Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

By Colorado Natural Heritage Program

For

The Colorado Rare Plant Conservation Initiative

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This document was prepared by Lee Grunau, Jill Handwerk, and Susan Spackman-Panjabi of the Colorado Natural Heritage Program. Much of the information contained herein was based on, or taken from, the Rare Plant Conservation Initiative's *Colorado Rare Plant Conservation Strategy* (Neely et al. 2008). Thanks and gratitude go out to the authors, contributors, and reviewers of that document.

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Cover photos: Background – shortgrass prairie (Renée Rondeau); foreground – *Asclepias uncialis* (Steve Olson).

EXECUTIVE SUMMARY

The purpose of this proposed Addendum to Colorado's State Wildlife Action Plan (SWAP) (CDOW 2006) is to set a statewide strategic direction for the conservation of Colorado's most imperiled plant species and their habitats, and to establish a coordinated statewide approach for partners working on rare plant conservation. The Colorado Rare Plant Conservation Initiative (RPCI) compiled the information in this document, and developed much of the conservation strategy reflected in the contents herein, to set a conservation direction for Colorado's imperiled plants and their habitats. This Addendum, and the Colorado Rare Plant Conservation Strategy upon which it is based (Neely et al. 2008), represent a collective vision for plant conservation in Colorado, emphasizing a proactive approach to ensure the long-term stewardship and viability of Colorado's rarest plants. If implemented, this plan will enable concerned partners to systematically and meaningfully advance urgently needed plant conservation in Colorado, thus avoiding the need for federal listings.

Using the RPCI Strategy as a starting point, botanists and planners from CNHP, CNAP, and TNC developed the draft components of this Addendum. Draft components were circulated among all RPCI members for review and revision. The development of this Addendum was guided by the eight required elements set forth in the U.S. Fish and Wildlife Service's guidance on State Wildlife Action Plans.

Plants of Greatest Conservation Need

Plants of Greatest Conservation Need (PGCN) are defined as the 121 critically imperiled and imperiled plant species in Colorado. These are globally rare species with NatureServe Conservation Status ranks of G1 (critically imperiled) and G2 (imperiled). These species are considered to be at risk throughout their range and vulnerable to extinction. Rare plant experts within RPCI prioritized this list into Tier 1 species and Tier 2 species (Table 1, Figure 1):

Tier 1 Plants of Greatest Conservation Need – all G1 species, all federally listed species;
Tier 2 Plants of Greatest Conservation Need – all G2 species not federally listed.

Key Habitats

Colorado's imperiled plants occur within eight major habitat types: ***alpine***, ***barrens***, ***cliffs and canyons***, ***grasslands***, ***forests***, ***pinyon-juniper woodlands***, ***shrublands***, and ***wetlands*** (CNHP 2011; CNHP and TNC 2011; Colorado Native Plant Society 1997). Colorado's barrens and

shrublands are especially rich habitats for imperiled plant species, followed by pinyon-juniper woodlands, cliffs and canyons, and alpine habitats (CNHP and TNC 2011). Barrens occupy less than 1% of Colorado, but nearly 25 of our rarest plants are primarily associated with barrens (23% of imperiled species). Shrublands are Colorado's second most important habitat for rare plants (supporting 21% of the imperiled species), occupying 19% of the state's acreage. Pinyon-juniper woodlands cover nearly 10% of Colorado, providing habitat for at least 16% of the rare plant species (Figures 2 and 3). Mapping of habitat types is from SWReGAP (Prior-Magee et al. 2007).

Conservation Issues

Colorado's irreplaceable native plants, plant communities, and ecosystems are thus increasingly being threatened. Most of Colorado's imperiled plants are naturally rare. They are rare because they are restricted to very specific, narrowly distributed habitats, rather than as a result of human actions, per se. However, because these species occupy such small areas, planning is necessary to avoid placing these species at further risk from human activities. Degradation, fragmentation, and loss of habitat are major reasons plant species and their habitats are imperiled or vulnerable in Colorado. The primary contributors to habitat degradation for imperiled plants are ***energy development***, ***motorized recreation***, ***residential development***, and ***road construction and maintenance*** (CNHP and TNC 2011). Other risk factors include altered hydrologic regime, invasive species, agricultural development, loss of pollinators, incompatible grazing/trampling, and plant collecting (CNHP and TNC 2011). Additionally, there is strong scientific consensus that human-induced climate change is affecting species and ecological systems, and this is likely to exacerbate the effects of other human activities on plants (Enquist and Gori 2008).

One of the biggest issues is a ***lack of awareness*** and information regarding the presence, distribution, and precarious status of Colorado's native and imperiled plant species. Many rare plants inhabit small areas, have specialized needs, and have unique habitat requirements that are often missed by other approaches to conservation (e.g., those focused primarily on wildlife).

Conservation Objectives

The following statewide conservation objectives, adapted from the RPCI Rare Plant Conservation Strategy, are necessary to meet the conservation needs of Colorado's PGCN. These objectives represent the most urgent and critical actions needed to effectively conserve Colorado's imperiled plant species. These objectives will guide conservation activities and catalyze collaborative conservation action over the next decade.

The following Objectives and Conservation Actions are statewide in scope, and are applicable to all PGCN. Table 3 presents specific, prioritized conservation actions on a species-by-species basis.

The six statewide conservation objectives are:

1. ***Secure on-the-ground, site-specific habitat protection and/or management*** to achieve specific goals for all of Colorado's imperiled plants on public and private lands. Focus these activities in places that are likely to remain stable under predicted climate change scenarios, and on areas needed to maintain habitat connectivity (e.g., to facilitate climate-related distributional shifts).

2. ***Minimize threats*** from specific land uses that impact many of Colorado's imperiled plants statewide, and ***develop climate change adaptation strategies*** for vulnerable species.

3. ***Improve scientific understanding*** of the distribution, natural history, response to climate change, and status of Colorado's most imperiled plants through inventory, research, and monitoring.

4. ***Develop and implement a state program and policies*** to enhance the conservation of Colorado's most imperiled plants in cooperation with public land managers, private landowners, and other interested stakeholders.

5. ***Facilitate the stewardship*** of Colorado's most imperiled plants through education, outreach, and coordination.

6. ***Adopt measures for the ex situ (off site) conservation*** of Colorado's most imperiled plants in case native populations are extirpated due to stochastic events, anthropogenic impacts, and/or climate change.

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INTRODUCTION

The purpose of this proposed Addendum to Colorado's State Wildlife Action Plan (CDOW 2006) is to set a statewide strategic direction for the conservation of Colorado's most imperiled plant species and their habitats, and to establish a coordinated statewide approach for partners working on rare plant conservation. The Colorado Rare Plant Conservation Initiative (RPCI) compiled the information in this document, and developed much of the conservation strategy reflected in the contents herein, to set a conservation direction for Colorado's imperiled plants and their habitats. This Addendum, and the Colorado Rare Plant Conservation Strategy upon which it is based, represent a collective vision for plant conservation in Colorado, emphasizing a proactive approach to ensure the long-term stewardship and viability of Colorado's rarest plants. If implemented, this plan will enable concerned partners to systematically and meaningfully advance urgently needed plant conservation in Colorado, thus avoiding the need for federal listings.

