. macounii</i>) typically grows in wet locations, while sagebrush buttercup (<i>R. glaberrimus</i>) is usually found on drier sites.</p>

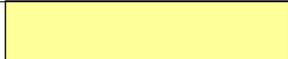


Figure 4.5 continued.

Northern Bedstraw	
<i>Galium septentrionale</i>	Bloom: Late Spring, Summer
<p>Family: Madder (Rubiaceae)</p> <p>General: Erect, up to 2' tall</p> <p>Flowers/Fruit: Tiny, white to creamy white flowers, each with 4 petals, grouped in many-flowered, terminal clusters</p> <p>Leaves: In whorls of 4 along the stems, linear to lanceolate, to 2" long, green, and smooth</p> <p>Habitat: Wet meadows, woods, dry grasslands, riparian</p>	<p>ID Hints: Whorled, sweet-smelling leaves, square stems and numerous tiny white flowers distinguish northern bedstraw. Unlike other <i>Galium</i> species, which have rough leaves and stems, <i>G. septentrionale</i> has smooth leaves and stems.</p> <p>Did You Know? This species is very similar to the introduced species <i>G. boreale</i>, and therefore the two are often lumped together and simply referred to as <i>G. boreale</i>.</p>



Figure 4.5 continued.

Snowball Saxifrage, Diamond-leaf Saxifrage	
<i>Micranthes rhomboidea</i>	Bloom: Late Spring, Summer
<p>Family: Saxifrage (Saxifragaceae)</p> <p>General: Erect, up to 12" tall</p> <p>Flowers/Fruit: Small white flowers with yellow centers, crowded in a rounded terminal cluster to 2 1/2" wide, atop a leafless stem</p> <p>Leaves: Mostly basal, rhomboid to ovate, to 2 1/2" long, toothed margins, often reddish on underside</p> <p>Habitat: Rocky, open areas, sagebrush</p>	<p>ID Hints: This species is distinguished by one leafless, hairy stem supporting a round cluster of tiny white flowers that resemble a snowball and clusters of leathery, diamond-shaped basal leaves. Often found growing in rocky crevices.</p> <p>Did You Know? Snowball saxifrage grows at many elevations and a variety of habitats in Colorado. Also known as <i>Saxifraga rhomboidea</i> and <i>S. austrina</i>.</p>
	

Figure 4.5 continued.

Prairie Paintbrush, Plains Paintbrush	
<i>Castilleja sessiliflora</i>	Bloom: Late Spring
<p>Family: Figwort (Scrophulariaceae)</p> <p>General: Erect, up to 10" tall, grows in clusters</p> <p>Flowers/Fruit: White to greenish-yellow, narrow, beak-like flowers, to 2" long, clustered in terminal spikes; see also Red Paintbrush Group</p> <p>Leaves: Alternate, linear to pinnately divided, especially on upper portion of stem</p> <p>Habitat: Dry grasslands, rocky areas</p>	<p>ID Hints: Narrow, two-lipped flowers with a beak-shaped curve surrounded by numerous green leaf-like bracts.</p> <p>Did You Know? Prairie paintbrush and other <i>Castilleja</i> species are hemiparasitic, meaning that they can both photosynthesize to make their own food, and also attach to other plant species via specialized roots to "rob" nutrients from their hosts. Members of this genus are also classified under the broomrape family (Orobanchaceae).</p>
	

Figure 4.5 continued.

Nuttall's Violet, Yellow Prairie Violet

Viola nuttallii

Bloom: Spring

Family: Violet (Violaceae)

General: Erect, up to 6" tall, clumps

Flowers/Fruit: Bright yellow, nodding flowers, to ¾" wide, with 2 upper, backward curving petals, and 3 lower petals, one of which is spurred

Leaves: Basal, lanceolate, to 8" long, dark green, mostly entire margins, sometimes shallowly toothed

Habitat: Meadows, woods, rocky, open areas, dry grasslands

ID Hints: A lower petal with brown/purple veins and leafless stems are very distinctive. Nuttall's violet is one of the only violet species with lanceolate leaves, making for easy identification; many others have heart-shaped leaves.

Did You Know? The lines on the petals, also known as nectary guides, serve to direct pollinating insects toward the nectar, which is located in the spur.

Figure 4.5 continued.

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APPENDIX

ANNOTATED CHECKLIST OF VASCULAR PLANTS DOCUMENTED AT RED
MOUNTAIN OPEN SPACE AND SOAPSTONE PRAIRIE NATURAL AREA

FERN ALLIES

Equisetaceae

- *Equisetum arvense* L., field horsetail;
RMOS; WL; 6335'; i; [477a]
- *Equisetum laevigatum* A. Braun, smooth
horsetail; RMOS, SPNA; 6442 – 6457';
DC, TR, WL; o; [215, 303, 318e]

Selaginellaceae

- *Selaginella densa* Rydb., Rocky Mountain
spike-moss; RMOS, SPNA; 6777 –
7031'; RT, SP; o; [184, 209]

Juniperus scopulorum Sarg., Rocky
Mountain juniper; RMOS, SPNA; 6420
– 6855'; CA, CL, FS; o; [211, 278, 404]

Pinaceae

Pinus ponderosa Dougl. ex Laws var.
scopulorum Engelm., ponderosa pine;
RMOS, SPNA; 6311 – 6404'; CL, SB;
o; [349*, 403d, 817b]

Pseudotsuga menziesii (Mirb.) Franco var.
glauca (Beissn.) Franco, Douglas fir;
RMOS; 6645'; CA, CL, PP; o; [371]

FERNS

Dryopteridaceae

- ▼ *Cystopteris fragilis* (L.) Bernh., brittle
bladder fern; RMOS, SPNA; 6336 –
6610'; CA, CL, MM, RA; i; [543, 584,
733, 812]

Pteridaceae

- Cheilanthes feei* T. Moore, slender lip
fern; RMOS, SPNA; 6361 – 6496'; CA,
CL, TR; i-o; [327, 367, 504]
- Δ *Pellaea glabella* Mett. ex Kuhn ssp.
simplex (Butters) A. Löve & D. Löve,
smooth cliff-brake; RMOS; 6596'; CA,
CL; r-i; [372]

GYMNOSPERMS

Cupressaceae

- *Juniperus communis* L. var. *depressa*
Pursh, common juniper; RMOS; 6754';
CA, CL; i; [544]

ANGIOSPERMS

Agavaceae

Leucocrinum montanum Nutt. ex Gray,
common sand lily; RMOS, SPNA; 6511
– 7219'; SP, TR; c; [58*, 61, 68, 73]

Yucca glauca Nutt., Great Plains yucca;
RMOS, SPNA; 6337 – 6355'; FS, SP,
TR; c; [666, 834*]

Alismataceae

- *Sagittaria brevirostra* Mackenzie &
Bush, shortbeak arrowhead; RMOS;
6318'; DA, RA; r; [425a]

Sagittaria cuneata Sheldon, arrowleaf
arrowhead; SPNA; 6395'; RA; i;
[832b*]

Alliaceae

- ▼ *Allium cernuum* Roth, nodding onion;
RMOS, SPNA; 6526 – 6838'; FS, SP,
TR; o-i; [395, 745c, 790b]

Allium geyeri S. Wats. var. *geyeri*, Geyer's
onion; SPNA; 6385'; WL; i; [152]

Allium textile A. Nels. & J.F. Macbr.,
textile onion; RMOS, SPNA; 6108 –
6508'; TR, SP; o-i; [102*, 591c, 612]

Amaranthaceae

▼ *Amaranthus blitoides* S. Wats., mat
amaranth; SPNA; 6905'; SP, TR; i;
[756]

Anacardiaceae

Rhus trilobata Nutt. var. *trilobata*,
skunkbrush sumac; RMOS, SPNA; 6112
– 6539'; CA, FS, SP; c; [551, 579]

Toxicodendron rydbergii (Small) Greene,
western poison ivy; RMOS, SPNA;
6359 – 6461'; AG, CA, CL; i-o; [490*,
808a*]

Apiaceae

■ *Angelica ampla* A. Nels., giant angelica;
RMOS; 6494'; RA; i-o; [364b]

◇ *Berula erecta* (Huds.) Coville, cutleaf
waterparsnip; SPNA; 6442'; WL; o;
[318a]

Cicuta maculata L., spotted water hemlock;
RMOS; 6350 – 6586'; CA, RA, WL; i;
[370, 453*]

▼ *Cymopterus acaulis* (Pursh) Raf., plains
springparsley; RMOS, SPNA; 6272 –
6960'; DA, SP, TR; o; [506, 510, 534]

■ ▼ *Cymopterus montanus* Nutt. ex Torr. &
Gray, mountain springparsley; RMOS,
SPNA; 6202 – 6475'; DA, FS, SP; o;
[514, 523]

Harbouria trachypleura (Gray) Coult. &
Rose, whiskbroom parsley; RMOS,
SPNA; 5918 – 6504'; CA, FS, SP, TR;
c; [87, 553b]

Lomatium orientale Coult. & Rose, salt-and-
pepper; RMOS, SPNA; 6508 – 6669';
CA, SP, TR; o; [59*, 518, 529]

■ *Musineon divaricatum* (Pursh) Nutt. ex
Torr. & Gray, leafy wildparsley; RMOS,
SPNA; 6446 – 7213'; FS, SP, TR; i-o;
[70, 74, 517]

■ *Musineon tenuifolium* Nutt., slender
wildparsley; RMOS, SPNA; 6289 –
7074'; CL, CA, FS, TR; o-c; [120, 333,
441, 511, 513]

Apocynaceae

■ *Apocynum x floribundum* Greene,
dogbane; RMOS; 6372'; MM; r; [249]

Araceae

■ *Lemna minor* L., common duckweed;
RMOS; 6306'; RA; i-r; [475b]

Asclepiadaceae

■ *Asclepias speciosa* Torr., showy
milkweed; RMOS; 6068'; DA, SP; r;
[736]

Asteraceae

Achillea millefolium L., common yarrow;
RMOS, SPNA; 6526 – 6903'; CA, FS,
RA, SP, TR; o-c; [279, 387b, 790c]

Agoseris glauca (Pursh) Raf. var.
dasycephala (Torr. & Gray) Jeps., pale
agoseris; SPNA; 6084 – 6303'; RA, WL;
i; [652, 771]

Ambrosia artemisiifolia L., common
ragweed; SPNA; 6482'; RA; o; [824b]

Ambrosia psilostachya DC., western
ragweed; SPNA; 6256'; DA, SP; i;
[807a]

■ *Ambrosia tomentosa* Nutt., perennial
bursage; RMOS; 6651'; WL; o; [252]

■ *Anaphalis margaritacea* (L.) Benth. &
Hook., pearly everlasting; RMOS;
6651'; CA, RA; o; [800d]

▼ *Antennaria anaphaloides* Rydb., pearly
pussy-toes; SPNA; 6779'; SP, TR; i-o;
[313]

Antennaria microphylla Rydb., littleleaf
pussy-toes; SPNA; 6331'; WL; o; [138]

■ *Antennaria parvifolia* Nutt., small-leaf
pussy-toes; RMOS; 6841'; SP, WL; o;
[207]

- ◇■*Arctium minus* Bernh., common burdock;
RMOS, SPNA; 6454 – 6798'; CA, RA
r-i; [415a, 827b*]
- Artemisia campestris* L. var. *caudata*
(Michx.) Palmer & Steyerl, field
sagewort; SPNA; 6340'; DC; i-o;
[809a]
- Artemisia dracunculus* L., tarragon;
RMOS; 7186'; FS, TR; i-o; [750]
- Artemisia frigida* Willd., prairie sagewort;
RMOS, SPNA; 6460 – 6526'; CA, FS,
SP, TR; c; [467, 790a]
- Artemisia ludoviciana* Nutt. var.
incompacta (Nutt.) Cronquist, white
sagebrush; RMOS; 6651'; CA, RA; i;
[799]
- Artemisia ludoviciana* Nutt. var.
ludoviciana, Louisiana wormwood;
RMOS, SPNA; 6177 – 6370'; DA, SP,
TR; o-i; [833a, 842b, 852]
- ◇*Bidens cernua* L., nodding beggar-ticks;
RMOS, SPNA; 6306 – 6395'; DA,
RA; o; [475, 832a*]
- ◇■*Bidens frondosa* L., devil's beggar-ticks;
RMOS; 6395'; CA, WL; i; [492c]
- ▼*Brickellia eupatorioides* (L.) Shinnery,
false bonnet; SPNA; 6578'; DC, TR; i;
[839*]
- Brickellia grandiflora* (Hook.) Nutt.,
tasselflower brickellbush; RMOS;
6798'; CA; i; [415b]
- ◇*Carduus nutans* L., musk thistle; RMOS;
6591'; CA; i; [792]
- ◇■*Cirsium arvense* (L.) Scop., Canada
thistle; RMOS, SPNA; 6074 – 7038';
DC, SP, TR, WL; o; [354a, 430b, 466a,
491a, 747b, 822]
- Cirsium canescens* Nutt., prairie thistle;
SPNA; 6458 – 6646'; SP, TR; o;
[239]
- Cirsium flodmanii* (Rydb.) Arthur,
Flodman's thistle; SPNA; 6370
– 6626'; SP, WL; o-i; [321, 430a,
833b]
- Cirsium ochrocentrum* Gray, yellowspine
thistle; SPNA; 6416'; SP, TR; i; [392a]
- Cirsium undulatum* (Pursh) Spreng.
wavyleaf thistle; RMOS; 6374 – 6626';
TR; i; [334, 702, 704b]
- ◇■*Conyza canadensis* (L.) Cronquist,
horseweed; RMOS; 6318'; RA; o;
[425e]
- Crepis runcinata* (E. James) Torr. & Gray
var. *runcinata*, fiddleleaf hawk's-beard;
SPNA; 6058 – 6447'; RA, WL; o-i;
[722c*, 769a]
- ▼*Cyclachaena xanthifolia* (Nutt.) Fresen.,
giant sumpweed; SPNA; 6417 – 6423';
DA, DC, SP; o-i; [829a, 862b]
- ▼*Dieteria bigelovii* (Gray) D.R. Morgan &
R.L. Hartman var. *bigelovii*, Bigelow's
tansy-aster; SPNA; 6645'; DC, FS; o-i;
[469]
- Dieteria canescens* (Pursh) Nutt., hoary
tansy-aster; RMOS; 6377'; CL, DA; i-o;
[843]
- Dyssodia papposa* (Vent.) Hitchc., fetid
marigold; RMOS, SPNA; 6361 – 6432';
DA, SP; o; [489b, 863]
- Ericameria nauseosa* (Pallas ex Pursh)
Nesom & Baird var. *graveolens* (Nutt.)
Reveal & Schuyler, rubber rabbitbrush;
SPNA; 6525'; FS; i-o; [326]
- Ericameria nauseosa* (Pallas ex Pursh)
Nesom & Baird var. *nauseosa*, rubber
rabbitbrush; RMOS, SPNA; 6165 –
6356'; FS, SP; c; [338b*, 428]
- ▼*Erigeron caespitosus* Nutt., tufted daisy;
RMOS, SPNA; 6638 – 7141'; MM, TR;
o; [310, 739a, 870a]
- Erigeron canus* Gray, hoary daisy; RMOS,
SPNA; 6232 – 6754'; DA, FS, TR; o;
[197, 357a, 673, 835]
- ▼*Erigeron compositus* Pursh, cutleaf
daisy; RMOS, SPNA; 6147 – 6733';
CA, CL; i-o; [531, 601]
- Erigeron engelmannii* A. Nels., Engelmann's
daisy; RMOS; 6350'; TR; i-o; [675]
- Erigeron flagellaris* Gray, trailing daisy;
RMOS; 6202 – 6342'; DC, MM, WL;
i-o; [599, 661b]

