

# Inventory Needs and Areas of Botanical Significance on the Colorado Plains



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Prepared for  
Colorado Natural Areas Program  
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## Background

The Flora of Colorado includes 2797 native vascular plant taxa (Ackerfield 2015). The Colorado Natural Heritage Program (CNHP) maintains range wide and state wide rarity ranks (G1-G5, S1-S5) for all of these taxa, and “Tracks” the location and condition of 524 plant taxa that are ranked G1-G3 range-wide (globally), or if ranked G4 or G5, ranked S1 or S2 in Colorado. These are plants that warrant conservation attention in Colorado. Additionally, 78 Colorado plant taxa are assigned a Watchlist (W) tracking status by CNHP. These are plants that require additional research because the overall significance of the occurrences of these taxa in Colorado is unclear, usually because the plants are considered to be globally secure from a range-wide perspective (G4-G5), or because the plants are known to occur in areas where botanical research has been sparse. The T rank (T1-T5) is a trinomial rank that applies to the subspecies or variety of a species. For additional information about CNHP ranking and tracking status please see the Colorado Natural Heritage Program and NatureServe websites.

Our analysis focused on tracked and watchlisted plants that occur on the eastern plains of Colorado (CNHP 2019). The study area is represented by the Colorado portion of the Central Shortgrass Prairie ecoregion as defined by TNC (2009, modified from Bailey 1998). Of the 524 Colorado vascular plant taxa tracked by CNHP, 137 (26%) are found on the eastern plains of the state (**Appendix 1**). The vast majority of these (about 100) are thought to be globally secure (ranked G4-G5), but are rare in Colorado (S1 or S2). In general, these taxa are on the edges of their ranges in Colorado. Some of these peripheral populations are more disjunct from their primary ranges than others, and potentially of increased conservation interest.

Colorado’s eastern plains occupy approximately the eastern third of the state, and range from about 3300 to 7000 feet in elevation. The plains cover a variety of land forms including

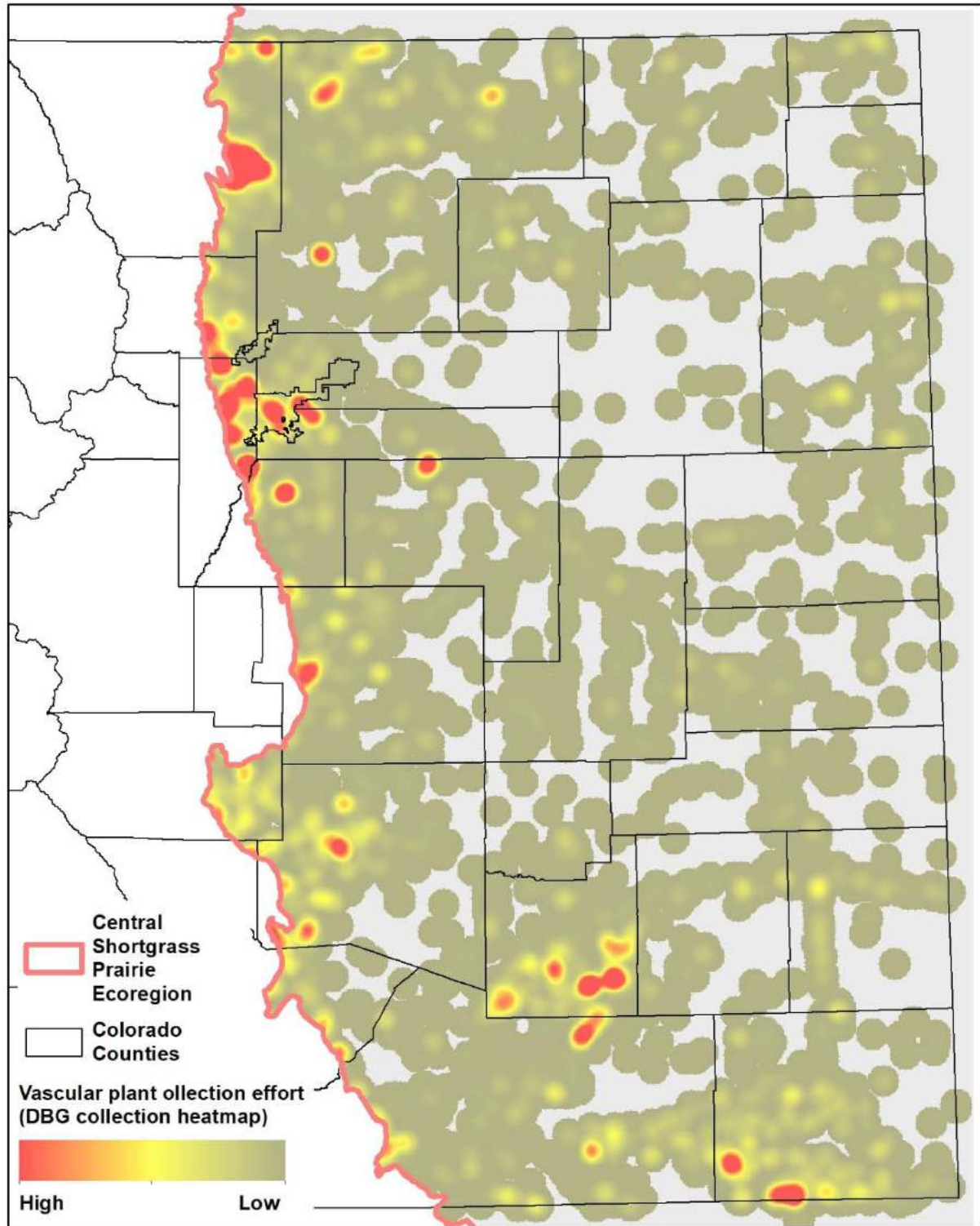
grasslands, mesas, rock outcrops, and canyons (Ackerfield 2015). The majority of land on the eastern plains of Colorado is in private ownership, and consequently many regions are poorly surveyed for plants (**Figures 1 and 2**). The lack of well distributed survey and collection effort has resulted in potential knowledge gaps for plant taxa that may be rare and/or have conservation needs. This gap in status and locational information can lead to unintentional impacts. Additional botanical inventories across the plains are needed.

Temperate grasslands are considered to be one of the most threatened biomes worldwide (Samson et al. 2004). The primary threats to Colorado plains habitats include habitat loss, incompatible agricultural practices (i.e., sodbusting tillage), energy exploration and development, wind development, property subdivision, roads, and other forms of development. Desertification of soils from long-term continual grazing without adequate recovery periods can pose a threat. Fire regimes on the plains have been altered by direct and indirect fire suppression resulting in longer fire return intervals, and allowing invasion by woody plants. Soil health is critical, and encroachment of exotic plant species is a potential threat, as is herbicide application, particularly to populations occurring along highway right-of-ways. Climate change also presents rising concerns about drought, lower soil moisture, and reduced stream flows.

Although large areas of the Colorado plains have been developed, tilled, or otherwise altered, many areas of high biological significance and ecological integrity remain (**Figure 3**, Stevens et al. 2007, Rondeau et al. 2010, Doyle et al. 2005, Panjabi et al. 2003, Doyle et al. 2001). These high quality habitats are some of the best known not only for Colorado, but for the entire Central Shortgrass Prairie Ecoregion (Neely et al. 2006).