The Rare Plant Conservation Initiative

The Rare Plant Conservation Initiative is a diverse partnership of state and federal agencies, private organizations, academic institutions, and individuals concerned with the stewardship and survival of imperiled plants in Colorado (see frontispiece for list of RPCI members). The RPCI grew out of the Colorado Rare Plant Technical Committee (RPTC), a statewide group of botanists, ecologists, and planners that have been meeting regularly since 1992 to exchange information, assess plant species conservation status, and identify and prioritize management and stewardship actions for plants. In 2007, the group determined that there was a growing need to improve coordination and take proactive steps to address rapidly increasing impacts to rare plants in Colorado. This Initiative has built on previous RPTC and partnership efforts, including the Colorado Rare Plant Field Guide (Spackman et al. 1997), Rare Plants of Colorado (Colorado Native Plant Society 1997), on-the-ground conservation of imperiled plants in the Adobe Hills and Arkansas Valley, Annual Colorado Rare Plant Symposia, Colorado Natural Areas Program (CNAP) special designations, U.S. Forest Service species assessments, and the Denver Botanic Gardens (DBG) monitoring projects. The RPCI is committed to achieving results through a collaborative approach that is based on the best available science, close coordination, data sharing, and taking strategic action.

RPCI and the Development of this Addendum

In 2009, the RPCI published their Colorado Rare Plant Conservation Strategy (Strategy). This was a collaborative effort among many partners, and represents the collective knowledge, expertise, and priorities of all major agencies, non-profits, and educational institutions involved in conservation of Colorado's rarest plants. The Strategy was thoroughly vetted by Colorado's rare plant conservation community, and presents a summary of status, threats, and conservation goals and objectives for 121 of Colorado's rarest plant species.

Chief among the conservation objectives that RPCI has identified for rare plants is the need for focused state-level conservation. They identified the incorporation of rare plants into Colorado's SWAP as one significant step to take in that direction. To that end, RPCI has prepared this Addendum to Colorado's SWAP, in collaboration with the Colorado Division of Wildlife, and with assistance from the Colorado Natural Heritage Program (CNHP), Colorado Natural Areas Program (CNAP), and The Nature Conservancy (TNC). This Addendum is closely based on the RPCI Strategy, and much of the information herein was taken directly from that document. The Addendum goes further, in that it:

1) makes direct links between specific plant species and species-level threats and conservation actions;
2) sets priorities for specific conservation actions on a species-by-species basis;
3) includes species-specific assessments of vulnerability to climate change; and
4) makes rare plant information, and the opportunity to review and comment on priority conservation actions, available to new audiences.

The Addendum Development Process

Using the RPCI Strategy as a starting point, botanists and planners from CNHP, CNAP, and TNC developed the draft components of this Addendum. Draft components were circulated among all RPCI members for review and revision. The development of this Addendum was guided by the eight required elements set forth in the U.S. Fish and Wildlife Service's guidance on State Wildlife Action Plans. Details of the process for addressing each required element are described in the following sections.

Element 1: Information on the distribution and abundance of species

The RPCI Strategy identified the 121 plant species of greatest conservation need in Colorado (PGCN) (Table 1). These are globally rare species with NatureServe Conservation Status ranks of G1 (critically imperiled) and G2 (imperiled). These species are considered to be at risk throughout their range and vulnerable to extinction. Rare plant experts within RPCI prioritized this list into Tier 1 species and Tier 2 species:

Tier 1 Plants of Greatest Conservation Need – all G1 species, all federally listed species;
Tier 2 Plants of Greatest Conservation Need – all G2 species not federally listed.

Information on distribution, population status, and trends for all PGCN was compiled from a variety of sources. Data sources included:

1) the Colorado Natural Heritage Program's conservation databases (Element Occurrence records, Element Tracking records, Element Rank forms, and characterization abstracts);
2) Colorado's Biodiversity Scorecard (CNHP and TNC 2011);
3) U.S. Forest Service species assessments (http://www.fs.fed.us/r2/projects/scp/assessments/index.shtml);
4) the Colorado Rare Plant Field Guide (http://www.cnhp.colostate.edu/);
5) published and unpublished literature, and herbarium collections;
6) expert opinion of Colorado's scientific community, via the RPCI and the NS network of Heritage Programs.

These data were compiled in an Access database to support data organization and reporting for this Addendum in the same format as the wildlife SWAP, as well as to allow for ease in future updating as new information becomes available. Distribution information is based primarily on CNHP's element occurrence database. Population status information is based on Colorado's Biodiversity Scorecard, and trend information is based on CNHP's Element Rank database. Where appropriate, these data were augmented or amended by expert review. Results are presented in Part 1 and Table 6 of this document.

Element 2: Locations and relative condition of key habitats

Colorado's SWAP addressed key habitats from a wildlife perspective. RPCI botanists reviewed this component of the SWAP for any additions necessary to complete the picture from a rare plant perspective. Two additional key habitat types were identified (barrens, cliffs and canyons), and the habitat distribution map was adjusted to display all key rare plant habitats. The Access database was updated to reflect the plant species that occur in each habitat type, as well as the threats and conservation actions for the two additional habitats. These data were augmented,

amended, and confirmed by expert review. Results are presented in Part 2 and Table 7 of this document.

Element 3: Issues that may adversely affect PGCN or their habitats, and priority research and survey efforts needed

The RPCI Strategy identified five significant issues that adversely affect many of the PGCN across Colorado: ***energy development***, ***motorized recreation***, ***residential development***, ***road construction and maintenance***, and ***climate change***. In developing this Addendum, RPCI botanists consulted the data sources listed above to expand this list, and to provide more detail on a species-by-species basis. Plants that warrant significant research and survey efforts were also identified during this process. This information was captured in the same Access database used to compile distribution/abundance and habitat information for each PGCN (Table 6). In order to capture similar concepts in as consistent a way as possible, we used a "Threats Taxonomy" to categorize threats in the Access database (Appendix A). The Threats Taxonomy was based on a taxonomy originally developed by The Nature Conservancy, and adapted for use in the SWAP and this Addendum.

Because climate change is potentially a very significant issue for rare plants, we conducted a focused analysis on this topic using NatureServe's Climate Change Vulnerability Index. The Index is an Excel-based tool that uses a scoring system to integrate species' predicted exposure to climate change and three sets of factors associated with climate change sensitivity: 1) indirect exposure to climate change, 2) species-specific factors (including dispersal ability, temperature and precipitation sensitivity, physical habitat specificity, interspecific interactions, and genetic factors), and 3) documented response to climate change.

Content of the Access database and results of the CCVI analysis were submitted to RPCI botanists for expert review. Results are presented in Part 3 and Tables 3-5 of this document. Details of CCVI methods are in Appendix B.

Element 4: Conservation actions necessary to conserve the PGCN and their habitats, and priorities for implementing

The RPCI Strategy identified six broad conservation objectives that are needed to conserve Colorado's PGCN, including land conservation and management, threat abatement, research, policy, education, and *ex situ* conservation. In developing this Addendum, RPCI used these broad objectives, as well as the data sources listed above, to identify specific conservation actions that are needed on a species-by-species basis, and to relate these actions directly to each species' most pressing threats. This information was captured in the same Access database used to

compile distribution/ abundance, habitat, and conservation issues information for each PGCN. In order to capture similar concepts in as consistent a way as possible, we used a "Conservation Actions Taxonomy" to categorize actions in the Access database (Appendix A). The Conservation Actions Taxonomy was based on a taxonomy originally developed by The Nature Conservancy, and adapted for use in the SWAP and this Addendum. Content of the database was submitted to RPCI botanists for expert review. Results are presented in Part 4 and Tables 6 and 7 of this document.

Element 5: Strategies for monitoring PGCN, their habitats, and the effectiveness of conservation actions

The monitoring strategies and objectives presented in this Addendum were taken from the RPCI Strategy. They have been widely vetted by Colorado's botanical community, and represent a consensus on the steps needed to determine the status of Colorado's PGCN and identify early warning signs of declining trends. They are presented in Part 5 of this document.