- Erigeron glabellus* Nutt., smooth daisy; SPNA; 6316'; TR, WL; o; [235]
- Erigeron lonchophyllus* Hook., shortray fleabane; SPNA; 6442'; WL; o; [318c]
- Erigeron pumilus* Nutt., shaggy daisy; RMOS, SPNA; 6266 – 6587'; SP, TR, WL; o; [101*, 107, 163, 631, 639, 692a]
- Erigeron vetensis* Rydb., early bluetop daisy; SPNA; 7035'; FS; i-o; [561]
- Gaillardia aristata* Pursh, blanketflower; RMOS, SPNA; 6305 – 6645'; DC, TR, WL; o; [191, 221, 231a]
- ▼ *Grindelia subalpina* Greene, subalpine gumweed; RMOS, SPNA; 6217 – 7037'; CA, DC, RP, TR; o; [309, 342, 461b, 739b, 811*]
- Gutierrezia sarothrae* (Pursh) Britt. & Rusby, broom snakeweed; RMOS, SPNA; 6488 – 6525'; FS, SP, TR; c; [305, 326, 332]
- *Helianthus annuus* L., common sunflower; RMOS, SPNA; 6340 – 6707'; FS, SP; i-o; [729, 779, 810]
- *Helianthus petiolaris* Nutt. ssp. *fallax* Heiser, prairie-sunflower; RMOS; 6334'; FS; i; [842d]
- Helianthus pumilus* Nutt., little sunflower; RMOS, SPNA; 6012 – 6686'; CA, CL, DC, FS, SP; c; [175, 272, 295, 726a]
- *Heterotheca villosa* (Pursh) Shinnery var. *minor* (Hook.) Semple, hairy false goldenaster; RMOS; 6404'; CL; o; [403b]
- Heterotheca villosa* (Pursh) Shinnery var. *nana* (Gray) Semple, hairy false goldenaster; SPNA; 6414 – 6914'; DC, TR; c; [228, 386]
- *Hymenopappus filifolius* Hook. var. *polycephalus* (Osterhout) B.L. Turner, manyhead hymenopappus; RMOS, SPNA; 6058 – 6404'; DC, TR, SP; o; [403a, 662c, 722a]
- *Iva axillaris* Pursh, poverty weed; RMOS, SPNA; 6427 – 6534'; DA, WL; o; [650a, 658a]
- ◇ *Lactuca serriola* L., prickly lettuce; RMOS, SPNA; 6067 – 6392'; CA, DA, DC, WL; i; [794*, 831*]
- Lactuca tartarica* (L.) C.A. Mey. var. *pulchella* (Pursh) Breitung, blue lettuce; RMOS, SPNA; 6447 – 6916'; CA, DA; o; [385a, 466b, 499, 723]
- *Liatris punctata* Hook. var. *punctata*, dotted blazingstar; RMOS, SPNA; 6203 – 6543'; DC, FS, SP, TR; c; [356, 407b, 437]
- Lygodesmia juncea* (Pursh) D. Don ex Hook., rush skeletonweed; RMOS, SPNA; 6218 – 7035'; DA, FS, SP, TR; c; [329, 346, 379, 468a]
- *Machaeranthera tanacetifolia* (Kunth) Nees, tansyleaf tansy-aster; RMOS, SPNA; 6427 – 6533'; FS, SP; i; [328b, 650b]
- *Nothocalais cuspidata* (Pursh) Greene, sharp-point prairie-dandelion; RMOS; 6695'; FS; i; [585]
- Packera cana* (Hook.) W.A. Weber & A. Löve, woolly groundsel; RMOS; 6305 – 6656'; CA, TR; o; [193, 676]
- Packera fendleri* (Gray) W.A. Weber & A. Löve, hoary groundsel; RMOS, SPNA; 6488 – 6521'; DC, TR; o; [113, 645a]
- Picradeniopsis oppositifolia* (Nutt.) Rydb. ex Britt., oppositeleaf bahia; SPNA; 6466 – 6582'; DA, TR, WL; o; [274, 315a, 693]
- ▼ *Pyrrocoma lanceolata* (Hook.) Greene var. *lanceolata*, lanceleaf goldenweed; SPNA; 6076'; RA, WL, i; [770a]
- Ratibida columnifera* (Nutt.) Woot. & Standl., prairie coneflower; SPNA; 6073'; SP, WL; o; [432b]
- Rudbeckia hirta* L. var. *pulcherrima* Farw., black-eyed Susan; SPNA; 6071'; SP, WL; o; [431a]
- Rudbeckia laciniata* L. var. *ampla* (A. Nels.) Cronq., cutleaf coneflower; RMOS; 6494'; RA; i; [364f]
- ◇ *Scorzonera laciniata* L., cutleaf vipergrass; SPNA; 6275'; DA; i; [630]

- *Senecio integerrimus* Nutt. var. *exaltatus* (Nutt.) Cronq., lambs-tongue ragwort; RMOS, SPNA; 6646 – 6762'; SP; i; [179, 192c]
- *Senecio spartioides* Torr. & Gray, narrow-leaved butterweed; RMOS, SPNA; 6356 – 6695'; FS, SP, TR; o-i; [312a, 338a, 496b]
- Solidago canadensis* L., Canada goldenrod; SPNA; 6356'; DA, SP; i; [807b]
- Solidago gigantea* Ait., giant goldenrod; RMOS; 6494'; CA, RP; i; [364e]
- Solidago missouriensis* Nutt., Missouri goldenrod; SPNA; 6167 – 7010'; AG, CA, DC, TR; o; [362, 380, 808d, 817, 849a]
- Solidago mollis* Bartl., soft goldenrod; SPNA; 6838 – 6907'; CL, MM, SP, TR; i-o; [745a]
- *Solidago nemoralis* Ait. var. *decemflora* (DC.) Brammall ex Semple, gray goldenrod; RMOS; 6755'; PP, i; [785]
- #Δ ■ *Solidago ptarmicoides* (Nees) Boivin, prairie goldenrod; RMOS; 6977 – 7037'; CA, DC; r; [422f, 461a]
- *Solidago velutina* DC. ssp. *sparsiflora* (Gray) Semple, threenerve goldenrod; RMOS; 6907'; RT; i; [780]
- ◇ *Sonchus asper* (L.) Hill, spiny sow-thistle; SPNA; 6073 – 6120'; TR, WL; o; [354b, 432d]
- Stenotus armerioides* Nutt. var. *armerioides*, thrift mock goldenweed; RMOS; 6226 – 6645'; CL, FS; o-i; [442*, 580]
- Δ ■ *Stephanomeria runcinata* Nutt., desert wire lettuce; RMOS, SPNA; 6488 – 6728'; DA, FS, TR; o-i; [301, 444*, 464]
- Symphyotrichum ascendens* (Lindl.) Nesom, western aster; SPNA; 6140 – 6464'; DC, RA; i; [826, 850a]
- *Symphyotrichum ericoides* (L.) Nesom, white aster; RMOS; 6964'; SP; o; [421b]
- Symphyotrichum ericoides* (L.) Nesom var. *ericoides*, white aster; SPNA; 6071 – 7007'; DA, SP, TR; o; [431c, 465, 767]
- ▼ *Symphyotrichum falcatum* (Lindl.) Nesom var. *commutatum* (Torr. & Gray) G.L. Nesom, white prairie aster; RMOS, SPNA; 6334 – 7007'; DA, DC, FS, SP; o; [501, 825b, 842a]
- *Symphyotrichum laeve* (L.) A. & D. Löve var. *geyeri* (Gray) Nesom, smooth blue aster; RMOS; 6533'; CA, RA; i; [800b]
- ▼ *Symphyotrichum lanceolatum* (Willd.) Nesom ssp. *hesperium* (Gray) Nesom, western lined aster; RMOS, SPNA; 6533'; DA, RA, WL; o; [365, 838c]
- *Symphyotrichum porteri* (Gray) Nesom, smooth white aster; RMOS; 6543 – 7141'; CL, FS; i; [407e, 413b, 870b]
- ◇ *Taraxacum officinale* G.H. Weber ex Wiggers, common dandelion; RMOS, SPNA; 6335 – 6376'; AG, DC, TR; i; [63*, 526a]
- *Tetradymia canescens* DC., common horsebrush; RMOS; 6539'; SP, TR; o; [707]
- *Tetraneris acaulis* (Pursh) Greene var. *acaulis*, stemless four-nerve daisy; RMOS, SPNA; 6596 – 7188'; DC, TR, WL; c; [92, 103, 146, 419]
- Tetraneris acaulis* (Pursh) Greene var. *caespitosa* A. Nels., caespitose four-nerve daisy; SPNA; 7114; SP; i; [79]
- Thelesperma filifolium* (Hook.) Gray, stiff greenthread; SPNA; 6244 – 6339'; DC, TR; i; [360b, 438]
- *Thelesperma megapotamicum* (Spreng.) Kuntze, Hopi tea greenthread; RMOS, SPNA; 6058 – 6595'; TR; r; [434, 844*]
- *Townsendia exscapa* (Richards.) Porter, stemless Easter daisy; RMOS; 6259'; SP; i-r; [515]
- Townsendia grandiflora* Nutt., largeflower Easter daisy; RMOS, SPNA; 6414 – 6583'; DC, SP, TR; o-i; [130*, 605b, 605c, 619]

- *Townsendia hookeri* Beaman, Hooker's Easter daisy; RMOS, SPNA; 6404 – 6985'; DC, MM, PP, SP, TR; o-c; [85, 156*, 503*, 522, 527, 547]
- ◇ *Tragopogon dubius* Scop., western salsify; RMOS, SPNA; 6483 – 6646'; DA, RA, TR; i; [192, 679]
- Xanthisma grindelioides* (Nutt.) D.R. Morgan & R.L. Hartman var. *grindelioides*, goldenweed; RMOS; 6465'; FS, TR; i-r; [846*]
- *Xanthisma spinulosum* (Pursh) D.R. Morgan & R.L. Hartman var. *spinulosum*, spiny goldenweed; RMOS, SPNA; 6205 – 6456'; SP, TR; o; [427a, 468b, 840*]
- ◇ *Xanthium strumarium* L., common cocklebur; RMOS; 6340 – 6760'; CA, DC, WL; i; [413a, 476a]

Betulaceae

- *Betula occidentalis* Hook., water birch; RMOS; 6651'; RA; o-i; [800e]

Boraginaceae

- ▼ *Cryptantha fendleri* (Gray) Greene, sand-dune cryptantha; SPNA; 7038'; DA; r; [747c]
- ◇ ■ *Cynoglossum officinale* L., gypsyflower; RMOS, SPNA; 6126 – 6441'; DA, DC, WL; o-i; [144, 216, 610, 670c]
- *Hackellia floribunda* (Lehm.) I.M. Johnst., manyflower stickseed; RMOS; 6551'; CA, PP; i; [791a]
- ◇ *Lappula occidentalis* (S. Wats.) Greene, western stickseed; SPNA; 6700'; DC; o-i; [560b]
- ◇ ■ *Lappula occidentalis* (S. Wats.) Greene var. *occidentalis*, western stickseed; RMOS, SPNA; 6329 – 6705'; CA, TR; o; [131, 196, 339, 694c]
- ◇ ▼ *Lappula squarrosa* (Retz.) Dumort., European stickseed; SPNA; 6883'; CA, DA; i; [498a]

- Lithospermum incisum* Lehm., plains stoneseed; RMOS, SPNA; 6171 – 6627'; DC, TR; i-o; [86*, 100*, 114, 537]
- *Mertensia ciliata* (James ex Torr.) G. Don. var. *ciliata*, streamside bluebell; RMOS; 6494'; RA; i; [364d]
- Mertensia lanceolata* (Pursh) DC. var. *lanceolata*, prairie bluebells; RMOS, SPNA; 6526 – 7214'; SP, TR; c-o; [60, 69, 80]
- Oreocarya thyrsoiflora* Greene, calcareous cryptantha; RMOS, SPNA; 6399 – 6459'; SP; o; [94*, 159]
- Oreocarya virgata* (Porter) Greene, miner's candle; SPNA; 6646; DC, TR; i-o; [239b*]

Brassicaceae

- ◇ *Alyssum desertorum* Stapf, desert madwort; SPNA; 6818'; CA; i; [532b]
- ◇ *Alyssum simplex* Rudolphi, alyssum; RMOS; 6373 – 6864'; CL, TR; o-i; [205, 609]
- ◇ ■ *Barbarea vulgaris* R. Br., yellow-rocket; RMOS; 6544'; CA, RA; i; [368d]
- ▼ *Boechea retrofracta* (Graham) A. Löve & D. Löve, reflexed rockcress; SPNA; 6818'; CA, o; [532a]
- ◇ *Camelina microcarpa* Andr. ex DC., littlepod false flax; RMOS, SPNA; 6432 – 6538'; CA, DC, TR, WL; o; [324, 328d, 369b, 557b, 591a]
- ◇ *Capsella bursa-pastoris* (L.) Medik, shepherd's purse; SPNA; 6883'; CA; o; [498b]
- ◇ *Chorispora tenella* (Pall.) DC., blue mustard; RMOS; 6476'; CA, RA; o; [540]
- ◇ *Descurainia sophia* (L.) Webb ex Prantl, flixweed; RMOS, SPNA; 6054 – 6786'; CL, DA, TR, WL; o-i; [185, 198, 763d]
- Draba nemorosa* L., woodland draba; RMOS; 6536'; CA; i; [541]
- Draba reptans* (Lam.) Fernald, Carolina draba; RMOS; 6938 – 7196'; CA, MM, PP, o-i; [548, 565]