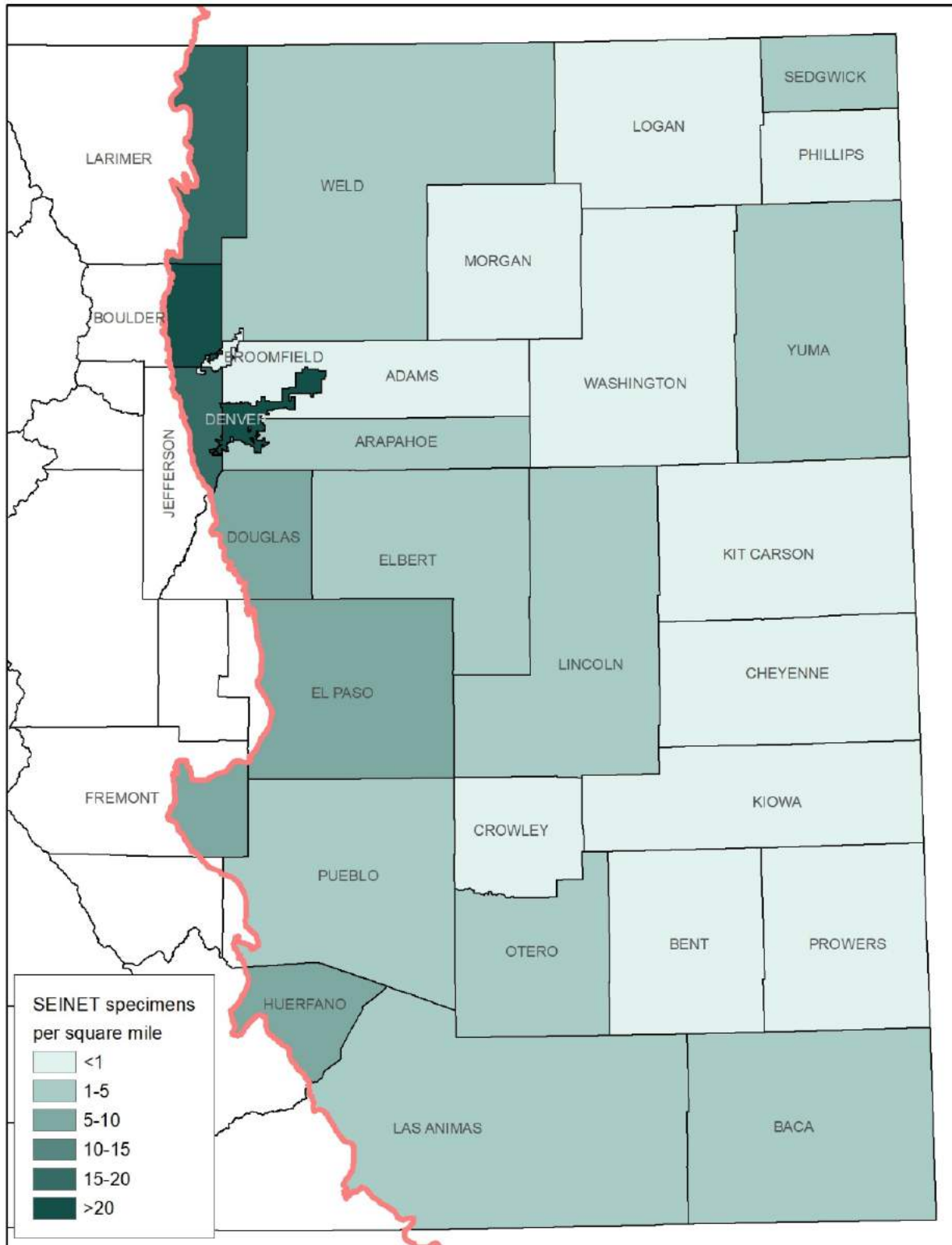
## **Objective**

Identify vascular plants known from the Colorado plains that may be of conservation concern. Evaluate the CNHP tracked vascular plant list for the Colorado plains to identify plants that may be missing from the list. Identify data gaps and inventory needs. Produce a list of plant species that are priorities for field inventory work on the Colorado plains. Produce maps that identify high priority areas and timing for field research, as well as areas known areas of botanical significance.

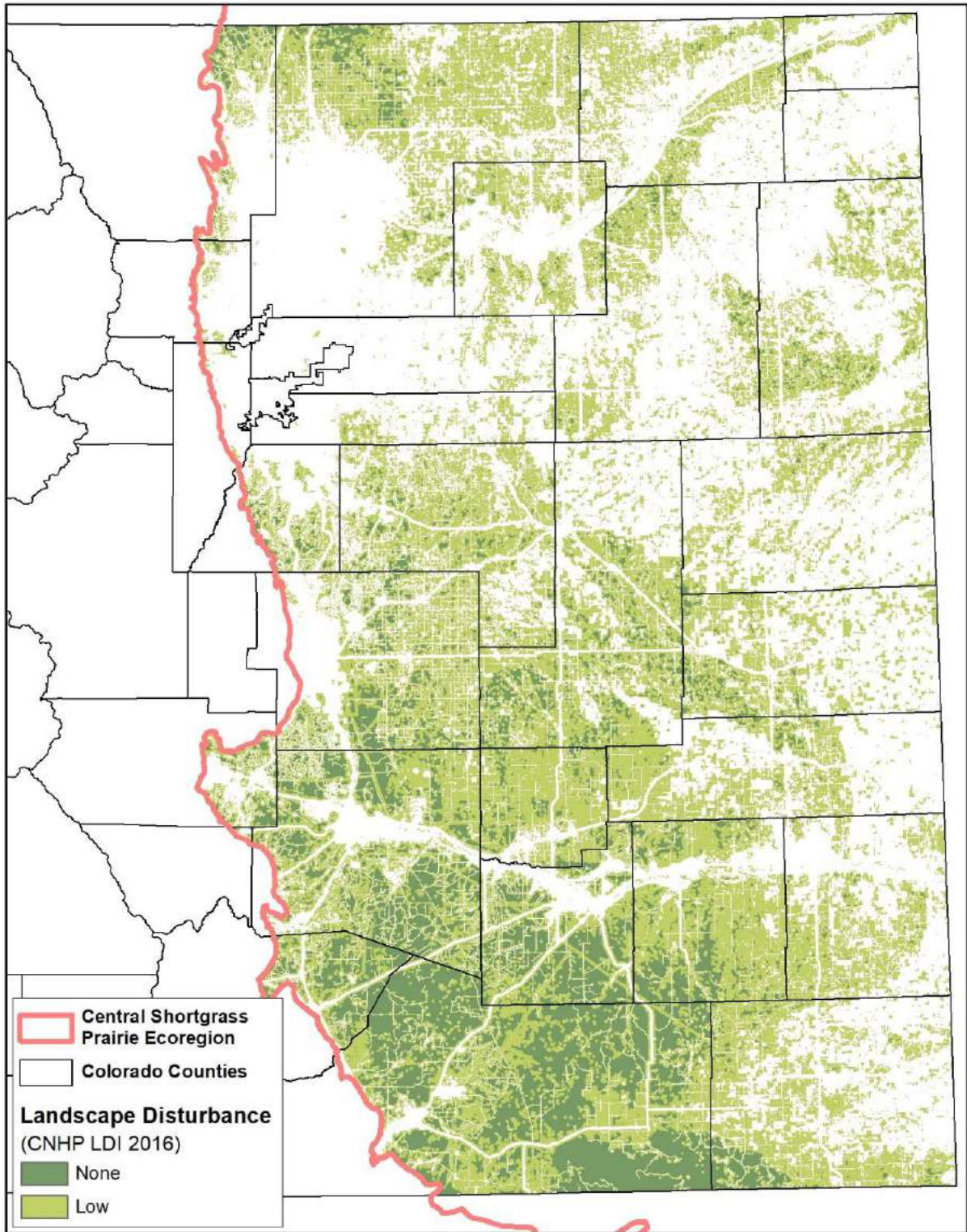


**Figure 1.** Relative collection effort as estimated from vascular plant specimen locations in SEINet database (from Denver Botanic Gardens 2014).





**Figure 2.** Map showing collection efforts in eastern Colorado based on SEINet data (2019).



**Figure 3.** Eastern Colorado areas of low landscape disturbance that are expected to support higher quality habitat (CNHP 2016).

## Methods and Results

In 2019, CNHP reviewed the published floras of Colorado (Ackerfield 2015, Weber and Wittmann 2012), and select field guides (e.g., Culver and Lemly 2013), and sought expert input to identify plants known from the plains of Colorado that were not tracked by CNHP, yet appeared to merit conservation attention (e.g., globally rare, or if globally common, known from 1-2 Colorado counties in five or fewer locations). Through this process we identified six plants to be fully tracked by CNHP (**Table 1**). *Grindelia hirsutula* var. *cautifolia* is a new variety that is endemic to Colorado. This taxon is will be ranked G5T1/S1. *Grindelia hirsutula* var. *revoluta* is also new and endemic to Colorado. This taxon will be ranked G5T2/S2. *Erigeron radicans* is ranked G3G4/S1. *Penstemon versicolor* is endemic to Colorado, and is ranked G3/S3. All available data for these taxa, mostly data posted on SEINet, were entered into BIOTICS, the CNHP conservation database (CNHP 2019). Now fully tracked by CNHP, these taxa are included in **Appendix 1**.