Element 6: Procedures to review the Comprehensive Wildlife Conservation Strategy (referred to hereafter as "SWAP")

This element is tiered to the CWCS published in 2006. The next revision of that document is scheduled to begin in 2011. During that revision, we hope to update the content of this Addendum as necessary, and have it incorporated into Colorado's newly updated SWAP. The review process established in the SWAP is presented in Part 6 of this document.

Element 7: Coordination with federal, state, and local agencies and Native American Tribes

The Rare Plant Conservation Initiative was the primary means of coordination with federal, state, and local agencies on the development and content of this Addendum.

Element 8: Public participation

Agencies, technical experts, and non-governmental organizations have been engaged throughout the RPCI's efforts to develop their Conservation Strategy and this SWAP Addendum, as summarized in the Introduction section of this document. The RPCI partners are working with the Colorado Division of Wildlife to achieve consensus on including rare plants in the next iteration of the State's SWAP. If successful, all interested parties within Colorado will be invited and encouraged to comment on the information presented in this Addendum during the

upcoming statewide SWAP revision. This portion of the document will be updated accordingly at that time.

Part 1: PLANTS OF GREATEST CONSERVATION NEED

In a comprehensive evaluation of the Colorado flora completed over a decade ago (Weber and Wittmann 1992), a total of 3,088 vascular plant species were documented to occur in Colorado; 2,596 of these were native, and 492 non-native but variously naturalized. Some 125 of the native species are endemic to Colorado. The plant families with the greatest number of rare plants in Colorado are the legume, sunflower, mustard, and figwort families. The Colorado Natural Heritage Program (CNHP) at Colorado State University currently tracks approximately 520 rare plant species in Colorado; of these, 121 species are ranked critically imperiled (G1) or imperiled (G2) on a global level. Sixty-eight of these are endemic to Colorado, occurring only here and nowhere else in the world. Another 140 species are vulnerable to extinction (ranked G3) (CNHP 2011). Eighty-two plant species are on the BLM Sensitive Species List, and approximately 70 on the U.S. Forest Service Sensitive Species List. Currently, 13 Colorado native plant species are federally listed by the U.S. Fish and Wildlife Service as Threatened or Endangered; another five species are candidates for listing.

Plants of Greatest Conservation Need (PGCN) are defined as the 121 critically imperiled and imperiled plant species in Colorado. These are globally rare species with NatureServe Conservation Status ranks of G1 (critically imperiled) and G2 (imperiled). These species are considered to be at risk throughout their range and vulnerable to extinction. Rare plant experts within RPCI prioritized this list into Tier 1 species and Tier 2 species (Table 1, Figure 1):

Tier 1 Plants of Greatest Conservation Need – all G1 species, all federally listed species;
Tier 2 Plants of Greatest Conservation Need – all G2 species not federally listed.

Table 1 lists all PGCN, along with each species' priority tier, NatureServe global and state status ranks, federal agency status, and the extent of its range relative to Colorado's state boundary. Species are listed alphabetically by the scientific name used in Colorado (Weber and Wittmann 2001). NatureServe status ranks are: 1 = Critically Imperiled; 2 = Imperiled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Demonstrably Secure; T = subspecies; Q = taxonomic question; SNR = not ranked; SNA = Not Applicable (not in Colorado); U = Unknown. Agency status indicates federal listing under the U.S. Endangered Species Act (LE = Listed Endangered; LT = Listed Threatened; C = Candidate for listing), and/or inclusion on the Sensitive Species lists of the Bureau of Land Management (BLM) Colorado Office or US Forest Service (USFS) Region 2. The percent of a species' range in Colorado is calculated as: Endemic = 100% of range within Colorado; Very High = 75-99% of range within Colorado; High = 50-75% of range within Colorado; Medium = 25-50% of range within Colorado; Low = < 25% of range within Colorado (source: Colorado Natural Heritage Program).

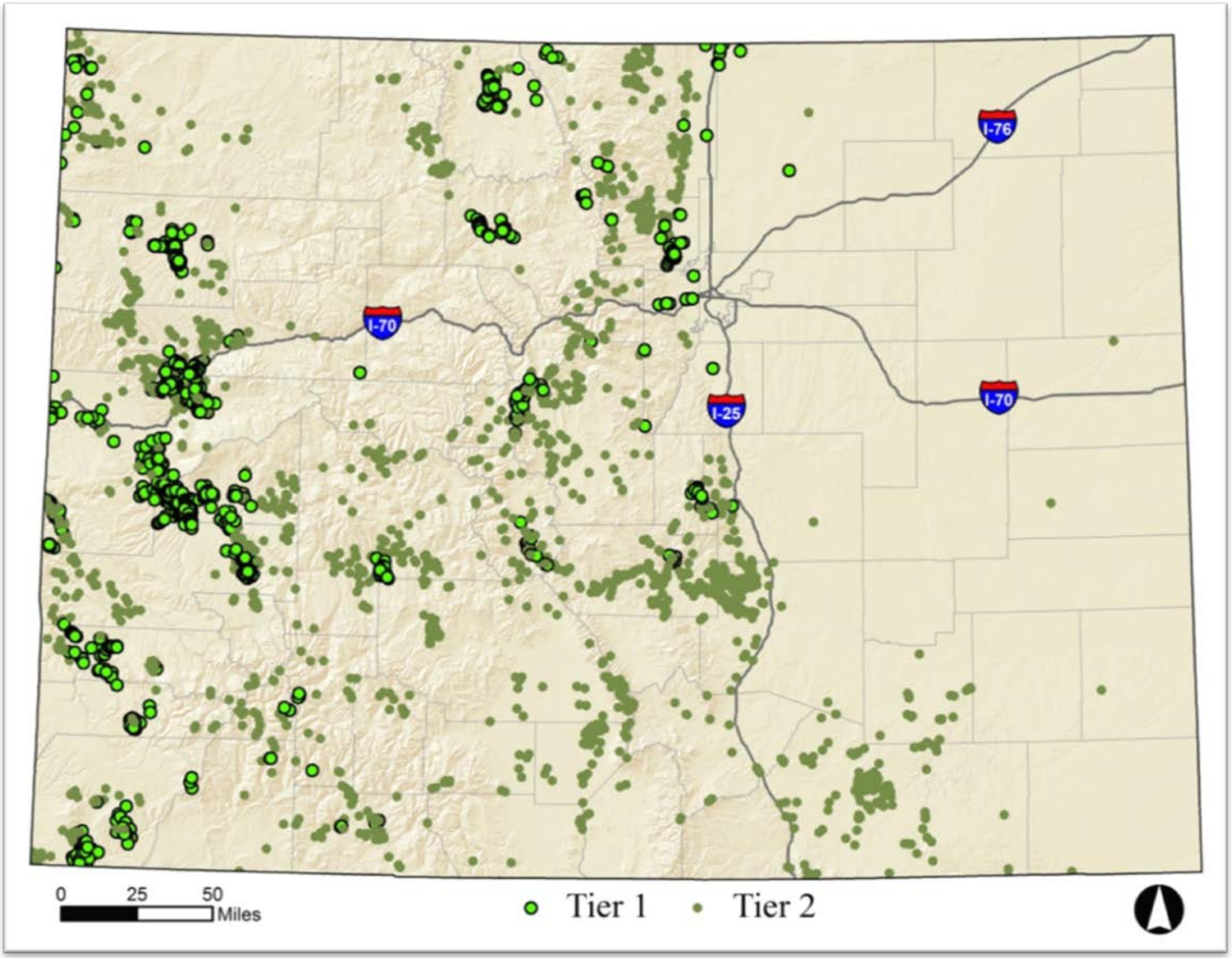

Figure 1. Distribution of Colorado's Plants of Greatest Conservation Need.