Erysimum capitatum (Dougl. ex Hook.)
Greene, sanddune wallflower; RMOS,
SPNA; 6345 – 6559'; MM, SP, TR; o-c;
[91, 563, 608]

Erysimum inconspicuum (S. Wats.)
MacMill., shy wallflower; SPNA; 6678';
FS; i; [308b]

■ *Nasturtium officinale* W.T. Ait.,
watercress; RMOS; 6152'; RA; o-i;
[348d]

Physaria ludoviciana (Nutt.) O'Kane & Al-
Shehbaz, foothill bladderpod; RMOS,
SPNA; 6366 – 6442'; DC, FS, MM,
TR; o; [115, 591a, 633b]

Physaria montana (Gray) Greene, mountain
bladderpod; (75, 397, 414a, 600, 668a);
RMOS, SPNA; 6287 – 7202'; DC, SP,
TR; o; [75, 397, 414a, 600, 668a]

▼ *Rorippa sinuata* (Hook.) Hitchc.,
spreading yellow-cress; SPNA; 6374';
WL; o; [689a]

◇ *Sisymbrium altissimum* L., tall
tumblemustard; SPNA; 6374'; FS; i;
[328c]

□ *Stanleya pinnata* (Pursh) Britt. var.
bipinnata (Greene) Rollins, desert
prince's plume; RMOS; 6194'; SB; i;
[718]

◇ *Thlaspi arvense* L., field pennycress;
SPNA; 6538 – 6700'; CA, DC, TR,
WL; o; [167, 557a, 560a]

Cactaceae

■ *Coryphantha vivipara* (Nutt.) Britt. &
Rose, pincushion cactus; RMOS, SPNA;
6677 – 7086'; CA, SP, TR; i; [389, 760,
762c]

■ *Echinocereus viridiflorus* Engelm., nylon
hedgehog cactus; RMOS, SPNA; 6195
– 6837'; FS, SG; i; [105*, 182, 208,
470, 598a, 782]

Opuntia macrorhiza Engelm., western
pricklypear; SPNA; 6995'; SP; i-r;
[759]

Opuntia polyacantha Haw. var.
polyacantha, starvation pricklypear;
RMOS, SPNA; 6324 – 6971'; CA, CL,
FS, MM, SP, TR; c; [164*, 418b, 420*,
667b, 692b, 695]

■ *Pediocactus simpsonii* (Engelm.) Britt. &
Rose, mountain cactus; RMOS, SPNA;
6429 – 6974'; SP, i; [83*, 524, 533*,
549]

Campanulaceae

Campanula rotundifolia L., bluebell of
Scotland; RMOS, SPNA; 6618 – 6638';
CA, CL, DC, TR; o-c; [276, 290]

Cannabaceae

■ *Humulus lupulus* L. var. *neomexicanus* A.
Nels. & Cockerell, common hop;
RMOS; 6638'; CA, RA; i; [798b]

Capparaceae

■ ▼ *Cleome serrulata* Pursh, Rocky
Mountain beeplant; RMOS, SPNA; 6109
– 6283'; FS, TR; r; [347, 429, 474*]

Polanisia dodecandra (L.) DC. ssp.
trachysperma (Torr. & Gray) Iltis, red-
whisker clammyweed; RMOS, SPNA;
6185 – 6760'; DA, DC, TR; o; [331,
413e, 436]

Caprifoliaceae

Symphoricarpos occidentalis Hook.,
wolfberry; RMOS, SPNA; 6344 –
6463'; AG, FS, TR; o; [267, 286, 808c]

Caryophyllaceae

■ *Eremogone fendleri* (Gray) Ikonn.,
Fendler's sandwort; RMOS, SPNA;
6749 – 7093'; FS, SP, TR; o; [183, 210,
391]

Eremogone hookeri (Nutt.) W.A. Weber var.
hookeri, Hooker's sandwort; SPNA;
6463'; FS; o-i; [158]

- ▼ *Paronychia depressa* (Torr. & Gray) Nutt. ex A. Nels., spreading nailwort; RMOS, SPNA; 6058 – 6583'; DC, TR; o; [606, 645b, 722b]
- Paronychia jamesii* Torr. & Gray, James' nailwort; RMOS; 6295'; TR; i-r; [665]
- Paronychia sessiliflora* Nutt., creeping nailwort; RMOS, SPNA; 6250 – 6794'; CA, SP, TR; o; [176, 302, 662d, 682, 685]
- ◇△ *Silene csereii* Baumg., biennial campion; RMOS; 6340 – 6386'; RA, WL; i-o; [288, 484]
- ▼ *Silene drummondii* Hook. ssp. *striata* (Rydb.) J.K. Morton, Drummond's catchfly; SPNA; 6745'; TR; i; [698]
- ◇△■ *Silene noctiflora* L., night-flowering catchfly; RMOS; 6535'; CA, RA; i; [796]

Chenopodiaceae

- Atriplex canescens* (Pursh) Nutt., fourwing saltbush; RMOS, SPNA; 5932 – 6672'; SS, TR; o; [169, 350*, 616, 735]
- ◇■▼ *Chenopodium album* L. var. *album*, lambsquarters; RMOS, SPNA; 6056 – 7142'; DC, TR; o; [711b; 755, 762a]
- *Chenopodium desiccatum* A. Nels., aridland goosefoot; RMOS; 6776'; TR; i; [711a]
- *Chenopodium incanum* (S. Wats.) Heller var. *incanum*, mealy goosefoot; RMOS; 5981'; DC, SP; i; [724f]
- ▼ *Chenopodium pratericola* Rydb., desert goosefoot; RMOS, SPNA; 5981 – 6964'; CL, SP, TR, WL; o; [409, 421a, 724a, 740, 762b]
- *Chenopodium simplex* (Torr.) Raf., maple-leaf goosefoot; RMOS; 6551'; CA, CL; i; [791b]
- ◇ *Dysphania botrys* (L.) Mosyakin & Clemants, Jerusalem oak; RMOS; 6257'; CA, TR; i; [875]
- ◇ *Kochia scoparia* (L.) Schrad., burning bush; SPNA; 6376'; DA, DC; o; [855b]

Krascheninnikovia lanata (Pursh) A. Meeuse & Smit, winterfat; RMOS, SPNA; 6113 – 6376'; DC, FS, SP; c; [294, 774d]

- *Monolepis nuttalliana* (Schult.) Greene, Nuttall's povertyweed; RMOS; 6534'; WL; o; [658b]
- ◇■ *Salsola tragus* L., Russian thistle; RMOS, SPNA; 5777 – 7142'; DA, TR; o; [724b, 746a, 849b]

Clusiaceae

- *Hypericum scouleri* Hook. ssp. *nortoniae* (M.E. Jones) J. Gillett, Norton's St. John's-wort; RMOS; 6764'; CA, RA; i-r; [801]

Commelinaceae

- *Tradescantia occidentalis* (Britt.) Smyth, prairie spiderwort; RMOS, SPNA; 6601 – 6660'; DC, TR; r; [240, 607]

Convolvulaceae

- ◇ *Convolvulus arvensis* L., field bindweed; RMOS, SPNA; 6054 – 6276'; DA, DC, TR, WL; o; [282, 343, 361, 763e]
- *Evolvulus nuttallianus* J.A. Schultes, shaggy dwarf morning-glory; RMOS; 6543'; FS; r; [360*]

Cornaceae

- *Cornus sericea* L. ssp. *sericea*, redosier dogwood; RMOS; 6760'; CA, RA; r-i; [802a]

Cyperaceae

- *Carex aurea* Nutt., golden sedge; RMOS; 6544'; CA, RA; o; [368b]
- Carex douglasii* Boott, Douglas' sedge; SPNA; 6374'; FG; i; [689b]
- Carex duruiscula* C.A. Mey, needleleaf sedge; RMOS, SPNA; 6107 – 6854'; DC, WL; o; [206d, 263, 359, 536, 569]
- *Carex elynoides* Holm, blackroot sedge; RMOS; 6746'; FG; i; [786]

- Carex filifolia* Nutt., threadleaf sedge; RMOS, SPNA; 6666'; FS, GW, SP; o; [443, 509, 568, 581]
- Carex hoodii* W. Boott, Hood's sedge; SPNA; 6054'; WL; o; [763b]
- Carex nebrascensis* Dewey, Nebraska sedge; RMOS, SPNA; 6322 – 6854'; DC, WL; o; [127, 136, 206c, 213a, 560d, 764a]
- *Carex occidentalis* L.H. Bailey, western sedge; RMOS; 6854'; TR, WL; o; [206d]
- Carex praegracilis* W. Boott., clustered field sedge; SPNA; 7078'; DC, TR; i; [390b, 766a]
- ▼ *Carex praticola* Rydb., meadow sedge; SPNA; 7078'; TR; o; [390b]
- ▼ *Carex ca. siccata* Dewey, dryspike sedge; SPNA; 6390'; DC; i; [270]
- Carex simulata* Mack., analogue sedge; SPNA; 6051 – 6457'; DC, TR; i; [213c]
- *Eleocharis palustris* (L.) Roemer & Schultes, common spikerush; RMOS, SPNA; 6248 – 6605'; DC, RA, TR; o; [291a, 489d, 636a]
- *Eleocharis pauciflora* (Lightf.) Link, fewflower spikerush; RMOS; 6280'; CA; o; [117]
- *Schoenoplectus tabernaemontani* (K.C. Gmel.) Palla, softstem bullrush; RMOS, SPNA; 6340 – 6423'; WL; o; [320, 452b, 476b]
- *Scirpus pallidus* (Britton) Fernald, cloaked bullrush; RMOS; 6432'; WL; o; [491b]
- Euphorbiaceae**
- *Chamaesyce serpyllifolia* (Pers.) Small, thymeleaf sandmat; RMOS, SPNA; 6287 – 6893'; DA, TR; o-i; [668b, 746b]
- Euphorbia brachycera* Engelm., horned spurge; RMOS; 6431 – 6590'; TR; i-o; [111, 512, 575]

◇ *Euphorbia esula* L., leafy spurge; RMOS; 6401 – 6977'; TR; i-o; [95*, 98, 298, 422d]

Fabaceae

- Astragalus agrestis* Dougl. ex G. Don, purple milkvetch; SPNA; 6298 – 6757'; SP, WL; i; [180, 651a]
- Astragalus bisulcatus* (Hook.) Gray var. *bisulcatus*, two-grooved milkvetch; SPNA; 6172 – 6395'; TR; WL; o; [150, 593]
- Astragalus drummondii* Dougl. ex Hook., Drummond's milkvetch; RMOS, SPNA; 6381 – 6422'; SP, TR; i-o; [672, 690]
- Astragalus flexuosus* Dougl. ex G. Don var. *flexuosus*, flexible milkvetch; SPNA; 6318 – 6422'; SP, WL; i; [315c, 654]
- Astragalus laxmannii* Jacq. var. *robustior* (Hook.) Barneby & S.L. Welsh, prairie milkvetch; SPNA; 6519'; FS, TR; i; [692c]
- Astragalus missouriensis* Nutt. var. *missouriensis*, Missouri milkvetch; RMOS, SPNA; 6270 – 6355'; DC, SP, TR; o-i; [635, 670a]
- ▼ *Astragalus mollissimus* Torr., woolly locoweed; SPNA; 6960'; CA, FS; i-r; [534b]
- Astragalus pectinatus* (Dougl. ex Hook.) Dougl. ex G. Don, var. *pectinatus*, narrowleaf milkvetch; SPNA; 6166 – 6459'; SP; i; [572*, 592, 647]
- Astragalus shortianus* Nutt., Short's milkvetch; RMOS, SPNA; 6442 – 7192'; FS, TR; i-o; [78, 591b]
- Astragalus spatulatus* Sheldon, tufted milkvetch; SPNA; 6683 – 6960'; CA, DC; i; [82*, 530]
- Astragalus tridactylicus* Gray, foothill milkvetch; RMOS, SPNA; 6371 – 6676'; CL, SP, TR; i; [56*, 64, 525, 559]

■ *Dalea candida* Michx. ex Willd. var. *olgophylla* (Torr.) Shinnery, white prairie clover; RMOS, SPNA; 6451 – 6598'; SP, TR; i; [299, 737]
 ■ *Dalea purpurea* Vent., purple prairie clover; RMOS, SPNA; 6348 – 6678'; FS, SP, TR, i-o; [308a, 701]
Glycyrrhiza lepidota Pursh, wild licorice; SPNA; 6359'; AG, DC, WL; o; [262]
 ■ *Lathyrus eucosmus* Butters & H. St. John, seemly pea; RMOS; 7396'; MM, i; [872]
Lupinus argenteus Pursh var. *argenteus*, silvery lupine; SPNA; 6519 – 7066'; DA, SP; i; [173, 463]
Lupinus plattensis S. Wats., Nebraska lupine; SPNA; 7066'; TR; i-o; [242]
 ◇ *Medicago lupulina* L., black medick; SPNA; 6045 – 6426'; TR, WL; i; [218, 765a]
 ◇ *Medicago sativa* L., alfalfa; RMOS; 6258 – 6274'; DA, TR; i; [345, 411a, 663]
 ◇ ■ *Melilotus albus* Medik., white sweet clover; RMOS, SPNA; 6113 – 6234; DA, DC; i-o; [341, 774a]
 ◇ ■ *Melilotus officinalis* (L.) Pall., yellow sweet clover; RMOS, SPNA; 6113 – 6360'; DA, DC; i-o; [674, 774b]
Oxytropis lambertii Pursh, purple locoweed; RMOS, SPNA; 6298 – 6478'; FS, SP, TR; o; [230, 651b, 671]
Oxytropis multiceps Nutt., Nuttall's oxytrope; RMOS, SPNA; 6241 – 6646'; CA, DC, TR; o-i; [60b, 520, 528]
Oxytropis sericea Nutt. var. *sericea*, white locoweed; RMOS, SPNA; 6329 – 6512'; CA, SP, TR; o; [89*, 90, 552]
 Δ *Pediomelum esculentum* (Pursh) Rydb., large indian breadroot; SPNA; 6375'; RA, WL; r-i; [688]
Psoraleidum tenuiflorum (Pursh) Rydb., wild alfalfa; RMOS, SPNA; 6113 – 6519'; DC, FS, SP, TR; o; [340, 411c, 692d, 774c]