We identified 33 taxa that are not tracked by CNHP, but are known from less than five Colorado locations (**Table 2**). These taxa were assigned a S1 rank and a Watchlist (W) rather than a fully tracked status. All of these taxa are thought to be globally secure (G4-G5). However, the overall conservation significance of *these occurrences* is unclear because of how common they are range-wide. Further, these taxa are found in areas of the Colorado plains where thorough botanical studies have not been conducted, mainly because of a predominance of privately owned lands.

To improve our understanding of the newly watchlist taxa, we downloaded herbarium label data from SEINet (2019). We downloaded 304 records for the 33 selected taxa, and deleted 113 records because they were duplicated, or otherwise questionable. Using these data we summarized information about the habitat, elevation, and collection dates (phenology) of the newly watchlisted plants (**Table 2**). The primary habitats for the newly watchlisted taxa are sandy soils, wetlands, shortgrass prairie, and rock outcrops (**Figure 4**). Other important habitats were sand sage, riparian, and pinyon-juniper woodlands.

The newly watchlist taxa are found at elevations that range from 3600 to 7700 feet above sea level, and were collected from early May-early October, so a species-specific approach will need to be employed when identifying inventory areas based on those factors.

**Table 1.** Six plant taxa identified for CNHP tracking. These plants are also listed in **Appendix 1**. Summary species profiles for these taxa are being prepared by CNHP (in prep 2020).

Plant Family	Scientific name	Common name	Notes from the Flora of Colorado (Ackerfield 2015)	Colorado County Distribution	Global rank	State rank	Global distribution
Asteraceae	<i>Solidago capulensis</i>	Capulin goldenrod	Not listed. Newly described narrow endemic (Nesom and Lowrey 2011).	Las Animas	G1G3	S1	Known only from SE CO and NE NM (Nesom and Lowrey 2011).
Asteraceae	<i>Erigeron radicans</i>	Taproot Fleabane	Uncommon on plains	Weld	G3G4	S1	CAN: AB, SK USA: ID, MT, ND, WY (NatureServe 2019).
Fabaceae	<i>Dalea cylindriceps</i>	Andean prairie clover	Locally common in sandy soil of the Eastern plains	Larimer, Weld, Sedgwick, Washington, Arapahoe; El Paso, Lincoln, Cheyenne, Kiowa, Bent, Prowers, Baca	G3G4	S2S3	CO, KS, NE, NM, OK, SD, TX, W (NatureServe 2019).
Asteraceae	<i>Grindelia hirsutula</i> var. <i>acutifolia</i>	Raton Gumweed	New variety exclusive to the Flora of Colorado. Uncommon in dry, open places. Found near Trinidad in the Raton Mesa region.	Las Animas	G5T1	S1	Colorado endemic
Asteraceae	<i>Grindelia hirsutula</i> var. <i>revoluta</i>	Rolled Gumweed	New variety exclusive to the Flora of Colorado. Found in open, dry places.	El Paso, Huerfano, Pueblo	G5T2	S2	Colorado endemic
Plantaginaceae or Schrophulariaceae	<i>Penstemon versicolor</i>	Variable-color Beardstongue	Uncommon on limestone outcroppings and shale or gypsum hillsides.	El Paso, Pueblo, Fremont, Otero, Las Animas	G3	S3	Colorado endemic



**Table 2.** Vascular plant taxa that are not tracked by CNHP, but are thought to be rare in Colorado locations. These taxa were assigned a **Watchlist (W)** rather than a fully tracked status. All of these taxa are thought to be globally secure (G4-G5). However, the overall conservation significance of *these occurrences* is unclear because of how common they are range-wide. Plants listed in bold do not have locations represented on the maps in this report because the location-specific data was not available on SEINet (2019).

Family	Scientific name	Common name	Colorado County Distribution (Ackerfield 2015 and SEINet 2019)	Colorado Habitat summarized (SEINet 2019 and Ackerfield 2015)	Colorado Elevation range in feet above sea level from SEINet or other as noted	Colorado Phenology summarized	Global rank	State rank	G rank review recommended	Last G rank review date
Poaceae	<i>Alopecurus carolinianus</i>	Tufted Foxtail	Douglas, Phillips (from SEINet)	wetland	3800-6400	late June-early July	G5	S1	Yes	6/27/2016
Amaranthaceae	<i>Amaranthus wrightii</i>	Wright's Amaranth	El Paso, Otero (no Otero specimen on Seinet)	sand sage, disturbed	5400	late Aug-Sept	G5	S1	Yes	5/16/1989
Poaceae	<i>Aristida havardii</i>	Havard's Threeawn	Baca	disturbed, shortgrass prairie, sandy soils	4400-5000	mid July-mid Sept	G5	S1	Yes	2/24/1988
Asteraceae	<i>Chrysothamnus baileyi</i>	Bailey's Rabbitbrush	Baca	sand hills, sandy soils	3900	late August	G4G5	S1	Yes	8/2/2002
Poaceae	<i>Disakisperma dubia</i> (=Leptochloa dubia)	Green sprangletop	Las Animas, Denver	rock outcrops	4800	August-early Sept	G5	S1	Yes	5/17/1993
Cyperaceae	<i>Eleocharis wolfii</i>	Wolf's Spikerush	Logan, Weld	wetland	4200-5000	late August	G3G5	S1	No	5/9/2013
Poaceae	<i>Eragrostis curtispedicellata</i>	Gummy Lovegrass	Baca	shortgrass prairie, sandy soils	4200-4500	mid July-early August	G5	S1	Yes	2/24/1988

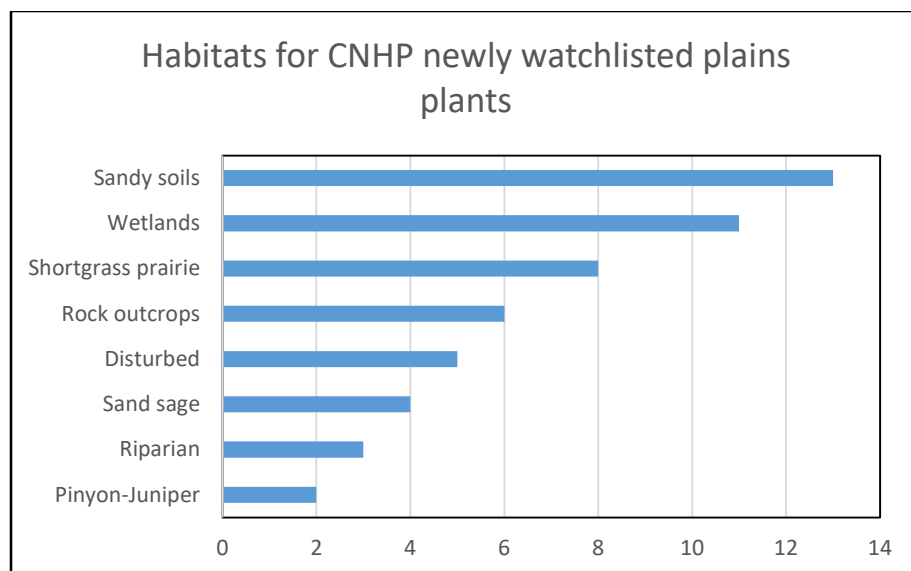
Family	Scientific name	Common name	Colorado County Distribution (Ackerfield 2015 and SEINet 2019)	Colorado Habitat summarized (SEINet 2019 and Ackerfield 2015)	Colorado Elevation range in feet above sea level from SEINet or other as noted	Colorado Phenology summarized	Global rank	State rank	G rank review recommended	Last G rank review date
Asteraceae	<i>Euthamia gymnospermoides</i>	Viscid Bushy Goldenrod; Texas Goldentop	Sedgwick. SEINet also has specimens from Yuma and Logan	wetland	3300-3700	mid August-mid Sept	G5	S1	No	12/4/1988
Cyperaceae	<i>Fimbristylis puberula</i> var. <i>interior</i>	Hairy Fimbry	Yuma, SEINet has Logan as well.	wetland	3000-3600	mid July-mid August	G5T5	S1	Yes	4/1/1996
Gentianaceae	<i>Gentianopsis procera</i>	Lesser Fringed Gentian	El Paso	wetland, riparian	6800-6900	mid August-mid Sept	G5	S1	Yes	4/5/1985
Asteraceae	<b><i>Heterotheca stenophylla</i></b>	Stiffleaf (False) Goldenaster	Yuma	shortgrass prairie, sandy soils	3500-3600 (Ackerfield 2015)	June-Sept	G4	S1	Yes	11/3/2003
Lamiaceae	<b><i>Lycopus uniflorus</i></b>	Northern Bugleweed	Boulder, Weld	wetland	4600-5400	mid July-mid Sept	G5	S1	No	5/13/2016
Fabaceae	<b><i>Mimosa nuttallii</i> (=Mimosa quadrivalis var. nuttallii)</b>	Nuttall's Sensitive-briar	Baca	sandy soil	3600-4000 (Ackerfield 2015)	May-August	G5T5	S1	No	6/8/1994
Fabaceae	<i>Mimosa rupertiana</i> (=Mimosa quadrivalis var. occidentalis; =Schrankia occidentalis)	Eastern Sensitive Plant	Baca	sand sage, sandy soils	3600-4400	late May-early August	G5T4T5	S1	Yes	6/8/1994