Table 1. Plants of Greatest Conservation Need

Scientific Name	**Common Name**	**Species Priority**	**Global & State Status Ranks**	**Federal Agency Status**	**Percent of Range in Colorado**
Aletes humilis	Larimer aletes	Tier 2	G2G3 / S2S3		Endemic
Aletes latilobus	Canyonlands aletes	Tier 1	G1 / S1	BLM	Medium
Aletes macdougalii ssp. *breviradiatus*	Mesa Verde aletes	Tier 2	G3T2T3 / S1		Medium
Aliciella sedifolia	Stonecrop gilia	Tier 1	G1 / S1	USFS	Endemic
Anticlea vaginatus	Alcove death camas	Tier 2	G2 / S2		Low
Aquilegia chrysantha var. *rydbergii*	Golden columbine	Tier 2	G4T1Q / S1	BLM/USFS	Endemic
Asclepias uncialis ssp. *uncialis*	Dwarf milkweed	Tier 2	G3G4T2T3 / S2	BLM/USFS	Very High
Astragalus anisus	Gunnison milkvetch	Tier 2	G2G3 / S2S3	BLM	Endemic
Astragalus cronquistii	Cronquist milkvetch	Tier 2	G2 / S2	BLM	High
Astragalus debequaeus	DeBeque milkvetch	Tier 2	G2 / S2	BLM	Endemic
Astragalus deterior	Cliff-palace milkvetch	Tier 1	G1G2 / S1S2		Endemic
Astragalus equisolensis	Horseshoe milkvetch	Tier 2	G5T1 / S1		Low
Astragalus humillimus	Mancos milkvetch	Tier 1	G1 / S1	LE	Low
Astragalus iodopetalus	Violet milkvetch	Tier 2	G2 / S1		Medium
Astragalus lonchocarpus var. *hamiltonii*	Hamilton milkvetch	Tier 1	G1 / S1		Low
Astragalus microcymbus	Skiff milkvetch	Tier 1	G1 / S1	BLM	Endemic
Astragalus missouriensis var. *humistratus*	Missouri milkvetch	Tier 2	G5T1 / S1	USFS	Endemic
Astragalus naturitensis	Naturita milkvetch	Tier 2	G2G3 / S2S3	BLM	High
Astragalus osterhoutii	Kremmling milkvetch	Tier 1	G1 / S1	LE	Endemic
Astragalus piscator	Fisher Towers milkvetch	Tier 2	G2G3 / S1	BLM	Low
Astragalus rafaelensis	San Rafael milkvetch	Tier 2	G2G3 / S1	BLM	High
Astragalus schmolliae	Schmoll milkvetch	Tier 1	G1 / S1		Endemic
Astragalus tortipes	Sleeping Ute milkvetch	Tier 1	G1 / S1	C	Endemic
Boechera crandallii	Crandall's rock-cress	Tier 2	G2/S2	BLM	High
Boechera glareosa		Tier 1	G1G2 / S1		Medium
Botrychium tax. nov. *"furcatum"*	Fork-leaved moonwort	Tier 2	G1? / SNR		Unknown
Botrychium lineare	Narrowleaf grape fern	Tier 1	G2? / S1	USFS	Medium
Caesalpinia repens	Creeping rush-pea	Tier 2	G2 / S1		Medium-low
Camissonia eastwoodiae	Eastwood evening primrose	Tier 2	G2 / S1		Medium
Carex stenoptila	Small-winged sedge	Tier 2	G2 / S2		Medium

Scientific Name	**Common Name**	**Species Priority**	**Global & State Status Ranks**	**Federal Agency Status**	**Percent of Range in Colorado**
Castilleja puberula	Downy Indian-paintbrush	Tier 2	G2G3 / S2S3		Endemic
Cirsium perplexans	Adobe thistle	Tier 2	G2G3 / S2S3	BLM/USFS	Endemic
Cirsium scapanolepis	Mountain-slope thistle	Tier 1	G1G2Q / S1		Endemic
Cleome multicaulis	Slender spiderflower	Tier 2	G2G3 / S2S3	BLM	High
Corispermum navicula	Boat-shaped bugseed	Tier 1	G1? / S1		Endemic
Cryptantha gypsophila	Gypsum Valley cat's- eye	Tier 1	G1G2 / S1S2		Endemic
Delphinium ramosum var. *alpestre*	Colorado larkspur	Tier 2	G2 / S2		High
Delphinium robustum	Wahatoya Creek larkspur	Tier 2	G2? / S2?		Medium
Descurainia kenheilii	Heil's tansy mustard	Tier 1	G1 / S1		Endemic
Dicoria wetherillii	Wetherill's dicoria	Tier 2	G4T2?Q / SU		Unknown
Draba exunguiculata	Clawless draba	Tier 2	G2 / S2	USFS	Endemic
Draba graminea	San Juan whitlow-grass	Tier 2	G2 / S2		Endemic
Draba grayana	Gray's Peak whitlow-grass	Tier 2	G2 / S2	USFS	Endemic
Draba malpighiacea	Whitlow-grass	Tier 1	G1 / S1		Endemic
Draba smithii	Smith whitlow-grass	Tier 2	G2 / S2	USFS	Endemic
Draba weberi	Weber's draba	Tier 1	G1 / S1		Endemic
Erigeron kachinensis	Kachina daisy	Tier 2	G2 / S1	BLM	Low
Erigeron wilkenii	Wilken fleabane	Tier 1	G1 / S1		Endemic
Eriogonum brandegeei	Brandegee wild buckwheat	Tier 1	G1G2 / S1S2	BLM/USFS	Endemic
Eriogonum clavellatum	Comb Wash buckwheat	Tier 2	G2 / S1	BLM	Medium
Eriogonum coloradense	Colorado wild buckwheat	Tier 2	G2 / S2	BLM	Endemic
Eriogonum pelinophilum	Clay-loving wild buckwheat	Tier 1	G2 / S2	LE	Endemic
Eutrema edwardsii ssp. *penlandii*	Penland alpine fen mustard	Tier 1	G1G2 / S1S2	LT	Endemic
Gaura neomexicana ssp. *coloradensis*	Colorado butterfly plant	Tier 1	G3T2 / S1	LT	Medium
Gutierrezia elegans	Lone Mesa snakeweed	Tier 1	G1 / S1		Endemic
Hackelia besseyi	Bessey's stickseed	Tier 2	G2G3 / SNR		Low
Hackelia gracilenta	Mesa Verde stickseed	Tier 1	G1 / S1		Endemic
Herrickia horrida	Canadian River spiny aster	Tier 2	G2? / S1		Medium
Ipomopsis aggregata ssp. *weberi*	Rabbit Ears gilia	Tier 2	G5T2 / S2	USFS	Very High
Ipomopsis globularis	Globe gilia	Tier 2	G2 / S2	USFS	Endemic
Ipomopsis polyantha	Pagosa skyrocket	Tier 1	G1 / S1	C, BLM/USFS	Endemic