Thermopsis rhombifolia (Nutt. ex Pursh) Nutt. ex Richardson var. *rhombifolia*, prairie goldenbanner; SPNA; 6376 – 6808'; FS, TR; o; [84*, 519]
 ■ *Vicia americana* Muhl. ex Willd. var. *americana*, American vetch; RMOS, SPNA; 6195 – 6537'; FS, MM, SP; i-o; [555, 598b]
Vicia americana Muhl. ex Willd. var. *minor* Hook., mat vetch; SPNA; 6344'; WL; o; [141]

Fumariaceae

Corydalis aurea Willd. ssp. *occidentalis*, golden corydalis; RMOS; 6794'; FS; i; [586a]

Gentianaceae

■ *Frasera speciosa* Dougl. ex Griseb., elkweed; RMOS, SPNA; 6763 – 6812'; DC, FS, TR; i; [199, 201, 825c*]
Gentiana affinis Griseb., Rocky Mountain gentian; SPNA; 6073 – 6533'; DA, WL; o-i; [432c, 838b]

Geraniaceae

◇ *Erodium cicutarium* (L.) L'Her. ex Ait., filaria; SPNA; 6494 – 6942'; CA, DC; i; [500, 554a]
Geranium caespitosum James, Rocky Mountain geranium; RMOS, SPNA; 6307 – 6785'; DC, FS, SP, TR; o; [123, 181]

Grossulariaceae

Ribes aureum Pursh var. *aureum*, golden currant; RMOS, SPNA; 6292 – 6494'; CA, DC, TR; i; [119, 554b]
Ribes cereum Dougl., wax currant; RMOS, SPNA; 6550 – 6702'; CA, DC, TR; o; [195, 556]
 ■ *Ribes inerme* Rydb., whitestem gooseberry; RMOS; 6538'; CA, RA; i; [795]

Hydrangeaceae

- *Jamesia americana* Torr. & Gray var. *americana*, fivepetal cliffbush; RMOS; 6603'; CA, CL, RA; i-r; [797a]

Hydrophyllaceae

- ▼ *Ellisia nyctelea* (L.) L., Aunt Lucy; RMOS, SPNA; 6448 – 6516'; FS, GW; i-o; [406*, 554c, 583b]
- #Δ *Phacelia denticulata* Osterh., Rocky Mountain phacelia; RMOS, SPNA; 6344 – 6919; CA, TR; i; [660b, 744a]
- Phacelia hastata* Dougl. ex Lehm., silverleaf phacelia; SPNA; 6459 – 6739'; DC, TR; i-o; [186, 680]

Iridaceae

- *Iris missouriensis* Nutt., Rocky Mountain iris; RMOS, SPNA; 6327 – 6432'; MM, WL; o-i; [137, 576*, 659]
- Sisyrinchium montanum* Greene var. *montanum*, Rocky Mountain blue-eyed grass; SPNA; 6070 – 6533'; DA, WL; o; [433c, 838a]

Juncaceae

- *Juncus arcticus* Willd. var. *balticus* (Willd.) Trautv., arctic rush; RMOS, SPNA; 6074 – 6854'; DC, RA, WL; o; [148, 206b, 213b, 560c, 636b, 731]
- *Juncus confusus* Coville, Colorado rush; RMOS; 6345'; RA; i; [289c]
- Δ■ *Juncus ensifolius* Wikstr., swordleaf rush; RMOS; 6345 – 6349'; RA, WL; i; [291a, 452d]
- *Juncus interior* Wieg., inland rush; RMOS; 6554'; CA, RA; i; [368c]
- *Juncus torreyi* Coville, Torrey's rush; RMOS, SPNA; 6058 – 6345'; DC, WL; i-o; [433d, 452a, 768c]

Juncaginaceae

- Triglochin maritima* L., seaside arrowgrass; SPNA; 6437'; WL; i; [317c]

Lamiaceae

- *Dracocephalum parviflorum* Nutt., American dragonhead; RMOS; 6638'; CA, RA; i; [798a]
- Hedeoma drummondii* Benth., Drummond's false pennyroyal; RMOS, SPNA; 6382 – 6533'; CA, CL, FS, MM, TR; o; [255*, 296b, 328, 337]
- ◇■ *Marrubium vulgare* L., common horehound; RMOS, SPNA; 6415 – 6824'; DA, TR; i; [204, 864]
- Mentha arvensis* L., wild mint; RMOS, SPNA; 6345 – 6494'; RA, WL; o-i; [364c, 425f, 452c, 828*]
- Monarda fistulosa* L. var. *menthifolia* (Graham) Fern., wild bergamot; RMOS, SPNA; 6346 – 6352; AG, CA, DC, TR; o; [265, 293]
- ◇ *Nepeta cataria* L., catnip; RMOS, SPNA; 6186 – 6663'; CA, CL, FS, TR; o; [306*, 358b, 366, 385b*]
- Salvia reflexa* Hornem., Rocky Mountain sage; SPNA; 6389'; DA, TR; r; [865]
- Scutellaria brittonii* Porter, Britton's skullcap; RMOS, SPNA; 6327 – 7117'; DC, FS, MM, TR; o; [129, 564, 573]
- Stachys palustris* L. var. *pilosa* (Nutt.) Fern., hairy hedge-nettle; RMOS; 6350'; WL; i; [454]

Liliaceae

- *Calochortus gunnisonii* S. Wats., Gunnison's mariposa lily; RMOS, SPNA; 6458 – 6983'; FS; i; [704a, 758b]

Linaceae

- ▼ *Linum compactum* A. Nels., compact flax; RMOS, SPNA; 6400 – 7199'; AG, DC, TR, WL; i; [174*, 264*, 296a, 319b]
- Linum lewisii* Pursh, Lewis flax; RMOS; 6760'; DC, TR; i-o; [413c]
- ◇■ ▼ *Linum perenne* L., perennial flax; RMOS, SPNA; 6336 – 6398'; DA, TR, WL; o; [154, 190, 633a]

Loasaceae

- *Mentzelia albicaulis* (Dougl. ex Hook.)
Dougl. ex Torr. & Gray, white-stem
blazingstar; RMOS; 6342'; FS; r; [661]
- Mentzelia decapetala* (Pursh ex Sims) Urb.
& Gilg ex Gilg, ten-petal blazingstar;
SPNA; 6140 – 6205'; DC; i; [813, 850b]
- *Mentzelia multiflora* (Nutt.) Gray, Adonis
blazingstar; RMOS, SPNA; 6334 –
6665'; DA, DC; i; [277, 842c, 853]
- Mentzelia oligosperma* Nutt. ex Sims,
chicken-thief; RMOS; 6291'; TR; i;
[479]
- # *Mentzelia speciosa* Osterh., jeweled
blazingstar; SPNA; 6485 – 6833'; DC,
TR; i; [394, 699]

Malvaceae

- Sphaeralcea coccinea* (Nutt.) Rydb., scarlet
globemallow; RMOS, SPNA; 6320 –
6418'; TR, CA; o; [96*, 126, 142]

Melanthiaceae

- Zigadenus elegans* Pursh, mountain death
camas; SPNA; 6315'; WL; i-r; [233]
- Zigadenus paniculatus* (Nutt.) S. Wats. var.
gramineus (Rydb.) Ackerfield comb.
nov., foothill death camas; RMOS,
SPNA; 6339'; TR, WL; i; [132, 134]

Nyctaginaceae

- Mirabilis hirsuta* (Pursh) MacM., hairy four
o'clock; RMOS, SPNA; 6058 – 7012';
SP, TR; i; [421c, 460*, 742]
- Mirabilis linearis* (Pursh) Heimerl var.
linearis, narrowleaf four o'clock;
RMOS, SPNA; 6098 – 7144'; FS, SP; i;
[435, 471, 734b]

Onagraceae

- ▼ *Epilobium brachycarpum* C. Presl.,
panicked willow-herb; SPNA; 6442';
WL; i; [318b]

Epilobium ciliatum Raf. var. *ciliatum*,
American willow-herb; RMOS, SPNA;
6152 – 6405'; RA, WL; i; [348c, 830]

Oenothera albicaulis Pursh, whitest evening
primrose; RMOS, SPNA; 6361 – 6442';
DC, SP; i; [571, 591d]

■ *Oenothera caespitosa* Nutt. var.
caespitosa, tufted evening primrose;
RMOS, SPNA; 6263 – 6508'; CA, DC;
TR; i-o; [116, 121* 643]

#□ *Oenothera coloradoensis* Rydb. ssp.
coloradoensis, Colorado butterfly
plant; SPNA; 6313 – 6431'; WL; o;
[234*, 319a*]

Oenothera coronopifolia Torr. & Gray,
crownleaf evening primrose; SPNA;
6443 – 6582'; SP; TR; i-o; [236, 393,
678a]

Oenothera howardii (A. Nels.) W.L.
Wagner, Howard's evening primrose;
SPNA; 6385 – 6499'; DA, DC, WL; o-i;
[147, 566, 642]

Oenothera nuttallii Sweet, Nuttall's
evening primrose; SPNA; 6454 – 6655';
DC, TR; i; [697, 827c*]

Oenothera suffretescens (Ser.) W.L. Wagner
& Hoch, scarlet beebalm; RMOS,
SPNA; 6322 – 6578'; CA, DA, TR; o-i;
[189, 628, 662a]

Oenothera villosa Thunb. var. *villosa*,
hairy evening primrose; RMOS; 6344';
TR; i; [292]

Orchidaceae

■ *Platanthera aquilonis* Sheviak, northern
green orchid; RMOS; 6651'; CA, RA; i;
[800a]

Orobanchaceae

- ▼ *Castilleja linariifolia* Benth., Wyoming
paintbrush; RMOS, SPNA; 6655 –
6871'; SP, TR; i; [280b, 300, 757]
- *Castilleja sessiliflora* Pursh, downy
paintedcup; RMOS, SPNA; 6446 –
6453'; SP, WL; i; [157, 703b]

- *Orobanche fasciculata* Nutt., clustered broomrape; RMOS; 6857'; MM, RT; r; [781]
- *Orthocarpus luteus* Nutt., yellow owl's clover; RMOS, SPNA; 6442 – 7429'; WL; i-r; [318f, 432e, 871]

Papaveraceae

- Argemone hispida* Gray, rough prickly-poppy; RMOS, SPNA; 6355 – 6415'; CA, DR, SP, TR; i; [229, 670b, 683, 743*]

Parnassiaceae

- *Parnassia palustris* L. var. *montanensis* (Fernald & Rydb. ex Rydb.) C.L. Hitchc., mountain grass-of-parnassus; RMOS, SPNA; 6439 – 6651'; CA, RA, WL; i-o; [317a, 800c]

Phrymaceae

- *Mimulus glabratus* Kunth, smooth monkey-flower; RMOS, SPNA; 6345 – 6441'; WL; i; [217a, 452e]

Plantaginaceae

- # *Besseya wyomingensis* (A. Nels.) Rydb., Wyoming kittentails; RMOS, SPNA; 6589 – 6650'; CA, FS; i; [542, 558c]
- ◇ *Linaria dalmatica* (L.) Mill, Dalmatian toadflax; RMOS, SPNA; 6327 – 6652'; FS, MM, PP, SP, TR; c; [165, 194b]
- *Penstemon angustifolius* Nutt. ex Pursh var. *angustifolius*, broadbeard penstemon; RMOS, SPNA; 6367 – 6593'; DC, TR; o-i; [93*, 109, 112*, 582, 594]
- #△ *Penstemon eriantherus* Pursh var. *eriantherus*, fuzzytongue penstemon; RMOS, SPNA; 6112 – 6764'; DA, DC, SP, TR; i-o; [202, 258b*, 613]
- *Penstemon glaber* Pursh var. *alpinus* (Torr.) Gray, sawsepal penstemon; RMOS, SPNA; 6456 – 6794'; CA, DC, TR; i; [280a, 586b, 681, 715]

- *Penstemon secundiflorus* Benth., sidebells penstemon; RMOS, SPNA; 6336 – 6431'; DC, TR; i; [649, 669]

- *Penstemon virens* Pennell ex Rydb., Front Range beardtongue; RMOS, SPNA; 6794 – 7074'; FS, TR; i; [243, 586b]

- Penstemon virgatus* Gray var. *asa-grayi* (Crosswh.) Dorn, oneside penstemon; RMOS; 6948'; MM; i; [804]

- *Plantago eriopoda* Torr., redwool plantain; RMOS, SPNA; 6045 – 6220'; DC, WL; i; [351, 614a, 765c, 768b]

- ◇ *Plantago major* L., common plantain; RMOS; 6395'; WL; o; [492b]

- Plantago patagonica* Jacq., woolly plantain; SPNA; 6617'; GW, TR; i; [237]

- *Veronica americana* Schwien. ex Benth., American speedwell; RMOS, SPNA; 6441 – 6480'; CA, DC, RA, TR; o-i; [217b, 788]

- Veronica anagallis-aquatica* L., water speedwell; RMOS, SPNA; 6058 – 6152' RA; i; [348a, 768a]

Poaceae

- Achnatherum hymenoides* (Roem. & Schult.) Barkworth, indian ricegrass; RMOS, SPNA; 6145 – 6646'; DC, FS, MM, RT, TR; c; [172, 192b, 220, 617b]

- Achnatherum robustum* (Vasey) Barkworth, sleepygrass; RMOS, SPNA; 5981 – 6466'; SP, TR, WL; o; [304, 315b, 724e]

- Achnatherum scribneri* (Vasey) Barkworth, Scribner's needlegrass; RMOS; 6630'; DC; i; [440]

- ◇ *Agropyron cristatum* (L.) Gaertn., crested wheatgrass; RMOS; 6354 – 6367'; DA, TR; o; [283, 285b]

- ◇ *Agrostis gigantea* Roth, redtop bent; RMOS; 6152'; RA; i; [348b]

- ◇ *Agrostis stolonifera* L., creeping bentgrass; SPNA; 6440'; WL; o; [316b]