Family	Scientific name	Common name	Colorado County Distribution (Ackerfield 2015 and SEINet 2019)	Colorado Habitat summarized (SEINet 2019 and Ackerfield 2015)	Colorado Elevation range in feet above sea level from SEINet or other as noted	Colorado Phenology summarized	Global rank	State rank	G rank review recommended	Last G rank review date
Onagraceae	<i>Oenothera cinerea</i> (= <i>Gaura villosa</i> )	High-plains Beeblossom	Baca, Las Animas (Seinet only has Baca)	shortgrass prairie, sandy soil	4200-4500	June-July	G5	S1	Yes	1/16/1990
Onagraceae	<i>Oenothera glaucifolia</i> (= <i>Stenosiphon linifolius</i> )	False Gaura	Baca, Morgan	shortgrass prairie, sandy soil	5600	mid July-early Sept	G5	S1	Yes	7/11/1993
Onagraceae	<i>Oenothera rhombipetala</i>	Four-point Evening Primrose	Morgan, Sedgewick; Seinet shows Morgan and El Paso. Not listed in Kelso (2016).	sand sage, shortgrass prairie	4200-6200	mid June-early August	G4G5	S1	No	12/1/1984
Fabaceae	<i>Pediomelum linearifolium</i> (= <i>Psoralidium linearifolium</i> )	Narrowleaf Indian Breadroot	Yuma	rock outcrops, sandy soil.	3600-3800	mid June-mid July	G4?	S1	Yes	10/2/1994
Plantaginaceae or Schrophulariaceae	<i>Penstemon cobaea</i>	Cobaea Beardtongue	Baca, Las Animas, SEINet only shows Baca and Jefferson, which is a questionable record.	rock outcrops	not recorded	mid June-July	G4	S1	Yes	9/24/1987
Plantaginaceae	<i>Penstemon eriantherus</i>	Fuzzytongue penstemon	Larimer, Weld	disturbed, shortgrass prairie	6200-7200	late May-mid July	G4G5	S1	No	7/11/2016
Poaceae	<i>Phalaris caroliniana</i>	May Grass	Baca, Otero	riparian	4300-5000	June-mid July	G5?	S1	No	4/28/1988

Family	Scientific name	Common name	Colorado County Distribution (Ackerfield 2015 and SEINet 2019)	Colorado Habitat summarized (SEINet 2019 and Ackerfield 2015)	Colorado Elevation range in feet above sea level from SEINet or other as noted	Colorado Phenology summarized	Global rank	State rank	G rank review recommended	Last G rank review date
Verbenaceae	<i>Phyla lanceolata</i>	Fogfruit	Las Animas, Yuma. SEINet only has Yuma and also has Jefferson, Lincoln, and Weld	wetland	3600	late June-Sept.	G5	S1	No	1/16/1990
Asteraceae	<i>Prionopsis ciliata</i> ( <i>Grindelia papposa</i> )	Goldenweed	Baca	sand sage, sandy soils	3600-3900	August	G4G5	S1	Yes	7/9/1993
Rosaceae	<i>Prunus rivularis</i>	Creek Plum	Baca	riparian		early May	G4	S1	Yes	3/21/1996
Asteraceae	<i>Psilostrophe tagetina</i>	Woolly Paperflower	Lincoln (Las Animas appears to be a typo at RM)	disturbed, sandy soil	4900	late July-early August	G5	S1	Yes	6/29/1993
Brassicaceae	<i>Rorippa tenerrima</i>	Modoc Yellowcress	Jefferson, Weld	wetland	6400	late June-August	G5	S1	No	11/8/1990
Rosaceae	<i>Rubus neomexicanus</i>	New Mexico Blackberry	Baca, Las Animas, Seinet also has Mesa Co. records. Plants shows only Baca, and across from Mesa Co in Utah.	rock outcrops	4400-7000	mid May-early August	G5	S1	Yes	3/19/1990
Lamiaceae	<i>Scutellaria lateriflora</i>	Blue Skullcap	Lincoln, Yuma	wetland	3900-5400	August-early Sept	G5	S1	No	5/13/2016



Family	Scientific name	Common name	Colorado County Distribution (Ackerfield 2015 and SEINet 2019)	Colorado Habitat summarized (SEINet 2019 and Ackerfield 2015)	Colorado Elevation range in feet above sea level from SEINet or other as noted	Colorado Phenology summarized	Global rank	State rank	G rank review recommended	Last G rank review date
Iridaceae	<i>Sisyrinchium angustifolium</i>	Narrowleaf Blue-eyed Grass	Weld, Boulder	wetland	5400-5500		G5	S1	No	6/27/2016
Asteraceae	<i>Symphotrichum oblongifolium</i>	Aromatic Aster	Las Animas. Huerfano (SEINet historical)	Pinyon-juniper, rock outcrops	5800-7700	mid May-early October	G5	S1	No	5/8/1987
Campanulaceae	<i>Triodanis holzingeri</i>	Holzinger's Venus' Looking-glass	Baca, Boulder; only two mapable specimens on Seinet (1947 & 1928, resp.)	disturbed, sandy or rocky soils	4000-5200	mid July	G4	S1?	No	4/21/1994
Verbenaceae	<i>Verbena plicata</i>	Fanleaf Vervain	Baca, Las Animas	Pinyon-juniper, rock outcrops, grasslands, sandy soils	4200-6200	June-early Sept	G5	S1	Yes	3/15/1994
Araceae or Lemnaceae	<i>Wolffia borealis</i>	Dotted Watermeal	Yuma, Larimer (SEINet only has Yuma)	wetland	not recorded	June-early August	G5	S1	No	7/14/2015
Araceae or Lemnaceae	<i>Wolffia columbiana</i>	Columbian Watermeal	Arapahoe, Yuma. SEINet has Adams, Denver, Yuma.	wetland	3100-3300	August-early October	G5	S1	No	7/14/2015