Scientific Name	**Common Name**	**Species Priority**	**Global & State Status Ranks**	**Federal Agency Status**	**Percent of Range in Colorado**
Lepidium crenatum	Alkaline pepperwort	Tier 2	G2 / S2		Medium
Lesquerella calcicola	Rocky Mountain bladderpod	Tier 2	G2 / S2		High
Lesquerella congesta	Dudley Bluffs bladderpod	Tier 1	G1 / S1	LT	Endemic
Lesquerella parviflora	Piceance bladderpod	Tier 2	G2 / S2	BLM	Endemic
Lesquerella pruinosa	Pagosa bladderpod	Tier 2	G2 / S2	BLM/USFS	Endemic
Lesquerella vicina	Good-neighbor bladderpod	Tier 2	G2 / S2	BLM	Endemic
Limnorchis zothecina	Alcove bog orchid	Tier 2	G2 / S1		Low
Lomatium concinnum	Colorado desert-parsley	Tier 2	G2G3 / S2S3	BLM	Endemic
Lupinus crassus	Payson lupine	Tier 2	G2 / S2	BLM	Endemic
Lygodesmia doloresensis	Dolores River skeletonplant	Tier 1	G1G2 / S1	BLM	High
Machaeranthera coloradoensis	Colorado tansy-aster	Tier 2	G2 / S2	USFS	High
Mentzelia rhizomata	Roan Cliffs blazing star	Tier 2	G2 / S2		Endemic
Mertensia humilis	Rocky Mountain bluebells	Tier 2	G2 / S1		Medium
Mimulus gemmiparus	Budding monkey flower	Tier 1	G1 / S1	USFS	Endemic
Nuttallia chrysantha	Golden blazing star	Tier 2	G2 / S2	BLM	Endemic
Nuttallia densa	Arkansas Canyon stickleaf	Tier 2	G2 / S2	BLM	Endemic
Oenothera acutissima	Narrow-leaf evening primrose	Tier 2	G2 / S2	BLM	Medium
Oenothera harringtonii	Arkansas Valley evening primrose	Tier 2	G2G3 / S2S3	USFS	Endemic
Oonopsis foliosa var. *monocephala*	Rayless goldenweed	Tier 2	G3G4T2 / S2		Endemic
Oonopsis puebloensis	Pueblo goldenweed	Tier 2	G2 / S2		Endemic
Opuntia heacockiae	Heacock's prickly-pear	Tier 2	G2G3Q / S2S3		Endemic
Oreocarya osterhoutii	Osterhout cat's-eye	Tier 2	G2G3 / S2	BLM	Low
Oreoxis humilis	Pikes Peak spring parsley	Tier 1	G1 / S1	USFS	Endemic
Oxybaphus rotundifolius	Round-leaf four o'clock	Tier 2	G2 / S2		Endemic
Oxytropis besseyi var. *obnapiformis*	Bessey locoweed	Tier 2	G5T2 / S2		Very High
Pediocactus knowltonii	Knowlton cactus	Tier 1	G1 / SNA	LE	Historical
Penstemon crandallii ssp. *procumbens*	Crandall's beardtongue	Tier 2	G4T2Q / SU		Endemic
Penstemon debilis	Parachute penstemon	Tier 1	G1 / S1	C	Endemic
Penstemon degeneri	Degener beardtongue	Tier 2	G2 / S2	BLM/USFS	Endemic
Penstemon fremontii var. *glabrescens*	Fremont's beardtongue	Tier 2	G3G4T2 / S2		Endemic

Scientific Name	**Common Name**	**Species Priority**	**Global & State Status Ranks**	**Federal Agency Status**	**Percent of Range in Colorado**
Penstemon gibbensii	Gibben's beardtongue	Tier 1	G1 / S1	BLM	High
Penstemon grahamii	Graham beardtongue	Tier 2	G2 / S1		Low
Penstemon penlandii	Penland penstemon	Tier 1	G1 / S1	LE	Endemic
Penstemon scariosus var. *albifluvis*	White River penstemon	Tier 1	G4T1 / S1	C	Low
Penstemon scariosus var. *cyanomontanus*	Plateau penstemon	Tier 2	G4T2 / S2		High
Penstemon teucrioides	Germander beardtongue	Tier 2	G2G3Q / S2S3		Endemic
Phacelia formosula	North Park phacelia	Tier 1	G1 / S1	LE	Endemic
Phacelia submutica	DeBeque phacelia	Tier 1	G2 / S2	C, USFS	Endemic
Physaria alpine	Avery Peak twinpod	Tier 2	G2 / S2		Endemic
Physaria bellii	Bell's twinpod	Tier 2	G2G3 / S2S3		Endemic
Physaria obcordata	Piceance twinpod	Tier 1	G1G2 / S1S2	LT	Endemic
Physaria pulvinata	Cushion bladderpod	Tier 1	G1 / S1		Endemic
Physaria rollinsii	Rollins twinpod	Tier 2	G2 / S2		Endemic
Physaria scrotiformis	West Silver bladderpod	Tier 1	G1 / S1		Endemic
Potentilla rupincola	Rocky Mountain cinquefoil	Tier 2	G2 / S2	USFS	Endemic
Ptilagrostis porteri	Porter feathergrass	Tier 2	G2 / S2	BLM/USFS	Endemic
Puccinellia parishii	Parish's alkali grass	Tier 2	G2G3 / S1		Low
Salix arizonica	Arizona willow	Tier 2	G2G3 / S1	USFS	Low
Saussurea weberi	Weber saussurea	Tier 2	G2G3 / S2	BLM	High
Sclerocactus glaucus	Colorado hookless cactus	Tier 1	G3 / S3	LT	High
Sclerocactus mesae-verdae	Mesa Verde hookless cactus	Tier 1	G2 / S2	LT	Low
Sisyrinchium pallidum	Pale blue-eyed-grass	Tier 2	G2G3 / S2	BLM	High
Spiranthes diluvialis	Ute ladies'-tresses	Tier 1	G2G3 / S2	LT	Medium
Telesonix jamesii	James telesonix	Tier 2	G2 / S2		Very High
Thalictrum heliophilum	Sun-loving meadow rue	Tier 2	G2 / S2	USFS	Endemic
Thelypodiopsis juniperorum	Juniper tumble mustard	Tier 2	G2 / S2		Endemic
Thelypodium paniculatum	Northwestern thelypody	Tier 2	G2 / S1		Low
Townsendia fendleri	Fendler's townsend-daisy	Tier 2	G2 / S1		High
Townsendia glabella	Gray's townsend-daisy	Tier 2	G2 / S2		Endemic
Townsendia rothrockii	Rothrock townsend-daisy	Tier 2	G2G3 / S2S3		Endemic

Part 2: KEY HABITATS

Colorado's imperiled plants occur within eight major habitat types: ***alpine***, ***barrens***, ***cliffs and canyons***, ***grasslands***, ***forests***, ***pinyon-juniper woodlands***, ***shrublands***, and ***wetlands*** (CNHP 2011; CNHP and TNC 2011; Colorado Native Plant Society 1997). Colorado's barrens and shrublands are especially rich habitats for imperiled plant species, followed by pinyon-juniper woodlands, cliffs and canyons, and alpine habitats (CNHP and TNC 2011). Barrens occupy less than 1% of Colorado, but nearly 25 of our rarest plants are primarily associated with barrens (23% of imperiled species). Shrublands are Colorado's second most important habitat for rare plants (supporting 21% of the imperiled species), occupying 19% of the state's acreage. Pinyon-juniper woodlands cover nearly 10% of Colorado, providing habitat for at least 16% of the rare plant species (Figures 2 and 3). Mapping of habitat types is from SWReGAP (Prior-Magee et al. 2007).