- Aristida purpurea* Nutt., purple three-awn; RMOS, SPNA; 6217 – 6592'; DC, FS, RT, TR; o; [407c, 472, 486, 488b]
- Bouteloua curtipendula* (Michx.) Torr., sideoats grama; RMOS, SPNA; 6232 – 6768'; FS, SP, TR; i; [357c, 407d, 451*]
- Bouteloua gracilis* (Kunth) Lag., blue grama; RMOS, SPNA; 5981 – 6551'; FS, GW, SB, SP, TR; c; [273a, 357b, 392b, 724d]
- *Bouteloua hirsuta* Lag. var. *hirsuta*, hairy grama; RMOS; 6493'; FS; i; [405]
- ◇ *Bromus inermis* Leyss., smooth brome; RMOS, SPNA; 5999 – 6509'; DA, DC, FS, GW, TR; o; [284, 487, 629, 725]
- ◇ *Bromus japonicas* Thunb., Japanese brome; SPNA; 6344'; AG, DC; i; [266]
- ◇ *Bromus tectorum* L., cheatgrass; RMOS, SPNA; 6406 – 6521'; GW, TR, WL; o; [104, 153]
- Buchloë dactyloides* (Nutt.) Engelm., buffalograss; RMOS, SPNA; 6244 – 6391'; SP, TR; c; [360a, 410]
- ◇ *Dactylis glomerata* L., orchard grass; SPNA; 6311'; SP, WL; i; [655]
- *Dicanthelium linearifolium* (Scribn.) Gould, slimleaf panicgrass; RMOS; FS, RT; r; [248]
- Distichlis spicata* (Torr.) Rydb., desert saltgrass; SPNA; 6051 – 6140'; DC, WL; i; [766b, 851]
- ◇ ■ *Echinochloa crus-galli* (L.) P. Beauv., barnyard grass; RMOS; 6318'; RA; i; [425d]
- Elymus canadensis* L., Canada wildrye; SPNA; 6340'; DC; i; [823]
- *Elymus elymoides* (Raf.) Swezey, squirreltail; RMOS; 6578'; TR; o; [106]
- ◇ *Elymus repens* (L.) Gould, quackgrass; RMOS; 6340'; WL; i; [476d]
- *Elymus trachycaulus* (Link) Gould, wheatgrass; RMOS, SPNA; 6076 – 6885'; CA, RA; o; [388b, 770c, 829b]
- Glyceria striata* (Lam.) Hitchc., fowl mannagrass; RMOS, SPNA; 6152 – 6494'; RA, WL; i; [317d, 348e, 364h]
- Hesperostipa comata* (Trin. & Rupr.) Barkworth, needle and thread; RMOS, SPNA; 6250 – 6602'; CL, DC, FS, MM, TR; c; [401b, 662b, 678b, 694b]
- #Δ *Hesperostipa neomexicana* (Thurb.) Barkworth, New Mexico feathergrass; RMOS; 6315'; i-o; [700b*]
- Hordeum jubatum* L., foxtail barley; SPNA; 6047 – 6885'; CA, RA, WL; o; [388a, 764b]
- Koeleria macrantha* (Ledeb.) Schult., Junegrass; RMOS, SPNA; 6360 – 6543'; DC, SP, TR; o; [224, 269, 696, 777]
- Leucopoa kingii* (S. Wats.) W.A. Weber, spike fescue; RMOS; 6442 – 6795'; RT, TR; i; [200, 247, 604b]
- Leymus cinereus* (Scribn. & Merr.) A. Löve, Great Basin wildrye; RMOS; 6322 – 6549'; CA, GW TR; i; [133, 369a]
- ▼ *Muhlenbergia asperifolia* (Nees & Meyen ex Trin.) Parodi, scratchgrass; SPNA; 6074'; SP; o; [430c]
- ▼ *Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb., plains muhly; RMOS, SPNA; 6355 – 6842'; CA, RA, RT, TR; i; [223, 408, 450, 459, 483, 825a]
- *Muhlenbergia filiculmis* Vasey, slimstem muhly; RMOS; 6845 – 7141'; CA, FS; i; [374, 447, 870c]
- Muhlenbergia montana* (Nutt.) Hitchc., mountain muhly; RMOS; 6404'; CL, FS; c; [403c]
- Muhlenbergia racemosa* (Michx.) Britton, Sterns, & Poggenb., marsh muhly; RMOS; 6773'; GW; i; [414b]
- *Muhlenbergia torreyi* (Kunth) Hitchc. ex Bush, ring muhly; RMOS, SPNA; 6365 – 6422'; MM, RT; i; [251, 867]
- Nassella viridula* (Trin.) Barkworth, green needlegrass; RMOS, SPNA; 6273 – 6426'; FS, SP, TR; o; [171, 219, 271, 401a]
- Panicum virgatum* L., switchgrass; SPNA; 6073 – 6076'; WL; i; [432a, 770b]

Pascopyrum smithii (Rydb.) Barkworth & D.R. Dewey, western wheatgrass; RMOS, SPNA; 5981 – 7038'; CA, SP, TR; o; [488a, 694a, 724c, 747a]

▼ *Phalaris arundinacea* L., reed canary grass; SPNA; 6437'; WL; i; [317b]

Phleum pratense L., timothy; RMOS, SPNA; 6249 – 6440'; CA, RA, TR, WL; i; [128, 316a, 352, 497a, 656]

Piptatherum micranthum (Trin. & Rupr.) Barkworth, littleseed ricegrass; RMOS; 6089 – 6849'; FS, SP; i; [245, 449]

◇ *Poa pratensis* L., Kentucky bluegrass; RMOS, SPNA; 6345 – 6865'; CA, DC, GW, RA, WL; c; [144b, 206a, 289a, 413d, 414a, 497b, 558b, 614b, 636c, 856]

◇ ■ *Psathyrostachys junceus* (Fisher) Nevski, Russian wildrye; RMOS; 6198'; FS; i; [253]

Pseudoroegneria spicata (Pursh) A. Löve, bluebunch; RMOS, SPNA; 6489 – 6673'; TR; i; [311, 847]

Schizachyrium scoparium (Michx.) Nash var. *scoparium*, little bluestem; RMOS, SPNA; 6071 – 6391'; RT, WL; o; [402, 431b]

◇ *Setaria viridis* (L.) P. Beauv. var. *viridis*, green bristlegrass; RMOS; 6295'; CA, TR; i; [478]

▼ *Sporobolus airoides* (Torr.) Torr., alkali sacaton; SPNA; 6051'; WL; i; [766c]

▼ *Sporobolus compositus* (Poir.) Merr., composite dropseed; SPNA; 6140'; DC, GW; o; [850c]

■ *Sporobolus cryptandrus* (Torr.) Gray, sand dropseed; RMOS, SPNA; 6143 – 6838'; CA, CL; i; [400, 745b]

◇ ■ *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey, common intermediate wheatgrass; RMOS; 6354'; TR; o; [285a]

■ *Torreyochloa pallida* (Torr.) G.L. Church, pale false mannagrass; RMOS; 6345'; GW, RA; o; [289b]

Vulpia octoflora (Walter) Rydb., sixweeks fescue; RMOS, SPNA; 6478 – 6640'; RT, TR; o; [238, 567, 605a]

Polemoniaceae

■ *Collomia linearis* Nutt., tiny trumpet; RMOS, SPNA; 6342 – 6374'; AG, CA, DC; i; [662, 689c]

Ipomopsis spicata (Nutt.) V. Grant ssp. *spicata*, spiked ipomopsis; RMOS, SPNA; 6469 – 6649'; DC, SP, TR; i-o; [99*, 108, 155, 496a]

■ *Phlox hoodii* Richardson, carpet phlox; RMOS; 7199'; SP, TR; i-o; [71b]

▼ *Phlox muscoides* Nutt., moss phlox; RMOS, SPNA; 6188 – 7199'; GW, TR; o; [72, 538]

Polygonaceae

■ *Eriogonum alatum* Torr., winged buckwheat; RMOS, SPNA; 6363 – 6630'; DC, SP, TR; o; [330, 738]

Eriogonum brevicaulum Nutt. var. *brevicaule*, shortstem buckwheat; RMOS, SPNA; 6334 – 6478'; GW, SP, TR; o-c; [260, 287, 728*]

Eriogonum effusum Nutt., spreading buckwheat; RMOS, SPNA; 6186 – 7183'; GW, SP, TR; o-c; [358, 427b, 751]

■ *Eriogonum flavum* Nutt. var. *flavum*, golden buckwheat; RMOS, SPNA; 6377 – 6489'; FS, GW, SP, TR, WL; o; [161, 225*, 703a]

Eriogonum umbellatum Torr. var. *umbellatum*, common sulfur flower; SPNA; 6366'; DC, GW; o-i; [268]

Fallopia convolvulus (L.) A. Löve, black bindweed; RMOS; 6504'; CA, RA; i; [789]

◇ ■ *Persicaria maculosa* Gray, lady's thumb; RMOS, SPNA; 6318 – 6440'; DA, DC, GW, RA, WL; o-i; [325a, 425c, 832c*]

◇■*Polygonum aviculare* L., prostrate knotweed; RMOS, SPNA; 6423 – 6723'; DA, DC, GW, PP; i-o; [784, 827a*, 862a]

▼*Polygonum engelmannii* Greene, Engelmann's knotweed; SPNA; 6919 – 6991'; CA, FS, GW, TR; o-i; [381, 744b]

◇*Rumex crispus* L., curly dock; RMOS, SPNA; 6045 – 6544'; CA, RA, WL; i; [368e, 765b]

Rumex triangulivalvis (Danser) Rech. f., willow dock; SPNA; 6482 – 6903'; CA, DC, RA; i; [387a, 824a]

■*Rumex venosus* Pursh, wild begonia; RMOS; 6141'; SP; o; [588]

Portulacaceae

◇*Portulaca oleracea* L., common purslane; SPNA; 6054'; WL; i; [763a]

Primulaceae

■*Dodecatheon pulchellum* (Raf.) Merr. var. *pulchellum*, darkthroat shooting star; RMOS; 6760'; CA, RA; i; [802b]

Ranunculaceae

Clematis ligusticifolia Nutt., western white virgin's bower, RMOS, SPNA; 6340 – 6424'; AG, CA, DC, TR; i; [297, 809b]

Delphinium geyeri Greene, Geyer's larkspur; RMOS, SPNA; 6315 – 6921'; SP, TR; o-i; [281, 312, 384, 667a, 700]

▼*Delphinium nuttallianum* Pritz., Nuttall's larkspur; RMOS, SPNA; 6448 – 6504'; FS, SP; o-i; [553, 583c]

Ranunculus acriformis Gray, sharp buttercup; SPNA; 6311 – 6358'; WL; o-i; [145, 232]

■*Ranunculus aquatilis* L. var. *diffusus* With., water crowfoot; RMOS; 6544'; CA, RA; r; [368a]

■*Ranunculus cymbalaria* Pursh, marsh buttercup; RMOS, SPNA; 6318 – 6457'; DC, RA, WL; i-o; [213d, 318d, 425b]

■*Ranunculus hyperboreus* R. Br., floating buttercup; RMOS; 6342'; CA, WL; r; [660d]

Ranunculus macounii Britt., Macoun's buttercup; RMOS; 6494'; CA, RA; i; [364g]

■*Ranunculus ranunculinus* (Nutt.) Rydb., tadpole buttercup; RMOS; 7016'; MM; c; [546]

Rosaceae

■*Amelanchier alnifolia* (Nutt.) Nutt. ex M. Roem. var. *utahensis* (Koehne) Ackerfield, comb nov, Utah serviceberry; RMOS; 7081'; FS; i; [805]

Cercocarpus montanus Raf., birchleaf mountain mahogany; RMOS, SPNA; 6313 – 6478'; FS, MM; c; [124, 160]

■*Chamaerhodos erecta* (L.) Bunge var. *parviflora* (Nutt.) C.L. Hitchc., little ground rose; RMOS, SPNA; 6258 – 6398'; DC, TR; o; [227, 664]

Physocarpus monogynus (Torr.) Coult., mountain ninebark; RMOS, SPNA; 6442 – 7013'; FS, TR; i-o; [195*, 244, 335, 604a]

Potentilla concinna Richardson var. *bicrenata* (Rydb.) S.L. Welsh & B.C. Johnst., elegant cinquefoil; SPNA; 6335 – 7196'; SP, TR; o-i; [76, 526b]

Potentilla fissa Nutt., bigflower cinquefoil; SPNA; 6410 – 6664'; RT, TR; i; [226, 241]

■*Potentilla fruticosa* Pursh, shrubby cinquefoil; RMOS; 6735 – 6780'; CA, CL; i; [373, 462]

Potentilla hippiana Lehm. var. *effusa* (Dougl. ex Lehm.) Dorn; SPNA; 6859'; CL; o; [177]

■*Potentilla hippiana* Lehm. var. *hippiana*, woolly cinquefoil; RMOS; 6977'; DC; o; [422b, 422c]

■*Potentilla norvegica* L., Norwegian cinquefoil; RMOS; 6977'; DC; i; [422e]

Potentilla pensylvanica L. var.
pensylvanica, Pennsylvania cinquefoil;
SPNA; 6965'; GW, TR; r; [382]

■ *Potentilla plattensis* Nutt., Platte River
cinquefoil; RMOS, SPNA; 6310 –
6605'; DC, TR, WL; o-i; [140, 214,
489a, 653]

▼ *Potentilla rivalis* Nutt., brook cinquefoil;
SPNA; 6440'; DC, GW; o; [325b]

Prunus americana Marsh., wild plum;
SPNA; 6326'; FS, PP, SB; i-o; [574]

Prunus virginiana L. var. *melanocarpa*
(A.Nels.) Sarg., chokecherry; RMOS,
SPNA; 6292 – 6838'; CA, DA, PP,
SB; o-i; [118, 587b, 596*, 874]

■ *Purshia tridentata* (Pursh) DC., antelope
bitterbrush; RMOS; 7169'; FS; i; [752]

Rosa blanda Ait., smooth rose; RMOS,
SPNA; 6394 – 6652'; CA, DC, GW, TR,
WL; o; [151, 194]

■ *Rubus idaeus* L. var. *strigosus* (Michx.)
Maxim., red raspberry; RMOS; 6603';
CA, RA; i-r; [797b]

Rubiaceae

◇▼ *Galium aparine* L., stickywilly; RMOS,
SPNA; 6344 – 6819'; CA, CL, DA; r-i;
[178, 660a]