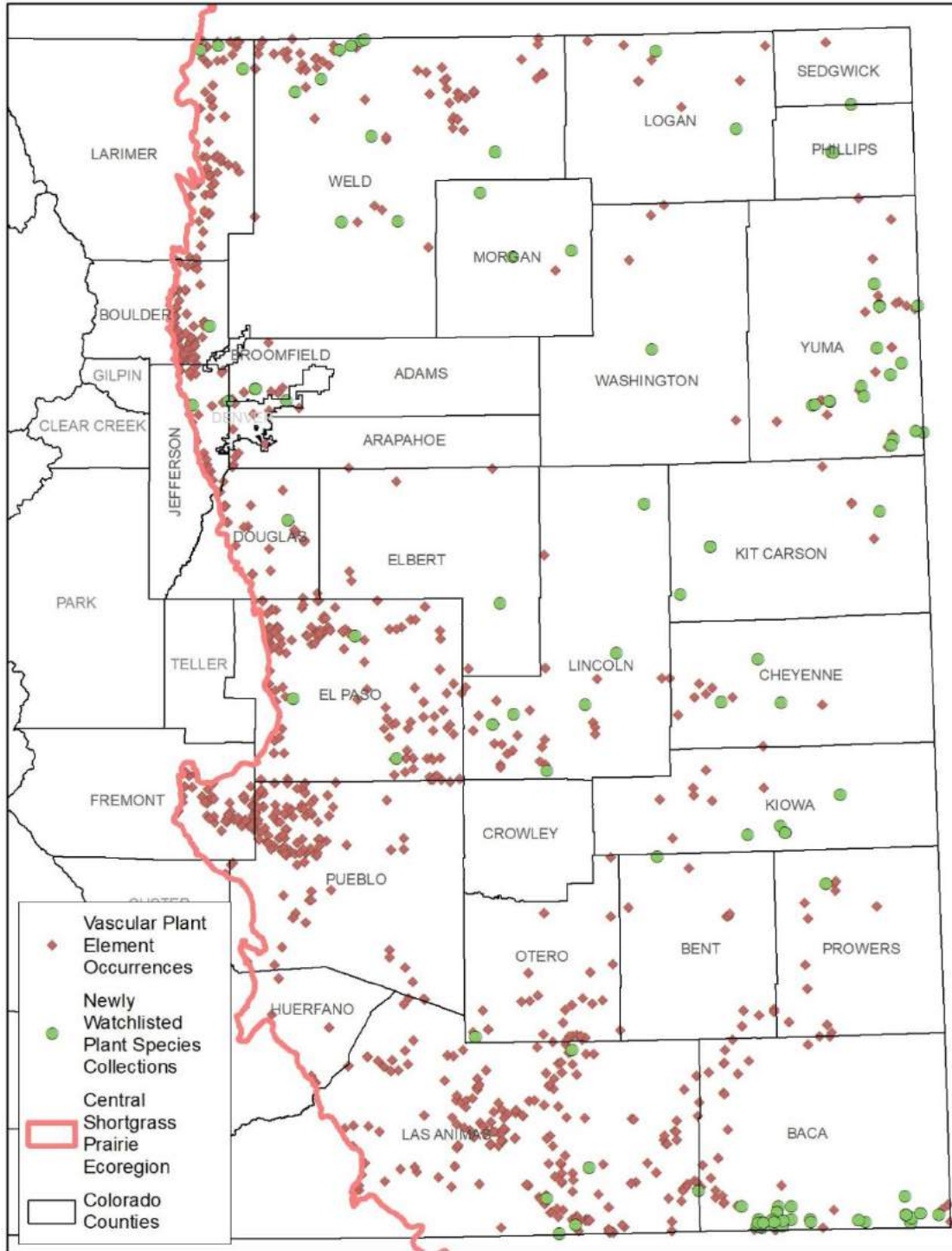
**Figure 4.** Primary habitats for the newly watchlisted plant taxa presented in **Table 2**.

### **Identifying specific priority areas for botanical inventory and known botanical significance on Colorado's eastern plains**

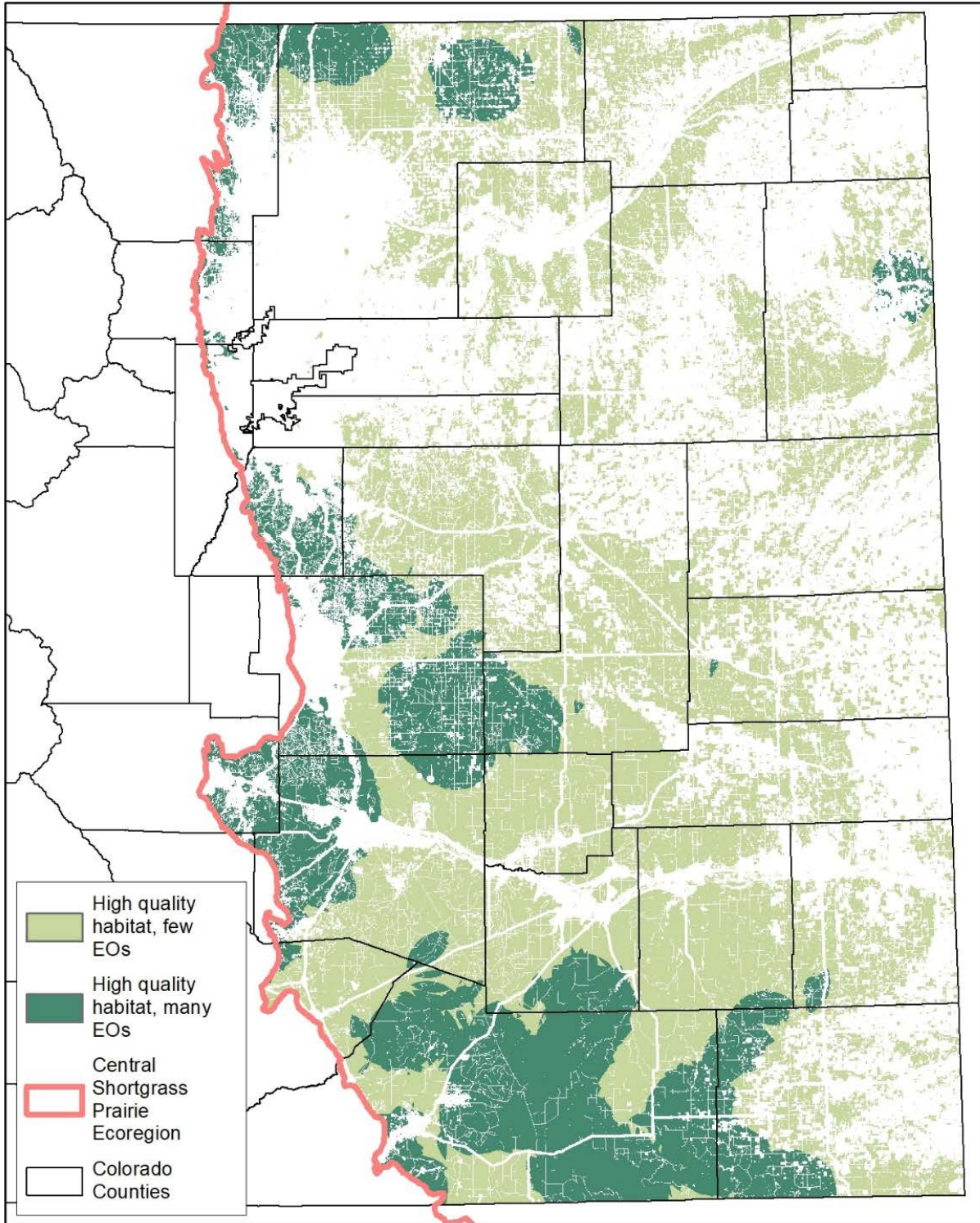
All available SEINet location data for the 33 newly watchlisted taxa (**Table 2**) were imported into a georeferenced point shapefile. We added SEINet location data for one additional species, *Oenothera canescens* (S2, Watchlisted) in an effort to include some consideration of playa habitat. Because SEINet data are not all reported using the same spatial projections, considerable QC, sorting and re-projecting was performed to assure map accuracy. These locations, in combination with CNHP element occurrence records are presented in **Figure 5**. The locations in in **Figure 5** in combination with the Landscape Disturbance Index (**Figure 3**, CNHP 2016) were used to identify two focus areas (**Figure 6**):

1. **Best focus for new inventory efforts in under-surveyed areas:** Areas with low collection density (fewer than 0.01 collection or EO points within a radius of 25 km), and high habitat quality (Landscape Disturbance Index values less than or equal to 250).
2. **Best focus for inventory in areas with known botanical significance:** Areas with higher collection density (more than 0.01 collection or EO points within a radius of 25 km), and high habitat quality (Landscape Disturbance Index values less than or equal to 250).

Areas of high quality habitat with *few* known occurrences of significant plants are areas thought to be priorities for new botanical surveys. Areas of high quality habitat with *many* known occurrences of significant plants, are areas thought to be priorities for inventory in areas with known botanical significance. Areas of low habitat quality are not included in the analysis, although many of these areas along the Front Range urban corridor are well-surveyed (**Figure 1**).