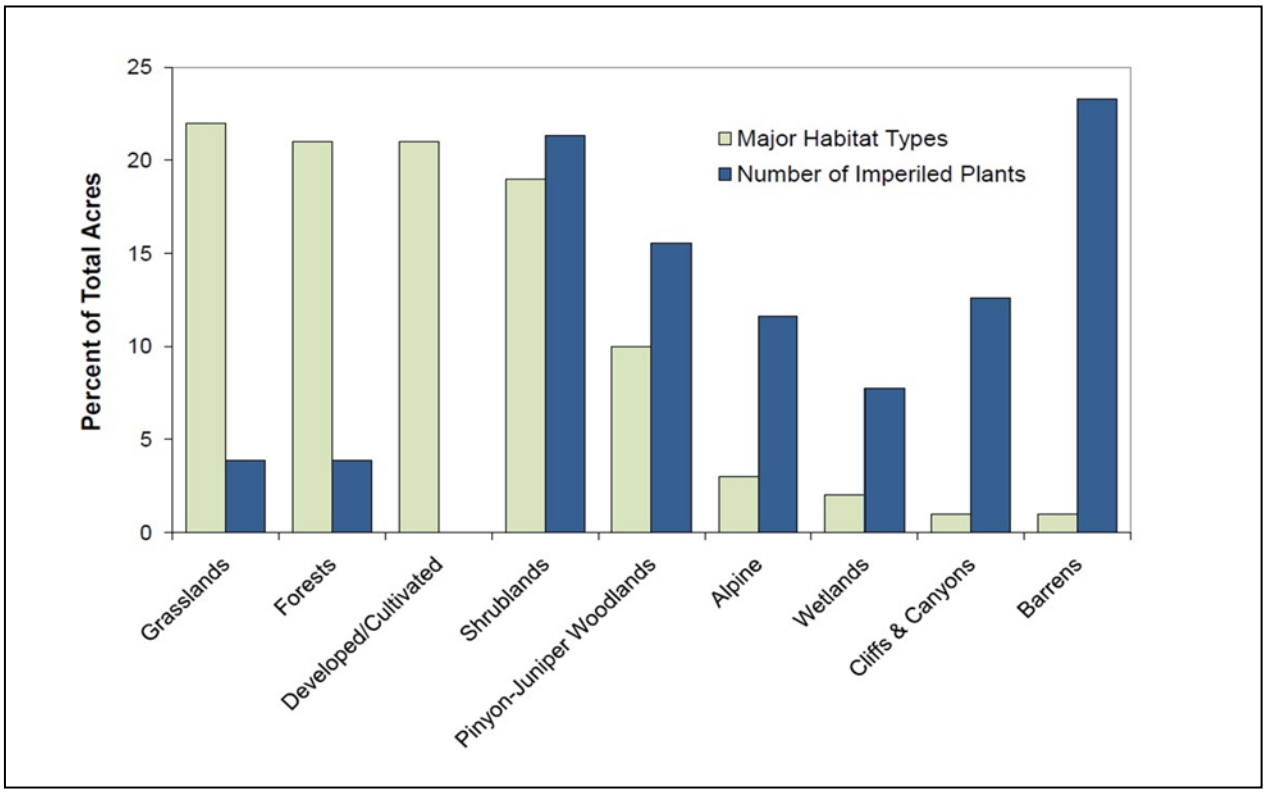

Figure 2. Key habitats as percentage of Colorado and number of PGCN.

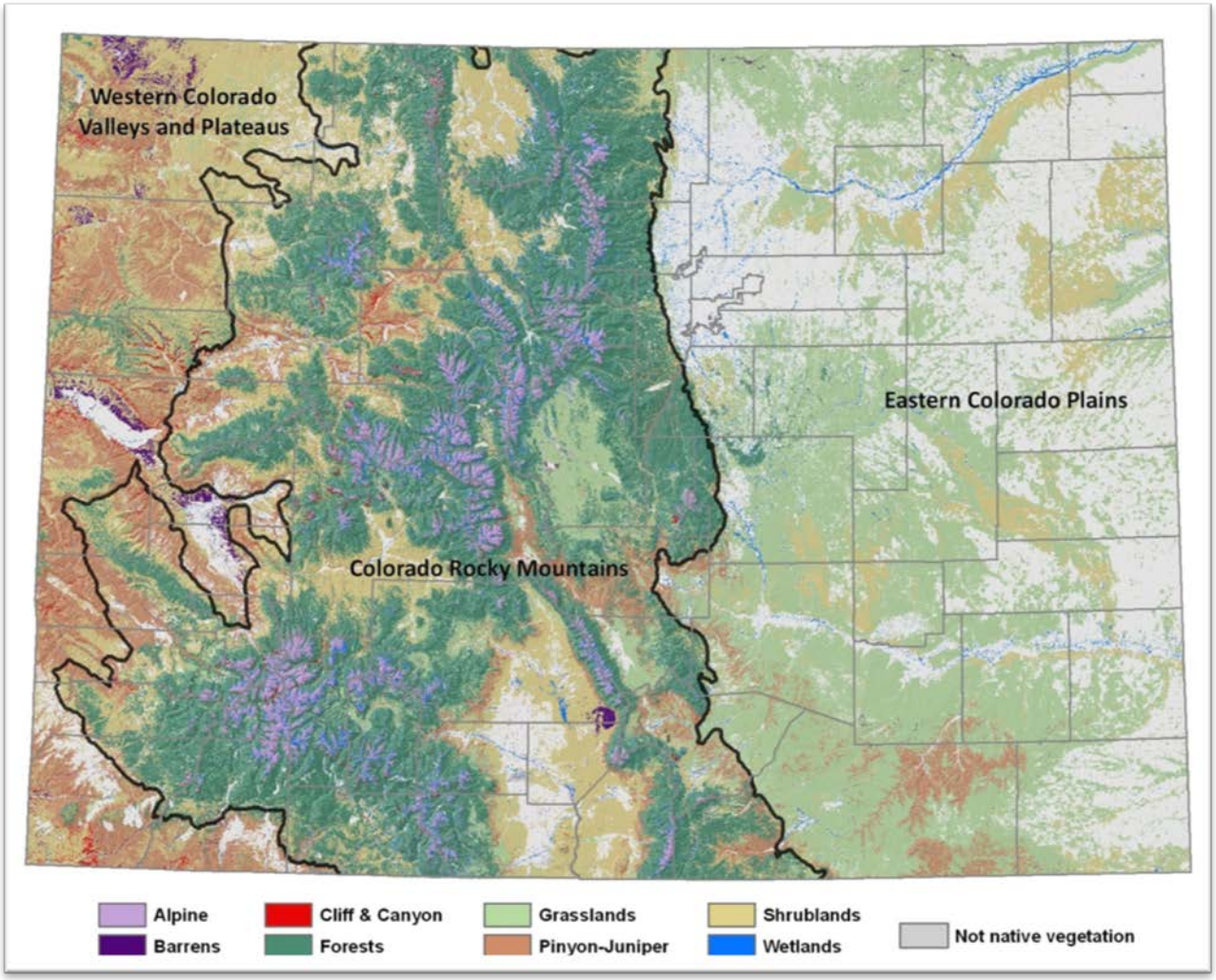

Figure 3. Distribution of major rare plant habitat types in Colorado.

Relationship Between Key Habitats for Wildlife and Plants

The way that rare plant habitat types have been categorized (Neely et al. 2009, CNHP and TNC 2011) is slightly different from the habitat categorization used for animals in Colorado's SWAP. Categories that are common to both plants (in this Addendum) and animals (in the SWAP) are grasslands, forests, shrublands, pinyon-juniper woodlands, alpine habitats, and wetlands. However, the SWAP did not specifically recognize two habitat types for wildlife that are, in fact, among the highest priority habitat types for plants: barrens, and cliffs and canyons.