■ *Galium boreale* L., northern bedstraw;
RMOS, SPNA; 6362 – 6820'; DC, RA;
i-o; [222, 710]

Ruscaceae

■ *Maianthemum stellatum* (L.) Link, false
Solomon's seal; RMOS, SPNA; 6342 –
6347'; WA; i; [143, 661c]

Salicaceae

■ *Populus balsamifera* L., balsam poplar;
RMOS; 6396'; DC, TR; o; [845]

Populus deltoides Bartram ex Marsh. ssp.
monilifera (Ait.) Eckenwalder, plains
cottonwood; SPNA; 6161 – 6257'; DC,
GW, RA; i-o; [622, 855a]

■ *Populus tremuloides* Michx., quaking
aspens; RMOS, SPNA; 6359 – 6875';
CA, RA; i-r; [492, 803*, 808b]

■ *Salix amygdaloides* Anderss., peach-leaf
willow; RMOS, SPNA; 6292 – 6495';
CA, RA; o; [122, 657, 678c]

Salix exigua Nutt. ssp. *exigua*, coyote
willow; RMOS, SPNA; 6152 – 7059';
DC, FS; o-i; [256*, 621]

Santalaceae

Comandra umbellata (L.) Nutt. ssp. *pallida*
(A. DC.) Piehl, pale bastard toadflax;
RMOS, SPNA; 6329 – 6824'; TR; i-o;
[139, 203]

Sapindaceae

Acer glabrum Torr. var. *glabrum*, Rocky
Mountain maple; RMOS, SPNA; 6551
– 6903'; CA, CL, TR; o; [387c *, 791d*]

Saxifragaceae

Heuchera parvifolia Nutt., common
alumroot; RMOS, SPNA; 6448 – 6983';
CA, CL, FS; i-r; [307*, 583a, 758a]

Scrophulariaceae

Scrophularia lanceolata Pursh, lanceleaf
figwort; SPNA; 6439'; WL; i; [323*]

◇ *Verbascum thapsus* L., woolly mullein;
RMOS, SPNA; 6426 – 6836'; CA, DA,
DC, GW, TR; o; [322, 417]

Solanaceae

■ *Physalis hispida* (Waterf.) Cronquist,
prairie ground cherry; RMOS; 6662';
DC, SP; i; [376b]

Quincula lobata (Torr.) Raf., purple ground
cherry; RMOS, SPNA; 6213 – 6269';
GW, TR; o-i; [168, 412]

Typhaceae

■ *Typha angustifolia* L., narrowleaf cattail;
RMOS; 6340'; WL; o; [476b]

Urticaceae

- *Parietaria pensylvanica* Muhl. ex Willd.,
Pennsylvania pellitory; RMOS; 6344 –
6551'; AG, CA, RA; i-o; [660c, 791b]
- *Urtica dioica* L. ssp. *gracilis* (Aiton)
Selandier, stinging nettle; RMOS,
SPNA; 6221 – 6359'; CA, DC, RA; o;
[344, 808e*]

Valerianaceae

- *Valeriana edulis* Nutt. ex Torr. & Gray,
tobacco root; RMOS, SPNA; 6299 –
6305'; CA, TR, WL; i; [125, 231b]

Verbenaceae

- ◆■ *Verbena bracteata* Cav. ex Lag. & Rodr.,
prostrate vervain; RMOS, SPNA; 6199 –
6605'; GW, RA, TR; o; [170, 355, 489c]

Violaceae

- Viola nuttallii* Pursh, Nuttall's violet;
RMOS, SPNA; 6339 – 7027'; FS, MM,
TR; o; [54*, 66, 81]
- Viola sororia* Willd., bog violet; SPNA;
6322'; WL; i-o; [135]

Vitaceae

- *Parthenocissus quinquefolia* (L.) Planch.,
Virginia creeper; RMOS; 6838'; FR,
RT; i; [587a]

Zygophyllaceae

- ◆■ *Tribulus terrestris* L., puncture vine;
RMOS; 6419'; TR; r; [848*]

The Most Common Plants of Red Mountain Open Space and Soapstone Prairie Natural Area

By: Jenna McAleer
2014



Introduction

I created this field guide while working on my Master's Degree in Botany from Colorado State University, which entailed inventorying the vascular plants of Red Mountain Open Space (RMOS) and Soapstone Prairie Natural Area (SPNA). I surveyed both properties between April-October 2012 and 2013, and while doing so, noted the most common plants I encountered while hiking on the public trails. The results of my observations are presented in the following guide, which is meant to serve as an easy-to-use picture identification aid for the novice plant enthusiast.

<p>Family <i>Scientific name*</i> Common Name</p> <p>Height: Maximum ht. Flowers: Color, size; arrangement No. Petals: # of flower petals Leaves: Position; shape, size, surface Blooms: Flowering time Common species: Those likely to be seen (only in genus cards)</p> <p>* denotes a non-native species</p>

Each plant species, or group of species, includes representative photographs, which I personally took at either RMOS or SPNA, and a description of several noteworthy characters to assist in identification. The general format of the information is as provided here (Fig. 1). However, as certain characters may be important for identifying one plant but irrelevant for others, variation amongst the descriptions does exist. I have attempted to simplify all technical terminology from these descriptions so that the guide may be utilized without any prior botanical knowledge, nor the aid of additional literature. Given the complicated nature of certain plant families however, this was not always possible. In these instances, I opted to use the technical term and then label the feature in the accompanying photograph(s). Additionally, certain plant species are only identifiable with an advanced skillset; here I chose to create genus cards (*Genus* spp.) that allow you to recognize a group of species, rather than individual species. I provide a list of the common species at the end of the description (Fig. 1), as well as label the photograph(s) with the species names, space permitting.

It is important to note that simplifying the guide in these ways and limiting the number of species to only 76 deems it exempt from being comprehensive. As such, I have provided a list of suggested readings and references, from which I obtained the information to write the descriptions (pg. 27). This list should accommodate all types of further inquiries; it includes other simplified picture guides and in-depth technical keys.

Fig. 1. Written species description template.

Guide Organization

This guide is organized into four major sections, as outlined below. Within each section, the species are alphabetized first by which family they are taxonomically grouped in, and then by their scientific name.

1. Trees and Shrubs (pgs. 4-8)

Trees and shrubs are identified as having one or more upright stems that persist from year to year; most often these stems are woody in nature. Their heights are extremely variable (~1' tall to 30+' tall), with trees being generally taller than shrubs. I have included several 'subshrubs' in this section as well, which are shrub-like, but shorter in stature. Additionally, there are one or more species that could be considered either subshrubs or herbaceous. In these cases, I chose to include them in this section, but I specifically list the habit type in the written description, to help clarify any confusion.

2. Flowering Herbs (pgs. 9-22)

Flowering herbaceous plants are commonly referred to as wildflowers. These include perennials that live more than one season, to annuals which only survive for one year. They are typically not woody in nature, although depending on the species, may appear to be woody at the base. I have divided this group into two sections, based on when they typically first begin to flower. Please note that nature is highly variable and that some species have long-ranging bloom times. For this reason, my groupings are somewhat arbitrary. For instance, if you see something blooming in August, this does not necessarily mean you will find it in the Summer-Fall Flowering Herb section, if it began to flower in May. Therefore, please refer to the Blooms listed in each description to help narrow down your identifications.

2a. Spring-Summer Flowering Herbs (pgs. 9-17)

Herbs grouped within this section typically begin to flower in spring to early summer (March-May). As noted above, their flowering time is dependent on the season and often extends past May.

2b. Summer-Fall Flowering Herbs (pgs. 18-22)

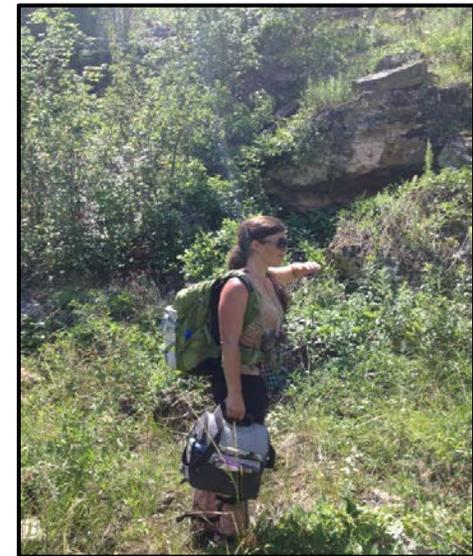
Herbs grouped within this section typically begin to flower in summer to fall (June-Sept). As noted above, their flowering time may be earlier depending on the weather.

3. Grasses (pgs. 23-26)

Although often underappreciated or overlooked, grasses are one of the dominant groups of plants at Red Mountain Open Space and Soapstone Prairie Natural Area. Therefore, I felt obligated to include them despite the fact that they can be extremely difficult to identify, even for the most experienced of botanists. Grass identification has its own specific set of terminology because grass flowers are highly modified and reduced. Keeping with my theme of simplification, I will only use the technical term ‘spikelet’ while describing the grass species. A spikelet is made up of one or more flowers, which each consist of a series of leaf-like structures (bracts) that enclose the male and female flower parts. I specifically refer to the arrangement of the spikelets (dense, open and airy, etc.) as a means to identify the different grass species. Space permitting, I have also labeled spikelets in many of the accompanying photographs. Supplementary literature from the list of References and Suggested Readings (pg. 27) may be extremely useful, particularly for species in this section.



Bubo virginianus (Great Horned Owl)



TREES AND SHRUBS



Agavaceae

Yucca glauca
Great Plains Yucca

Habit: Subshrub
Height: To 5' tall,
when in flower or fruit
Flowers: Creamy white
No. Petals: 6
Leaves: Mostly
clustered at the base;
narrow with sharp-
pointed tips
Blooms: May-July



Anacardiaceae

Rhus trilobata var.
trilobata
Skunkbrush Sumac

Habit: Shrub
Height: To 6' tall
Flowers: Yellow to cream
Fruit: Bright red to
orange
No. Petals: 5
Leaves: Comprised of 3
smaller leaflets, each one
lobed, to 1.5" long
Blooms: Apr-June



Asteraceae

Ericameria nauseosa
Rubber Rabbitbrush

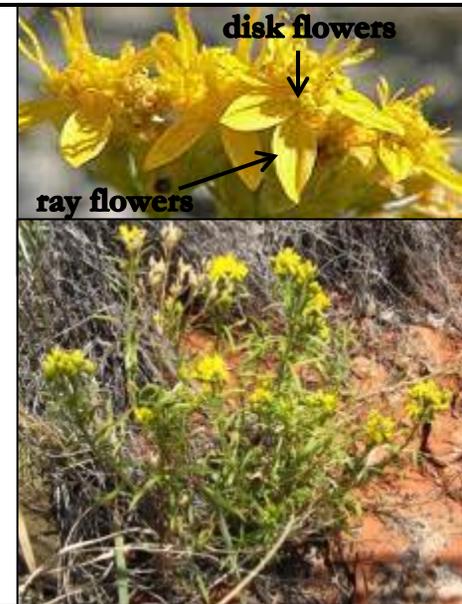
Habit: Shrub
Height: To 6' tall
Flowers: Yellow, small;
in clusters at the tips of
branches
Leaves: Narrow, to 2.5"
long
Blooms: July-Oct



Asteraceae

Gutierrezia sarothrae
Broom Snakeweed

Habit: Subshrub or
herb
Height: To 3' tall
Flowers: Yellow ray
and disk flowers
Leaves: Narrow to
sword-shaped
Blooms: July-Oct



Cactaceae

Opuntia polyacantha
var. *polyacantha*
Starvation
Pricklypear

Habit: Shrub
Height: To 10" tall
Flowers: Yellow to pinkish
No. Petals: Many
Leaves: Modified into sharp spines
Blooms: June-Aug



Caprifoliaceae

Symphoricarpos
occidentalis
Wolfberry

Habit: Shrub
Height: To 3' tall
Flowers: White to light pink
No. Petals: 5
Leaves: Egg-shaped, occasionally lobed, to 3" long
Blooms: June-Aug



Chenopodiaceae

Krascheninnikovia
lanata
Winterfat

Habit: Subshrub
Height: To 20" tall
Flowers: Tiny, reduced; male and female flowers on separate plants
Leaves: To 1.5" long, very hairy
Blooms: May-July



Cupressaceae

Juniperus scopulorum
Rocky Mountain
Juniper

Habit: Shrub or tree
Height: To 30+' tall
Leaves: Scale-like and overlapping, green to bluish-gray
Cones: Fleshy and berry-like, bluish-green, rounded, to 1/2" across; only on female plants



Grossulariaceae

Ribes aureum
Golden Currant

Habit: Shrub
Height: To 10' tall
Flowers: Bright yellow with reddish center, tubular-shaped
No. Petals: 5
Leaves: Often in clusters; 3-5-lobed at the tips
Blooms: Apr-June



Grossulariaceae

Ribes cereum
Wax currant

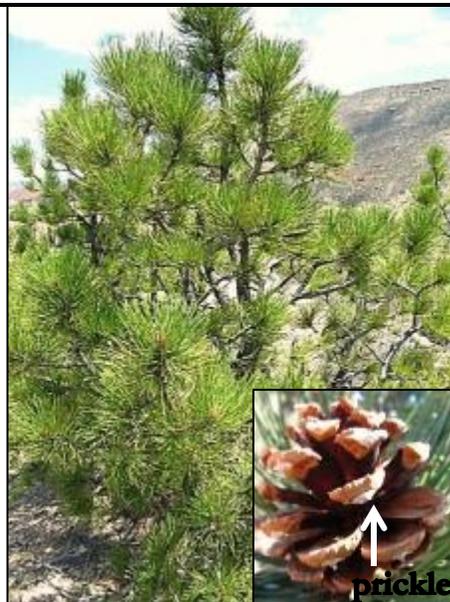
Habit: Shrub
Height: To 6.5' tall
Flowers: Pink to white, tubular-shaped
No. Petals: 5
Leaves: Often in clusters; lobed, to 1" long
Blooms: Apr-Aug



Pinaceae

Pinus ponderosa var.
scopulorum
Ponderosa Pine

Habit: Tree
Height: To 70+' tall
Leaves: Clustered in groups of 3, or sometimes 2; needle-like, 5-8" long
Cones: Brown at maturity, to 6" long, each scale tipped with a sharp prickle