**Figure 5.** Vascular plant Element Occurrences, including the newly tracked taxa (EOs, CNHP 2019) and Watchlisted plant species locations (SEINet 2019) in eastern Colorado.



**Figure 6.** Focal areas for new inventory (high quality habitat, few EOs) and focal areas for inventory in areas with known botanical significance (high quality habitat, many EOs) on Colorado's eastern plains.



The following approach is recommended to identify more specific areas for **botanical surveys** on Colorado's eastern plains.

- Identify target species using species lists provided in this report.
- Identify target habitats and times to visit based on target species habitat associations and phenology.
- Using maps and aerial photography, identify suitable, high quality patches of plains habitat that are likely to support the target species (see also **Figure 3**).
- Identify specific Targeted Inventory Areas within the high quality plains patches.
- Consider the distribution of potential impacts such as oil and gas development, wind energy, roads, etc.
- Contact landowners as necessary.
- Conduct field surveys.
- Within Targeted Inventory Areas, search areas of potential habitat as well as any unusual features such as rock outcrops or wetlands.
- Collect voucher specimens if there are enough plants present and permission has been obtained; deposit specimens in an herbarium.
- Document significant species and habitat with photos.
- Use GPS and maps to record precise locations and known extent of target plant populations.
- Complete CNHP Element Occurrence Records.

### **Future Needs**

- Review global ranks: in a review of over 100 taxa for this project we identified 55 plains plant taxa that appear to be in need of a global rank review. These are taxa that are ranked G4-G5, but may warrant a rank change to G3. Taxa that are endemic to the North American Central Grasslands (Locklear 2017) or just a few states are of particular interest. Please note that any taxon identified as G1-G3 would then be tracked by CNHP.
- Update datasets: CNHP tracked plants are known from locations that have not yet been included in the CNHP BIOTICS database (CNHP 2019). Continuing efforts to Map all locations and integrate associated information into this dataset would allow us to improve and update the results presented in this report.
- Use the lists and maps provided in this report in preparing for and conducting field visits to the Colorado plains. Collect needed information on species of potential conservation concern, especially population size, condition, and location information. Taxa known from the fewest records, and fewest counties (narrowest state ranges) are top priorities for further species-specific research. Areas with high quality habitat are top priorities for site-specific work.
- Locate and monitor key populations of rare plants on the CO plains, and create management plans to help support long term viability.

- Create species profiles for all taxa that are not yet included in the Colorado Rare Plant Guide (Colorado Natural Heritage Program 1997+). Update species profiles for all taxa that are included in the Guide.
- Describe habitat at a global level for all taxa in **Table 2**.
- Consider whether the Colorado plains plants occurrences of interest are included, peripheral, or disjunct from their global ranges. If disjunct, how far? This information can be integrated in plains conservation planning efforts.

## Acknowledgements

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## References

- Ackerfield, J. 2015. Flora of Colorado. Brit Press, Botanical Research Institute of Texas, Fort Worth, TX. 818 pp.
- Bailey, R. 1998. Ecoregions map of North America: Explanatory note. USDA Forest Service, Misc. Publication no. 1548. 10 pp. + map scale 1:15,000,000.
- Colorado Natural Heritage Program [CNHP]. 1997+. Colorado Rare Plant Guide. [www.cnhp.colostate.edu](http://www.cnhp.colostate.edu). Latest update: August 30, 2019.
- Colorado Natural Heritage Program [CNHP]. 2016. Landscape Integrity Layer for Colorado. Edition 6. Raster digital dataset. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Colorado Natural Heritage Program [CNHP]. 2019. Biodiversity Tracking and Conservation System (BIOTICS), Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.
- Culver, D.R. and J.M. Lemly. 2013. Field Guide to Colorado's Wetland Plants; Identification, Ecology and Conservation. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. 694 pp.
- Denver Botanic Gardens [DBG]. 2014. High Potential Under-collected Areas of Colorado. Unpublished report prepared for internal and partner use.

- Doyle, G.A., J. Armstrong, J. Gionfriddo, D. Anderson, J. Stevens, and R.A. Schorr. 2001. Survey of Critical Biological Resources of El Paso County, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Fort Collins, CO.
- Doyle, G.A., S.L. Neid, and R.J. Rondeau. 2005. Survey of Critical Biological Resources of Larimer County, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Fort Collins, CO.
- Kelso, T. 2016. Flora of the Pikes Peak Region. Unpublished report prepared by the Curator of the Carter Herbarium at Colorado College, Colorado Springs, CO.
- Locklear, J. 2017. Endemic plants of the central grassland of North America: Distribution, ecology and conservation status. *Journal of the Botanical Research Institute of Texas* 11(1): 193-234.
- NatureServe. 2019. NatureServe Explorer, An Online Encyclopedia of Life. Available at <http://explorer.natureserve.org/>
- Neely, B., S. Kettler, J. Horsman, C. Pague, R. Rondeau, R. Smith, L. Grunau, P. Comer, G. Belew, F. Pusateri, B. Rosenlund, D. Runner, K. Sochi, J. Sovell, D. Anderson, T. Jackson and M. Klavetter. 2006. Central Shortgrass Prairie Ecoregional Assessment and Partnership Initiative. The Nature Conservancy of Colorado and the Shortgrass Prairie Partnership. 124 pp. and Appendices.
- Panjabi, S.S, J. Sovell, G. Doyle, D. Culver, and L. Grunau. 2003. Survey of Critical Biological Resources of Pueblo County, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Fort Collins, CO.
- Rondeau, R., J. Sovell, J. Stevens, D. Clark, and L. Grunau. 2010. Southeastern Colorado Survey of Critical Biological Resources. Unpublished report prepared by the Colorado Natural Heritage Program, Fort Collins, CO.
- Samson, F.B., F.L. Knopf, and W.R. Ostlie. 2004. Great Plains ecosystems: past, present, and future. *Wildlife Society Bulletin*. 32(1): 1-15.
- SEINet Portal Network. 2019. <http://swbiodiversity.org/seinet/index.php>.
- Stevens, J., J. Sovell, D. Culver, K. Decker, L. Grunau, A. Lavender, and C. Gaughan. 2007. Southeastern Colorado Survey of Critical Biological Resources. Colorado Natural Heritage Program, Fort Collins, CO.
- The Nature Conservancy [TNC]. 2009. Terrestrial Ecoregions of the World, digital vector data. The Nature Conservancy, Arlington, VA.
- USDA, NRCS. 2019. The PLANTS Database (<http://plants.usda.gov>). National Plant Data Team, Greensboro, NC 27401-4901 USA.
- Weber, W.A. and R.C. Wittmann. 2012. Colorado Flora, Eastern Slope, A Field Guide to the Vascular Plants, Fourth Edition. Boulder, CO. 555 pp.

**Appendix 1.** List of vascular plants tracked by the Colorado Natural Heritage Program (2019) known from the Central Shortgrass Prairie Ecoregion (TNC 2009). Plants in bold are included in the Colorado Rare Plant Guide (CNHP 1997+), though many of the plant profiles in the guide are out of date.