In the SWAP, grassland, forest, shrubland, and wetland categories all had some habitat types that were considered high priority. For plants, all habitat types discussed in this Addendum are considered priority habitats, since they all support globally imperiled species that are at risk of extinction. However, based on the concentration of rare plants in each habitat type relative to

the percentage of Colorado covered by that habitat type (Figure 2), five habitat types stand out as being critically important to conservation of imperiled plant species: barrens, shrublands, pinyon-juniper woodlands, cliffs and canyons, and alpine (Figure 3, Table 2). This Addendum does not change the conservation priorities for habitats presented in the SWAP; rather, it expands the priority list to include the barrens and cliff/canyon habitats specific to rare plant conservation. Details on species supported, key threats, and prioritized conservation actions for PGCN habitats can be found in Part 6, Table 4.

Table 2. Relative priorities for key rare plant habitats based on the concentration of rare plants in each habitat type relative to the percentage of Colorado covered by that habitat type.

Habitat Priority	Habitat Category	Habitat Type
Very High	Alpine	Exposed Rock (alpine)
		Meadow Tundra
		Shrub Tundra
	Barrens	Barrens
		Exposed Rock
High	Cliff and Canyon	Cliff and Canyon
	Pinyon-Juniper Woodlands and Savannas	Pinyon-Juniper
	Shrublands	Deciduous Oak
		Desert Shrub
		Sagebrush
		Saltbrush Fans and Flats
		Sand Dunes Complex (Shrubland)
		Upland Shrub
	Wetlands	Eastern Plains Streams
		Grass/Forb Dominated Wetlands
		Mountain Streams
		Shrub-dominated Wetlands
		Playas
		Seeps and Springs
Moderate	Forests	Aspen Forest
		Douglas Fir
		Mixed Conifer
		Ponderosa Pine
		Rocky Mtn Bristlecone Pine
		Spruce-Fir
	Grasslands	Foothill/Mountain Grassland

Condition of Key Habitats

Colorado's SWAP addresses the condition of all key habitats pertinent to PGCN, with the exception of barrens, and cliffs and canyons. The current overall condition of barrens and cliff/canyon habitats in Colorado is good. These are harsh environments that generally do not support significant weed populations, and have not been among the higher priority areas for many common human uses (e.g., urban development, roads and infrastructure, agriculture). However, there is concern for downward trends in future condition of these habitats as human activities continue to expand. Specifically, these areas are impacted by motorized uses (including recreation – a significant threat in some places, as well as military use in certain areas). They are also experiencing increased urban and energy development in some places (e.g., some areas are becoming popular for second home and ranchette development). Increasing interest in renewable energy, and focus on natural gas as a "green" energy source, could push additional development of these resources into these habitats. These issues are discussed further in the following section. Habitat-specific threats and conservation actions are listed in Part 6, Table 7.

Part 3: PROBLEMS AFFECTING THE SPECIES

Colorado's human population is soaring and land uses, such as energy and residential development, are increasing impacts to Colorado's native plants and their habitats. Colorado continues to be one of the fastest growing states in the country. The population is expected to grow from approximately 5 million to over 7.5 million by 2030 and to double to 10 million by 2050. The statewide development footprint increased from 1.3 million acres in 1970 to 2.5 million acres in 2000 and is expected to expand to more than 3.5 million acres by 2030. The state is losing its largest privately owned agricultural and natural lands many times faster than any other state in the nation (Colorado Conservation Trust 2007).

Colorado's irreplaceable native plants, plant communities, and ecosystems are thus increasingly being threatened. Most of Colorado's imperiled plants are naturally rare. They are rare because they are restricted to very specific, narrowly distributed habitats, rather than as a result of human actions, per se. However, because these species occupy such small areas, planning is necessary to avoid placing these species at further risk from human activities. Degradation, fragmentation, and loss of habitat are major reasons plant species and their habitats are imperiled or vulnerable in Colorado. The primary contributors to habitat degradation for imperiled plants are ***energy development***, ***motorized recreation***, ***residential development***, and ***road construction and maintenance*** (CNHP and TNC 2011). Other risk factors include altered hydrologic regime, invasive species, agricultural development, loss of pollinators, incompatible grazing/trampling, and plant collecting (CNHP and TNC 2011). Additionally, there is strong scientific consensus that human-induced climate change is affecting species and ecological systems, and this is likely to exacerbate the effects of other human activities on plants (Enquist and Gori 2008).

One of the biggest issues is a ***lack of awareness*** and information regarding the presence, distribution, and precarious status of Colorado's native and imperiled plant species. Many rare plants inhabit small areas, have specialized needs, and have unique habitat requirements that are often missed by other approaches to conservation (e.g., those focused primarily on wildlife).

The following issues are statewide in scope, and apply to many PGCN. Table 7 presents general and specific threats on a species-by-species basis.

Energy Development

The region's recent energy boom has rapidly transformed areas of Colorado, both economically and environmentally. According to Colorado Conservation Trust (2007), applications for oil and gas drilling permits increased by almost 500% from 1999 (1,010) to 2006 (5,904). Also, over

6,000 drilling permit applications were approved in 2007 — more than two-and-a-half times the 2,378 permits approved during Colorado's last energy development boom in 1981. More than 30,000 oil and gas wells are currently operating statewide and production has grown by almost 60% since 2000 (Colorado Conservation Trust 2007). The habitat that supports several rare plants is underlain by rich deposits of oil and natural gas. Oil and gas development activities and associated infrastructure can cause population fragmentation, habitat destruction and degradation, introduction of non-native plants, and alteration of surface hydrology. Oil and gas development often creates a high density of roads; these roads can provide easy access to new areas for off-road vehicle use (Center for Native Ecosystems et al. 2005). The habitat for rare plant species restricted to the Green River Formation in the Piceance Basin contains high grade oil shale deposits. The Parachute Creek Member of the Green River Formation is reported to have the best deposits of oil shale known in the world and is considered to be a major potential source of oil in the United States. However, millions of tons of shale must be mined each year to make the process economically feasible. The impacts of oil shale mining and processing can increase erosion due to vegetation removal, increase air pollution, fragment and/or eliminate some plant populations, and degrade remaining habitat, e.g., by spread of introduced invasive plant species (Center for Native Ecosystems et al. 2005).

Motorized Recreational Activities

Motorized recreation (including off highway, off road, all terrain, and four-wheel drive vehicles, motorcycles, and snowmobiles) is rapidly increasing in many areas where Colorado's rare plants grow and it is often difficult to enforce regulations or close access to protect plant habitat. Motorized recreation can reduce natural habitat for plants, impacting individual plants and populations. Roads and trails created by off-road vehicles impact plants by altering habitat, killing plants, increasing erosion, and creating dispersal corridors for invasive plant species.

Residential Development

Twenty-four percent of the habitat occupied by imperiled plants in Colorado is found on private land. Accelerating residential and urban development, along with associated infrastructure such as roads and utilities, is consuming and fragmenting important habitat for native plants and plant communities. Exurban development (low-density rural development), the fastest growing land use in the United States, has been found to reduce many native species near homes and increase exotic species, with effects manifested over decades (Hansen et al. 2005). In addition to local effects, exurban development may alter ecological processes and biodiversity on adjacent and distant public lands. Underlying mechanisms involve alteration of habitat, ecological processes, biotic interactions, and increased human disturbance (Hansen et al. 2005).