Polygonaceae

Eriogonum effusum
Spreading Buckwheat

Habit: Subshrub to shrub
Height: To 2.5' tall
Flowers: White to yellowish, small
No. Petals: 6
Leaves: Bluish-green, to 1.25" long
Blooms: July-Nov



Rosaceae

Cercocarpus montanus
Mountain Mahogany

Habit: Shrub

Height: To 12+' tall

Flowers: Small,
pinkish-yellow

Fruit: Tipped with a
curled, fuzzy style

Leaves: Arising in
clusters; more or less
egg-shaped

Blooms: May-June



Rosaceae

Prunus virginiana var.
melanocarpa
Chokecherry

Habit: Shrub

Height: To 12' tall

Flowers: White; in
dense clusters

Fruit: Black to red
cherries, to 1/2" long

No. Petals: 5

Leaves: Glossy green,
to 4" long and 2" wide

Blooms: Apr-June



Rosaceae

Rosa blanda
Smooth Rose

Habit: Shrub

Height: To 5' tall,
prickly stems

Flowers: Pink to rose

No. Petals: 5

Leaves: Made up of an
odd number of leaflets,
which are often
mistaken as individual
leaves

Blooms: June-Aug



Sapindaceae

Acer glabrum var.
glabrum
Rocky Mountain
Maple

Habit: Shrub

Height: To 30' tall

Flowers: Yellow, small
and inconspicuous

Leaves: Lobed or
often divided into 3
leaflets, shiny green

Blooms: Apr-June





**FLOWERING HERBS
SPRING TO SUMMER**

Agavaceae

Leucocrinum montanum
Common Sand Lily

Height: To 6" tall
Flowers: White petals,
bright yellow anthers
No. Petals: 6
Leaves: Clustered at
the base; narrow, to 8"
long
Blooms: Apr-June



Alliaceae

Allium spp.
Onion

Height: To 2' tall
Flowers: White, pink or
lilac; in umbrella-like
clusters
No. Petals: 6
Leaves: Clustered at the
base; 3-5 narrow leaves,
to 15" long
Blooms: May-Aug
Common species: *A.*
cernuum, *A. geyeri*, *A. textile*



Apiaceae

Harbouria trachypleura
Whiskbroom Parsley

Height: To 2' tall
Flowers: Yellow, tiny;
in umbrella-like clusters
No. Petals: 5
Leaves: Mostly
clustered at the base;
dissected into stiff,
narrow leaflets
Blooms: Apr-June



Asteraceae

Erigeron spp.
Fleabane

Height: To 3' tall
Flowers: White, pink,
blue, or purple ray flowers;
yellow disk flowers
Leaves: Variable
Blooms: May-Sept
Common species: *E.*
compositus, *E. flagellaris*, *E.*
glabellus, *E. pumilus*



Asteraceae
Gaillardia aristata
 Blanketflower

Height: To 1.5' tall
Flowers: Yellow ray flowers, each with 3 lobes at the tip; reddish disk flowers
Leaves: Sword-shaped, to 6" long, hairy
Blooms: May-Sept



Asteraceae
Senecio spp.
 Ragwort

Height: To 3' tall
Flowers: Yellow ray and disk flowers
Leaves: Variable
Blooms: May-Oct
Common species: *S. integerrimus*, *S. spartioides*



Asteraceae
Tetraneuris acanthis
 Stemless Four-Nerve
 Daisy

Height: To 1' tall
Flowers: Yellow ray flowers that fade to white; yellow disk flowers; 1 flower head per 'stem'
Leaves: Clustered at the base; hairy
Blooms: May-Aug



Asteraceae
Townsendia grandiflora
 Largeflower Easter
 Daisy

Height: To 12" tall
Flowers: White rays flowers; yellow disk flowers
Leaves: Mainly clustered at the base; narrow, to 3" long
Blooms: May-Aug



Asteraceae

Townsendia hookeri
Hooker's Easter
Daisy

Height: To 1.5" tall
Flowers: White to pinkish ray flowers; yellow disk flowers
Leaves: Clustered at the base; narrow, to 1.5" long
Blooms: March-May



Boraginaceae

Mertensia lanceolata
var. *lanceolata*
Prairie Bluebells

Height: To 15" tall
Flowers: Blue-purple
No. Petals: 5, fused into a tube
Leaves: Sword-shaped, to 4" long, bluish-green
Blooms: Apr-Aug



Boraginaceae

Oreocarya spp.
Cryptantha

Height: To 2.5' tall
Flowers: White to yellowish
No. Petals: 5
Leaves: Narrow, rough-hairy
Blooms: May-July
Common Species: *O. thrysiflora*, *O. virgata*



Brassicaceae

Erysimum spp.
Wallflower

Height: To 2' tall
Flowers: Yellow
No. Petals: 4, in a cross-shaped pattern
Leaves: Narrow, to 4" long
Blooms: May-June
Common species: *E. asperum*, *E. capitatum*



Capparaceae

Polanisia dodecandra
ssp. *trachysperma*
Red-Whisker
Clammyweed



Height: To 1.5' tall
Flowers: White with red-pink stamens
No. Petals: 4
Leaves: Each leaf divided into 3 smaller leaflets, stinky
Blooms: May-July

Fabaceae

Astragalus drummondii
Drummond's
Milkvetch



Height: To 2.5' tall
Flowers: White to cream, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Made up of 17+ hairy leaflets that are often mistaken for individual leaves
Blooms: May-Aug

Fabaceae

Astragalus spp.
Purple Milkvetch



Height: To 2.5' tall
Flowers: Purple to blue, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Various; made up of several leaflets
Blooms: Apr-Aug
Common species: *A. bisulcatus*, *A. shortianus*, *A. spatulatus*, *A. tridactylicus*

Fabaceae

Dalea spp.
Prairie Clover



Height: To 3' tall
Flowers: White or purplish-pink; in dense clusters
No. Petals: 5
Leaves: Made up of several narrow leaflets, to 2.5" long
Blooms: May-Sept
Common species: *D. purpurea*, *D. candida* var. *olgophylla*

Fabaceae

Lupinus spp.

Lupine

Height: To 3' tall
Flowers: Bluish-purple, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Palmately compound
Blooms: May-Sept
Common species: *L. argenteus*, *L. plattensis*



Fabaceae

Oxytropis lambertii

Purple Locoweed

Height: To 1.5' tall
Flowers: Purplish-red, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Clustered at the base; made up of several gray-green, hairy leaflets which are often mistaken for individual leaves
Blooms: Apr-Aug



Fabaceae

Oxytropis sericea var. *sericea*

White Locoweed

Height: To 2' tall
Flowers: White to cream with a purple spot, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Clustered at the base; made up of several grayish, hairy leaflets
Blooms: Apr-Aug



Fabaceae

Thermopsis rhombifolia

Goldenbanner

Height: To 3' tall
Flowers: Bright yellow, pea-shaped
No. Petals: 5 (2 fused)
Leaves: Each leaf divided into 3 oval-shaped leaflets, which are often mistaken for individual leaves
Blooms: Apr-Aug



Geraniaceae

Geranium caespitosum
var. *caespitosum*
Rocky Mountain
Geranium

Height: To 2' tall
Flowers: Pink to purple
with reddish veins
No. Petals: 5
Leaves: Mainly
clustered at the base;
lobed, to 3" wide
Blooms: May-Aug



Linaceae

Linum lewisii
Lewis Flax

Height: To 2' tall
Flowers: Light blue,
with darker blue veins
and yellow to white
center
No. Petals: 5
Leaves: Narrow, to
0.5" long
Blooms: May-Sept



Loasaceae

Mentzelia spp.
Blazingstar

Height: To 3.5' tall
Flowers: White to yellow
No. Petals: 5 or 10
Leaves: Variable; sticky-
hairy
Blooms: May-Sept
Common species: *M.*
decapetala, *M. multiflora*, *M.*
oligosperma

M. multiflora



Malvaceae

Sphaeralcea coccinea
Scarlet Globemallow

Height: To 12" tall
Flowers: Orange to
pinkish-red
No. Petals: 5
Leaves: Lobed into 3
or 5 segments, to 1.5"
long, hairy
Blooms: May-Sept



Onagraceae
Oenothera spp.
 Evening Primrose

Height: To 3+' tall
Flowers: White, yellow, orangish, or pink-purple
No. Petals: 4
Leaves: Variable
Blooms: May-Sept
Common species: *O. caespitosa* var. *caespitosa*, *O. coronopifolia*, *O. howardii*, *O. suffretescens*, *O. villosa*



O. suffretescens

O. coronopifolia

O. caespitosa var. *caespitosa*

Orobanchaceae
Castilleja spp.
 Indian Paintbrush

Height: To 2' tall
Flowers: Yellow to white, orange to red
Leaves: Narrow to lobed
Blooms: May-Sept
Common species: *C. linariifolia*, *C. miniata*, *C. sessiliflora*



C. sessiliflora

C. linariifolia

Papaveraceae
Argemone hispida
 Rough Prickly-Poppy

Height: To 2' tall
Flowers: White papery petals; large and showy
No. Petals: 6
Leaves: To 8" long, bluish-green, prickly
Blooms: May-July

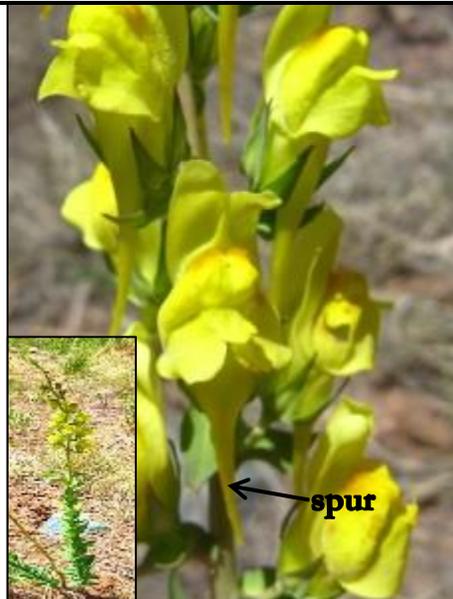


fruit

Plantaginaceae
*Linaria dalmatica**
 Dalmatian Toadflax

Height: To 2.5' tall
Flowers: Bright yellow, with a long spur
No. Petals: 5
Leaves: Egg-shaped to sword-shaped, to 1.5" wide
Blooms: May-Oct

* non-native



spur

Plantaginaceae

Penstemon spp.
Beardtongue

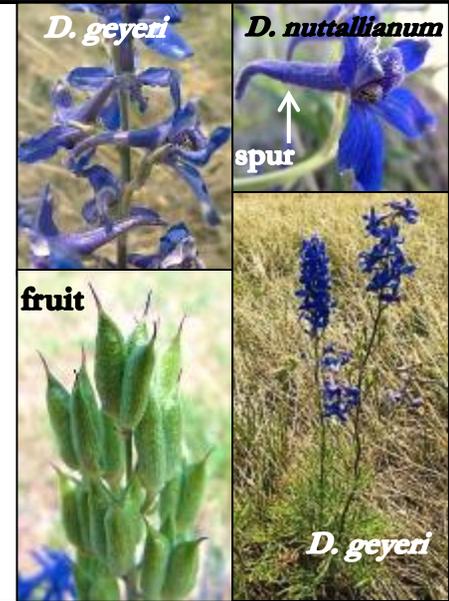
Height: To 2' tall
Flowers: Blue, purple, or pink
No. Petals: 5, fused into a two-lipped tube
Leaves: Variable
Blooms: May-Aug
Common species: *P. angustifolius*, *P. glaber*, *P. secundiflorus*, *P. virens*



Ranunculaceae

Delphinium spp.
Larkspur

Height: To 2.5' tall
Flowers: Blue-purple, with a long spur
Leaves: Often clustered at the base; divided into narrow leaflets
Blooms: Apr-July
Common species: *D. geyeri*, *D. nuttallianum*



Solanaceae

Quincula lobata
Purple Ground
Cherry

Height: To 6" tall
Flowers: Purple
No. Petals: 5, fused
Leaves: To 3" long, rough to the touch
Blooms: May-July



Violaceae

Viola nuttallii
Nuttall's Violet

Height: To 6" tall
Flowers: Yellow; the lowest petal with purplish stripes
No. Petals: 5
Leaves: Clustered at the base; broadly sword-shaped, to 8" long
Blooms: Apr-June





Asteraceae

Achillea millefolium
Common Yarrow

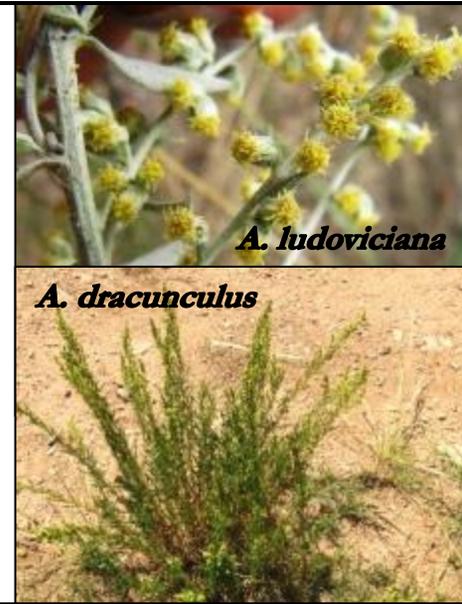
Height: To 2' tall
Flowers: White ray flowers; yellow disk flowers
Leaves: Finely dissected and fern-like
Blooms: June-Oct



Asteraceae

Artemisia spp.
Sagebrush

Habit: Herbs to subshrubs
Height: To 3' tall
Flowers: Yellow, tiny
Leaves: Variable
Blooms: July-Oct
Common species: *A. campestris*, *A. dracunculus*, *A. frigida*, *A. ludoviciana*



Asteraceae

Cirsium spp.
Thistle

Height: To 4+' tall
Flowers: Pink, purple, cream, or white; clustered in spiny heads
Leaves: Lobed, spiny
Blooms: June-Sept
Common species: *C. arvense**, *C. canescens*, *C. flodmanii*, *C. ochrocentrum*, *C. undulatum*

* non-native



Asteraceae

Grindelia spp.
Gumweed

Height: To 3' tall
Flowers: Yellow ray and disk flowers; clustered in sticky heads
Leaves: Oval to sword-shaped, to 2.5" long
Blooms: June-Oct
Common species: *G. squarrosa*, *G. subalpina*