Scientific name	Common name	G Rank	S Rank	Endemic to Colorado	Last Observed in Colorado in the shortgrass prairie ecoregion (CNHP 2019)	Federal Status	State Status	Aquatic Dependent
<i>Abutilon incanum</i>	Hoary mallow	G5?	S1	N	8/6/1948			N
<i>Acorus calamus</i>	Sweet flag	G4?	S1	N	6/3/2014			Y
<b><i>Adiantum capillus-veneris</i></b>	Southern maiden-hair fern	G5	S2	N	9/7/2007			N
<i>Aletes nuttallii</i> ( <i>Lomatium nuttallii</i> )	Dog parsley	G3	S1	N	6/12/1999			N
<i>Aletes tenuifolius</i> ( <i>Musineon tenuifolium</i> )	Slender parsley	G4	S2	N	8/31/2012			N
<i>Allionia incarnata</i>	Trailing windmills	G5	S2	N	6/11/2010			N
<b><i>Ambrosia linearis</i></b>	Plains ragweed	G3	S3	Y	6/17/2014			Y
<i>Amorpha nana</i>	Dwarf wild indigo	G5	S2	N	9/5/2018			N
<i>Anagallis minima</i>	Chaffweed	G5	S1	N	7/17/2015			Y
<b><i>Apios americana</i></b>	American groundnut	G5	S1	N	8/28/2000			Y
<b><i>Aquilegia chrysantha</i> var. <i>rydbergii</i></b>	Golden Columbine	G4T1Q	S1	Y	7/1/2009		BLM/USFS	N
<b><i>Argyrosma fendleri</i></b>	Fendler cloak-fern	G3	S3	N	6/12/2010			N
<i>Argythamnia humilis</i>	Low silverbush	G5	S2	N	7/9/2008			N
<b><i>Aristida basiramea</i></b>	Forktip three-awn	G5	S2	N	8/30/2018			N
<b><i>Asclepias hallii</i></b>	Hall's milkweed	G3	S3	N	6/28/2011			N
<i>Asclepias involucrata</i>	Dwarf milkweed	G5	S1	N	7/5/2007			N
<i>Asclepias macrotis</i>	Long-hood milkweed	G4	S2	N	6/7/2015			N
<i>Asclepias oenotheroides</i>	Zizotes milkweed	G4G5	S1	N	6/18/2008			N
<b><i>Asclepias stenophylla</i></b>	Narrow-leaved milkweed	G4G5	S2	N	6/29/2007			N



Scientific name	Common name	G Rank	S Rank	Endemic to Colorado	Last Observed in Colorado in the shortgrass prairie ecoregion (CNHP 2019)	Federal Status	State Status	Aquatic Dependent
<i>Asclepias uncialis ssp. uncialis</i>	Dwarf milkweed	G3G4T2T3	S2	N	5/25/2017		BLM/SWAP Tier 2/USFS	N
<i>Asplenium adiantum-nigrum</i>	Black spleenwort	G5	S1	N	9/20/2012			N
<i>Asplenium platyneuron</i>	Ebony spleenwort	G5	S1	N	9/21/2008			N
<i>Asplenium resiliens</i>	Black-stemmed spleenwort	G5	S1	N	9/9/2007			N
<i>Asplenium trichomanes-ramosum (Asplenium viride)</i>	Green spleenwort	G5	S1	N	9/24/2011			N
<i>Astragalus plattensis</i>	Platte River milkvetch	G5	S1	N	6/4/1994			N
<i>Astrolepis integerrima</i>	Southwestern cloak fern	G5	S1	N	4/19/2008			N
<i>Bergia texana</i>	Texas bergia	G5	S2	N	8/26/2007			Y
<i>Besseyia wyomingensis</i>	Kittentail	G5	S1	N	7/26/2012			N
<i>Bolophyta alpina (Parthenium alpinum)</i>	Wyoming feverfew	G3	S2	N	4/25/2018			N
<i>Bolophyta tetraneuris (Parthenium tetraneuris)</i>	Barneby's fever-few	G3	S3	Y	6/17/2010			N
<i>Bothriochloa springfieldii</i>	Springfield bluestem	G5	S1	N	10/5/2011			N
<i>Botrychium campestre</i>	Prairie moonwort	G3G4	S1	N	5/2/2017		USFS	N
<i>Campanula aparinoides</i>	Marsh bellflower	G5	S1	N	9/18/2019			Y
<i>Carex crawei</i>	Crawe sedge	G5	S1	N	6/10/2011			Y
<i>Carex lasiocarpa</i>	Slender sedge	G5	S2	N	7/15/2011			Y
<i>Carex oreocharis</i>	Grassyslope sedge	G3	S2	N	6/18/1999			Y
<i>Carex saximontana</i>	Rocky Mountain sedge	G5	S1	N	7/20/2007			Y
<i>Carex torreyi</i>	Torrey sedge	G4G5	S1	N	6/18/1973			Y
<i>Cheilanthes standleyi (Notholaena standleyi)</i>	Standley's cloak fern	G4	S1	N	6/8/2014			N

Scientific name	Common name	G Rank	S Rank	Endemic to Colorado	Last Observed in Colorado in the shortgrass prairie ecoregion (CNHP 2019)	Federal Status	State Status	Aquatic Dependent
<i>Cheilanthes wootonii</i>	Wooton's lip fern	G5	S1	N	6/22/2009			N
<b><i>Chenopodium cycloides</i></b>	Sandhill goosefoot	G3G4	S2	N	7/24/2009		USFS	N
<b><i>Claytonia rubra</i></b>	Redstem spring beauty	G5	S1	N	5/9/2017			N
<i>Commelina dianthifolia</i>	Birdbill day-flower	G5	S1	N	9/7/2004			N
<i>Crataegus chrysoarpa</i>	Yellow hawthorn	G5	S1	N	9/16/2011			N
<b><i>Crocianthemum bicknellii</i></b>	Plains frostweed	G5	S2	N	9/12/2018			N
<b><i>Cypripedium calceolus</i> ssp. <i>parviflorum</i> (<i>Cypripedium parviflorum</i>)</b>	American yellow lady's-slipper	G5	S2	N	6/22/2003		USFS	N
<i>Dalea cylindriceps</i>	Andean prairie-clover	G3G4	S2S3	N	9/8/2018			N
<i>Elatine rubella</i>	Southwestern waterwort	G5	S2	N	7/24/1987			Y
<b><i>Epipactis gigantea</i></b>	Giant helleborine	G4	S1S2	N	6/24/2009		USFS	Y
<i>Erigeron radicans</i>	Taproot fleabane	G3G4	S1	N	5/25/2010			N
<i>Eriogonum pauciflorum</i>	Few flowered wild-buckwheat	G5	S2	N	6/9/2009			N
<i>Forsellesia planitierum</i> ( <i>Glossopetalon planitierum</i> )	Texas greasebush	G4	S2	N	9/2/2015			N
<b><i>Frasera coloradensis</i></b>	Colorado green gentian	G2G3	S2S3	Y	7/18/2018		SWAP Tier 2	N
<i>Grammica umbellata</i> ( <i>Cuscuta umbellata</i> )	Flatglobe dodder	G5	S2	N	9/1/2017			N
<i>Grindelia hirsutula</i> var. <i>cautifolia</i>	Hairy gumweed variety	G5T1	S1	Y				N
<i>Grindelia hirsutula</i> var. <i>revoluta</i>	Hairy gumweed variety	G5T2?	S2	Y				N
<i>Guilleminea densa</i>	Small matweed	G5	S1	N	6/1/1991			N
<i>Hedyotis nigricans</i>	Narrowleaf bluet	G5	S1	N	8/11/1981			N
<i>Helenium microcephalum</i>	Small-head sneezeweed	G5?	S1	N	9/16/1994			N

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<i>Heterosperma pinnatum</i>	Wingpetal	G5?	S1	N	9/17/1994			N
<b><i>Heuchera richardsonii</i></b>	Richardson's alum-root	G5	S1	N	7/17/2015			N
<b><i>Hypoxis hirsuta</i></b>	Yellow stargrass	G5	S1	N	6/15/2011			Y
<i>Juncus brachycephalus</i>	Small-headed rush	G5	S1	N	9/4/2018			Y
<i>Krigia biflora</i>	Two-flowered dwarf dandelion	G5	S2	N	7/18/2015			N
<i>Liatris lancifolia</i>	Lanceleaf blazing star	G4	S1	N	8/15/1992			Y
<i>Liatris ligulistylis</i>	Rocky Mountain blazing star	G5?	S2	N	9/4/2018			Y
<i>Liatris squarrosa</i> var. <i>glabrata</i>	Scaly blazing star	G5T5	S1	N	6/26/2004			N
<i>Lobelia cardinalis</i>	Cardinal flower	G5	S2	N	9/14/2017			N
<i>Lomatium foeniculaceum</i> ssp. <i>macdougalii</i>	Macdougal's biscuitroot	G5T4T5	S1	N	5/16/2013			N
<i>Mahonia haematocarpa</i>	Colorado mahonia	G5	SH	N	1902-99-99			N
<i>Naumburgia thyrsoflora</i>	Tufted loosestrife	G5	S1	N	5/30/2007			Y
<i>Navarretia saximontana</i>	Rocky Mountain pincuchion-plant	G4?	S2	N	7/2/1973			Y
<i>Nolina texana</i>	Texas beargrass	G5	S1	N	6/28/1994			N
<b><i>Nuttallia chrysantha</i> (<i>Mentzelia chrysantha</i>)</b>	Golden blazing star	G2	S2	Y	6/17/2010		BLM/SWAP Tier 2	N
<b><i>Nuttallia speciosa</i> (<i>Mentzelia speciosa</i>)</b>	Jeweled blazingstar	G3	S3	N	8/24/2018			N
<b><i>Oenothera coloradensis</i> (<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>)</b>	Colorado butterfly plant	G3T2	S1	N	8/8/2017		SWAP Tier 1	Y

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<i>Oenothera engelmannii</i>	Engelmann's evening-primrose	G4	S1	N	6/2/1989			N
<i>Oenothera grandis</i>	Showy evening primrose	G5?	S1	N	5/9/2000			N
<b><i>Oenothera harringtonii</i></b>	Arkansas Valley evening primrose	G3	S3	Y	6/1/2019			N
<b><i>Onoclea sensibilis</i></b>	Sensitive fern	G5	SH	N	7/17/1948			Y
<i>Oonopsis engelmannii</i>	Engelmann goldenweed	G3	S3	N	9/14/2018			N
<b><i>Oonopsis foliosa</i> var. <i>monocephala</i></b>	Rayless goldenweed	G3G4T2	S2	Y	6/3/2009		SWAP Tier 2	N
<b><i>Oonopsis puebloensis</i></b>	Pueblo goldenweed	G2	S2	Y	6/17/2009		SWAP Tier 2	N
<i>Oreocarya cana</i> ( <i>Cryptantha cana</i> )	Mountain cat's-eye	G5	S2	N	5/23/2011			N
<i>Orophaca hyalina</i> ( <i>Astragalus hyalinus</i> )	Summer Orophaca	G4	S2	N	7/12/2013			N
<i>Orophaca triphylla</i> ( <i>Astragalus gilviflorus</i> )	Plains milkvetch	G5	S2	N	5/27/2011			N
<b><i>Oxybaphus rotundifolius</i> (<i>Mirabilis rotundifolia</i>)</b>	Round-leaf four-o'clock	G2	S2	Y	6/22/2015		SWAP Tier 2	N
<i>Pellaea glabella</i> ssp. <i>simplex</i>	Smooth cliff-brake	G5T4?	S2	N	6/13/1985			N
<b><i>Pellaea wrightiana</i></b>	Wright's cliff-brake	G5	S2	N	6/24/2007			N
<i>Penstemon eriantherus</i>	Fuzzytongue penstemon	G4G5	S1	N	6/8/2012			N
<i>Penstemon grandiflorus</i>	Large-flower beardtongue	G5?	S1	N	6/5/1999			N
<i>Penstemon jamesii</i>	James' beard-tongue	G4	S1	N	6/9/2009			N
<i>Penstemon versicolor</i>	Variable-color beardtongue	G3?	S3	Y	5/21/2010			N
<b><i>Phacelia denticulata</i></b>	Rocky Mountain phacelia	G3	S2	N	6/20/2018			N
<i>Physaria arenosa</i>	Great Plains bladderpod	G5	S1	N	5/13/2010			N

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<i>Physaria bellii</i>	Bell's twinpod	G2G3	S2S3	Y	9/10/2018		SWAP Tier 2	N
<i>Physaria brassicoides</i>	Rydberg's double twinpod	G5	S1	N	5/23/2007			N
<i>Physaria calcicola</i>	Rocky Mountain bladderpod	G3	S3	N	6/6/2014			N
<i>Physaria vitulifera</i>	Fiddleleaf twinpod	G3	S3	Y	8/26/2010			N
<i>Physaria x 1</i>	Twinpod hybrid	GNA	S1	Y	5/9/2017			N
<i>Polypodium saximontanum</i>	Rocky Mountain polypody	G3?	S3	N	6/6/2006			N
<i>Portulaca parvula (Portulaca halimoides)</i>	Dwarf purslane	G5	S1	N	8/17/2011			N
<i>Potamogeton diversifolius</i>	Waterthread pondweed	G5	S1	N	9/20/1990			Y
<i>Potentilla ambigens</i>	Southern Rocky Mountain cinquefoil	G3	S2	N	9/12/2018			N
<i>Prosopis glandulosa</i>	Honey mesquite	G5?	S1	N	8/30/2002			N
<i>Prunus angustifolia</i>	Chickasaw plum	G5	S1	N	7/23/2008			N
<i>Prunus gracilis</i>	Oklahoma plum	G4G5	S1	N	5/18/1981			N
<i>Reverchonia arenaria</i>	Sand reverchonia	G4G5	S1	N	9/2/1998			N
<i>Ribes americanum</i>	American currant	G5	S2	N	6/5/2018			Y
<i>Rotala ramosior</i>	Toothcup	G5	S1	N	7/6/2016			N
<i>Sagittaria graminea</i>	Grassy arrowhead	G5	S1	N	9/17/1994			N
<i>Salix nigra</i>	Black willow	G5	S1	N	6/7/2002			Y
<i>Sapindus drummondii</i>	Soapberry	G5T5	S1	N	6/7/2014			N
<i>Sarcostemma crispum</i>	Twinevine	G4G5	S1	N	6/23/2009			N
<i>Schoenoplectus saximontanus</i>	Rocky Mountain bulrush	G5	S1	N	7/3/2014			Y
<i>Silphium integrifolium var. laeve</i>	Wholeleaf rosinweed	G5T4?	SH	N	1924-99-99			N
<i>Silphium laciniatum</i>	Compass-plant	G5	SH	N	8/23/1924			N

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<i>Sisyrinchium pallidum</i>	Pale blue-eyed grass	G3	S3	N	6/15/2009		BLM	Y
<i>Solidago capulinensis</i>	Capulin goldenrod	G2	S1	N	8/5/1994			N
<i>Sparganium eurycarpum</i>	Broadfruit bur-reed	G5	S2	N	9/14/2017			Y
<i>Spiranthes diluvialis</i>	Ute ladies' tresses	G2G3	S2	N	8/12/2015	LT	SWAP Tier 1	Y
<i>Stillingia sylvatica</i>	Queen's delight	G5	S1	N	5/18/1981			N
<i>Thamnosma texana</i>	Dutchman's breeches	G5	SH	N	1877			N
<i>Townsendia fendleri</i>	Fendler's townsend-daisy	G3	S2	N	8/13/2009		SWAP Tier 2	N
<i>Trifolium dasyphyllum</i> ssp. <i>anemophilum</i>	Whip-root clover	G5T2?	S1	N	6/4/1999		SWAP Tier 2	N
<i>Triodanis leptocarpa</i>	Slim-pod Venus' looking-glass	G5?	S1	N	7/3/2014			N
<i>Truellum sagittatum</i> ( <i>Persicaria sagittata</i> )	Arrow-leaved tearthumb	G5	S2	N	7/7/1990			Y
<i>Unamia alba</i> ( <i>Oligoneuron album</i> )	Prairie goldenrod	G5	S1	N	7/18/2015			N
<i>Vernonia baldwinii</i>	Baldwin's ironweed	G5	S2	N	9/10/2013			N
<i>Vernonia fasciculata</i>	Fascicled Ironweed	G5	SH	N	8/5/1963			N
<i>Vernonia marginata</i>	Plains ironweed	G5?	S1	N	9/4/2018			N
<i>Viola pedatifida</i>	Prairie violet	G5	S2	N	5/23/2018			N
<i>Viola selkirkii</i>	Selkirk violet	G5	S2	N	9/24/2019		USFS	N
<i>Virgulus novae-angliae</i> ( <i>Symphyotrichum novae-angliae</i> )	New England aster	G5	S2	N	9/4/2018			Y
<i>Woodsia neomexicana</i>	New Mexico cliff fern	G4?	S2	N	9/24/2011			N
<i>Zosterella dubia</i> ( <i>Heteranthera dubia</i> )	Grassleaf mud-plantain	G5	S1	N	8/12/1981			N