Asteraceae
Helianthus spp.
 Sunflower

Height: To 10+' tall
Flowers: Yellow ray flowers; yellow to reddish-brown disk flowers
Leaves: Variable; coarse to the touch
Blooms: June-Oct
Common species: *H. annuus*, *H. pumilus*



Asteraceae
Heterotheca villosa
 Hairy False Goldenaster

Height: Stems to 2' long, spreading to upright
Flowers: Yellow ray and disk flowers
Leaves: To 2" long, hairy
Blooms: May-Oct



Asteraceae
Liatris punctata
 Dotted Blazing Star

Height: To 2.5' tall
Flowers: Pinkish-purple
Leaves: Narrow, to 6" long, with small dots or depressions on the surface (requires a close look)
Blooms: Aug-Oct



Asteraceae
Lygodesmia juncea
 Rush Skeletonweed

Height: To 2' tall
Flowers: Pink to lavender or whitish; with 5 prominent teeth at tip of each ray flower
Leaves: Narrow, to 1.5" long, often absent
Blooms: June-Sept



Asteraceae

Solidago spp.
Goldenrod

Height: To 6' tall
Flowers: Yellow, tiny;
often in arching clusters
Leaves: Sword-shaped
Blooms: July-Oct
Common species: *S.*
canadensis, *S.*
missouriensis, *S. mollis*, *S.*
nemoralis



Asteraceae

Symphiotrichum spp.
Aster

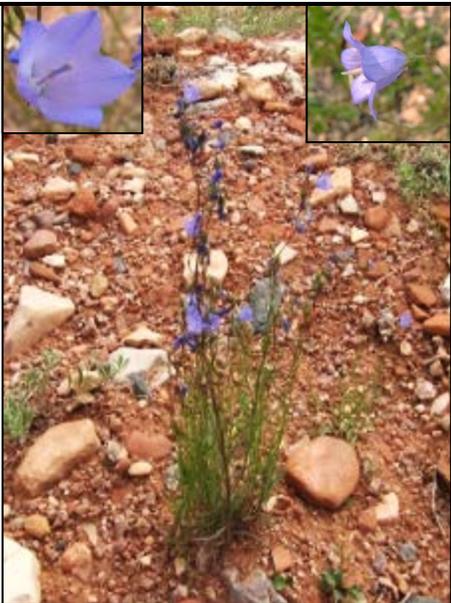
Height: To 3' tall
Flowers: White or blue-
purple ray flowers; yellow
disk flowers
Leaves: Variable
Blooms: July-Oct
Common species: *S.*
ascendens, *S. ericoides*, *S.*
falcatum, *S. laeve*



Campanulaceae

Campanula rotundifolia
Bluebell of Scotland

Height: To 2' tall
Flowers: Blue to
purple, bell-shaped
No. Petals: 5, fused
Leaves: Round leaves
clustered at the base;
narrow stem leaves, to
2.5" long
Blooms: June-Aug



Gentianaceae

Frasera speciosa
Elkweed

Height: To 5' tall
Flowers: Yellowish-
green to white, with
purple dots
No. Petals: 4
Leaves: Sword-shaped,
to 20" long
Blooms: June-Sept



Lamiaceae

Monarda fistulosa var.
menthifolia

Wild Bergamot

Height: To 4' tall

Flowers: Purple to pinkish; clustered in shaggy-looking heads

No. Petals: 4

Leaves: Sword-shaped, to 3.5" long

Blooms: June-Sept



Polygonaceae

Eriogonum brevicaulle var.
brevicaule

Shortstem Buckwheat

Habit: Herb to subshrub

Height: To 2' tall

Flowers: Bright yellow to cream, tiny

No. Petals: 6

Leaves: Narrow, to 4" long

Blooms: June-Sept



Polygonaceae

Eriogonum flavum var.
flavum

Golden Buckwheat

Height: To 1.5' tall

Flowers: Bright yellow; in dense, umbrella-like clusters

No. Petals: 6

Leaves: Clustered at the base; narrow, to 2" long, densely hairy

Blooms: June-Sept



Rosaceae

Potentilla spp.
Cinquefoil

Height: To 2' tall

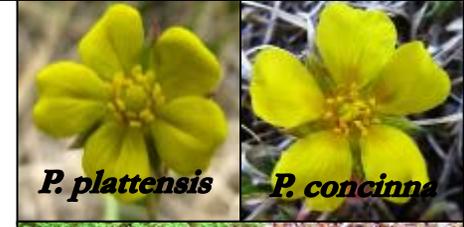
Flowers: Yellow

No. Petals: 5

Leaves: Various; each leaf divided into several leaflets

Blooms: June-Aug

Common species: *P. concinna*, *P. hippiana*, *P. pensylvanica*, *P. plattensis*,



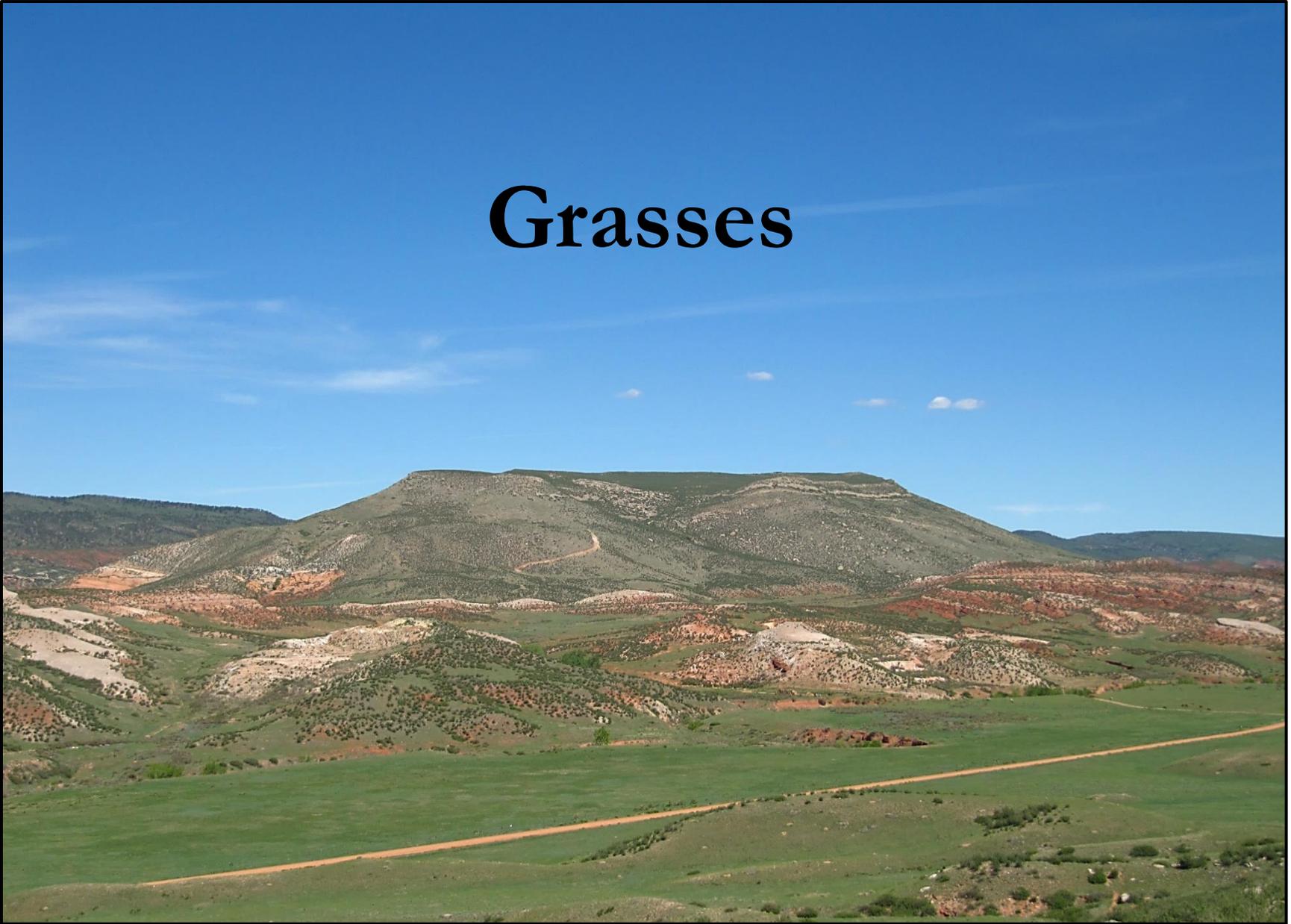
P. plattensis

P. concinna



P. pensylvanica

Grasses



Poaceae
Achnatherum hymenoides
 Indian Ricegrass

Habit: Tufted
Height: To 3' tall
Spikelets: At tips of widely spreading, airy branches
Leaves: To 10" long, tightly rolled outward
Blooms: May-July



Poaceae
Achnatherum robustum
 Sleepygrass

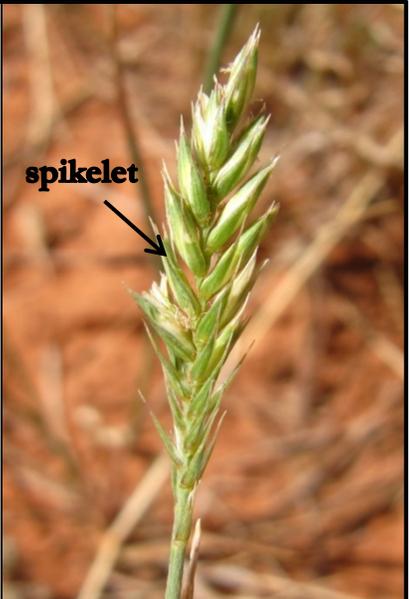
Habit: Tufted
Height: To 4' tall
Spikelets: Densely clustered in terminal cylinders; each spikelet with an awn to 1.5" long
Leaves: To 12" long, tightly rolled outward
Blooms: June-Aug



Poaceae
*Agropyron cristatum**
 Crested Wheatgrass

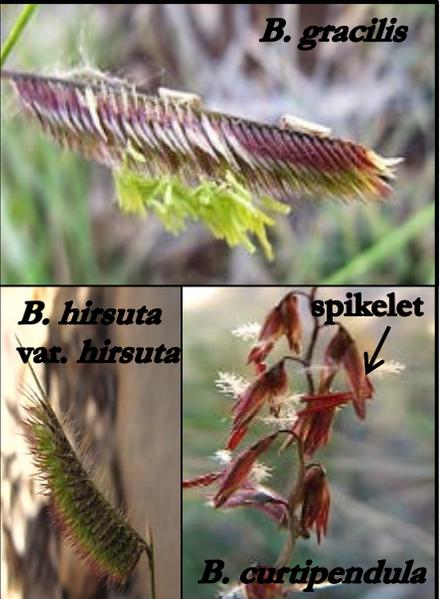
Habit: Densely tufted
Height: To 3' tall
Spikelets: Grouped on two sides of a central stalk, appearing bristly
Leaves: To 8" long, flat
Blooms: May-Aug

* non-native



Poaceae
Bouteloua spp.
 Grama

Habit: Mat-forming to tufted
Height: To 2.5' tall
Spikelets: Grouped on one-sided branches, or in drooping clusters
Leaves: To 12" long
Blooms: July-Oct
Common species: *B. curtipendula*, *B. gracilis*, *B. hirsuta* var. *hirsuta*



Poaceae
Bromus spp.
 Brome

Habit: Loosely tufted
Height: To 3+' tall
Spikelets: Grouped at the tips of branches
Leaves: To 15" long
Blooms: May-Sept
Common species: *B. inermis**, *B. japonicus**, *B. tectorum**

* non-native





Poaceae
Buchloë dactyloides
 Buffalograss

Habit: Mat-forming
Height: To 12" tall
Spikelets: Grouped in small, dense clusters; separate male and female clusters
Leaves: To 6" long, very narrow
Blooms: May-July





Poaceae
Elymus spp.
 Wildrye

Habit: Tufted
Height: To 3+' tall
Spikelets: Clustered along a central stalk, with or without awns
Leaves: To 15" long
Blooms: June-Sept
Common species: *E. canadensis*, *E. elymoides*, *E. repens**, *E. trachycaulus*

* non-native




Poaceae
Hesperostipa comata
 Needle and Thread

Habit: Tufted
Height: To 3.5' tall
Spikelets: Grouped in a narrow or airy arrangement; each spikelet tipped with a thread-like awn to 9" long
Leaves: To 15" long, flat to rolled inward
Blooms: May-July




Poaceae
Koeleria macrantha
 Junegrass

Habit: Tufted
Height: To 2' tall
Spikelets: Densely clustered in terminal cylinders, pale green
Leaves: To 10" long, flat to rolled inward, often twisted
Blooms: May-Aug



Poaceae
Muhlenbergia spp.
 Muhly

Habit: Mostly tufted
Height: To 2.5' tall
Spikelets: Grouped in narrow cylinders, or in an open, airy arrangement
Leaves: To 10" long
Blooms: July-Sept
Common species: *M. cuspidata*, *M. filiculmis*, *M. montana*, *M. torreyi*



Poaceae
Schizachyrium scoparium
 var. *scoparium*
 Little Bluestem

Habit: Tufted
Height: To 3' tall
Spikelets: Grouped in narrow cylinders; often appearing reddish in the fall
Leaves: To 10" long, flat or folded
Blooms: July-Sept



Poaceae
Sporobolus spp.
 Dropseed

Habit: Mostly tufted
Height: To 4' tall
Spikelets: Grouped in a narrow, or open airy arrangement
Leaves: To 24" long
Blooms: June-Sept
Common species: *S. airoides*, *S. compositus*, *S. cryptandrus*

S. cryptandrus



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LIST OF ABBREVIATIONS

Location abbreviations:

RMOS Red Mountain Open Space
SPNA Soapstone Prairie Natural
Area

Habitat abbreviations:

AG Aspen grove
CA Canyons
CL Cliff
DA Disturbed area
DC Dry creek bed
FS Foothills shrubland
GO Gypsum outcrops
GW Gravel wash
MM Mountain mahogany
shrubland
PP Ponderosa pine forest
RA Riparian area
RT Ridge top
SB Shale barren
SP Shortgrass prairie
SS Saltbrush shrubland
TR Trail (public or private)
WL Wetland

Abundance abbreviations:

c common throughout
property
i infrequent; isolated
populations of 25 or more
individuals
o occasional; locally abundant
r rare; very isolated small
populations (<25
individuals); overall hard to
locate