Road Construction and Maintenance

Roads can have a serious impact upon the natural integrity and habitat effectiveness of rare plant sites. Along with extirpating populations and destroying habitat, roads contribute to fragmentation that may interfere with natural processes such as pollination and seed dispersal. Roads can act as barriers to insect pollinators for some plants. Other impacts from road construction and maintenance (e.g., mowing and herbicide application) include erosion and sedimentation, as well as introduction of invasive species.

Other Factors

Many rare plants are restricted to unusual substrates and comprise very small populations, thereby rendering them subject to random catastrophic events such as landslides or infestation. Other factors that impact Colorado's rare plants include: 1) widespread lack of awareness regarding their existence and precarious status; 2) inadequate funding for conservation and research; 3) inadequate legal protection for plants; and 4) over-collection for horticultural purposes (e.g., penstemons, cacti, orchids) or medicinal uses (e.g., arnica).

Climate Change

Climate change is already having serious impacts across the globe. In the 20th century, global temperatures increased by 0.7 °C (1.3 °F) and Northern Hemisphere snow cover declined by 7% (Intergovernmental Panel on Climate Change 2007). The western United States has experienced an increase in average temperature during the last five years that is 70% greater than the world as a whole (Saunders et al. 2008).

The change in climate is driving plants out of their current geographic ranges and will likely result in regional extirpation and even extinction for some plant species (Schneider et al. 2007). Warmer temperatures and changing rainfall have shifted vegetation in several ecosystems up mountain slopes and towards polar regions. Alteration of seasons has changed the timing of life-cycle events of plants and animals, potentially resulting in an asynchrony between plants, environmental cues, and interacting organisms such as pollinators (Joyce 2008). The United Nations Intergovernmental Panel on Climate Change (IPCC 2007) predicts that all of North America is likely to warm by 2 °C (3.6 °F) during this century. There will likely be more droughts and other extreme weather events. Colorado will likely become hotter and drier with shorter snow seasons, earlier snow melt, and longer fire seasons. These potential impacts will interact with the other stresses to rare plants, e.g., loss or fragmentation of habitat from development, mining, and introduction of invasive species. The full impacts of climate change

on imperiled species are likely to significantly reduce habitat, which is particularly problematic for rare plants that demand very specific growing conditions (Loarie et al. 2008).

To get a better sense of the relative vulnerability of the PGCN to climate change, the Colorado Natural Heritage Program (CNHP) conducted a rapid, first-iteration assessment using NatureServe's Climate Change Vulnerability Index (CCVI) (Appendix B). They used available data sources, including CNHP's databases and the U.S. Forest Service species assessments. However, there are significant data gaps for most of the PGCN. Therefore, many assumptions were made based on field observations, expert judgment, information on related species, and general habitat-level information.

Not surprisingly, the majority of the 121 PGCN scored Extremely Vulnerable or Highly Vulnerable (Table 3). Exceptions were *Carex stenoptila* and *Ptilagrostis porteri*, which scored Moderately Vulnerable, and *Ipomopsis aggregata* ssp. w*eberi*, which scored Presumed Stable. There was insufficient information to complete the Index for 11 species. Overall, the most significant factors contributing to PGCN vulnerability to climate change are:

- restricted range,
- inability to disperse long distances,
- restricted habitats and natural barriers that prevent range/distribution shifting, and
- moisture regimes (reduced future moisture availability, physiological hydrological niche (micro-habitats), and historic hydrological niche (surrogate for species' tolerance for fluctuations in moisture availability).

Over half of Colorado's PGCN (69) have their entire range within the state, which is projected to experience temperature increases of approximately 5 – 5.5 degrees Fahrenheit (www.climatewizard.org). For most PGCN (89), natural barriers such as major rivers, mountain ranges, restriction of required substrates, and/or other environmental conditions exist that may inhibit or prevent range/distribution shifts in response to climate change. This is especially true for the species that inhabit alpine, barrens, and cliff/canyon habitats.

With a few exceptions, anthropogenic barriers are generally not as significant a factor in climate change vulnerability. However, the anthropogenic barrier factor was one of the factors with more significant uncertainty in the scoring, along with moisture regimes and climate change mitigation land uses. Anthropogenic barrier scores were estimated using coarse scale data in GIS. The degree to which coarse scale assessments are accurate at rare plant occurrence scales is unknown.

Among climate change projection models, there is much less agreement on precipitation projections for Colorado than there is on temperature. Scoring factors related to hydrology are

significant for some species, particularly those that inhabit riparian or wetland habitats, and those that seek out cool/moist micro-climates. Therefore, this factor should be re-assessed as climate change models improve.

Roughly half of the PGCN were rated vulnerable to potential future threats from land uses designed to mitigate climate change (e.g., renewable energy development such as wind, solar). However, there are many influences over land use – economic, political, social – and how actual land use plays out over future years is highly uncertain.

The most significant data gaps are pollinators and mutualisms such as mycorrhizal relationships. A significant issue that was beyond the scope of this project is estimating how and where rare plant habitats and distributions may shift as a result of changing climate. This is a crucial next step in refining conservation and adaptation strategies for Colorado's PGCN.

Part 4: PRIORITIES FOR CONSERVATION ACTION

The following statewide conservation objectives, adapted from the RPCI Rare Plant Conservation Strategy, are necessary to meet the conservation needs of Colorado's PGCN. These objectives represent the most urgent and critical actions needed to effectively conserve Colorado's imperiled plant species. These objectives will guide conservation activities and catalyze collaborative conservation action over the next decade.

The following Objectives and Conservation Actions are statewide in scope, and are applicable to all PGCN. Table 3 presents specific, prioritized conservation actions on a species-by-species basis.

Statewide Conservation Objectives

The six statewide conservation objectives are:

1. ***Secure on-the-ground, site-specific habitat protection and/or management*** to achieve specific goals for all of Colorado's imperiled plants on public and private lands. Focus these activities in places that are likely to remain stable under predicted climate change scenarios, and on areas needed to maintain habitat connectivity (e.g., to facilitate climate-related distributional shifts).

2. ***Minimize threats*** from specific land uses that impact many of Colorado's imperiled plants statewide, and ***develop climate change adaptation strategies*** for vulnerable species.

3. ***Improve scientific understanding*** of the distribution, natural history, response to climate change, and status of Colorado's most imperiled plants through inventory, research, and monitoring.

4. ***Develop and implement a state program and policies*** to enhance the conservation of Colorado's most imperiled plants in cooperation with public land managers, private landowners, and other interested stakeholders.

5. ***Facilitate the stewardship*** of Colorado's most imperiled plants through education, outreach, and coordination.

6. ***Adopt measures for the ex situ (off site) conservation*** of Colorado's most imperiled plants in case native populations are extirpated due to stochastic events, anthropogenic impacts, and/or climate change.

Recommended Conservation Actions for Short-term (1-5 years)

1. Select targeted PGCN for site-specific conservation action each year (e.g., select "poorly conserved" species from Colorado's Biodiversity Scorecard).
2. Prioritize the 32 Important Plant Areas ranked (B1) for action in 2009-2013. Develop and implement conservation action plans with working groups consisting of local experts, land trusts, and land managers. Identify appropriate actions for each area.
   a. Work with land trusts and willing landowners to place conservation easements on private lands within the 32 B1 Important Plant Areas (and selected B2s).
   b. Develop multi-species proposals to fund habitat protection of imperiled plant species across Colorado.
3. Work with public agencies to collect/share best available data, develop and implement best management practices, and pursue special agency designations for PGCNs.
4. Develop a plant policy for the Colorado Department of Natural Resources, General Assembly joint resolution, and Governor's executive order.
5. Develop a bill for a state plant statute that establishes a legally-recognized list of PGCN, acknowledges Colorado's interest in protecting them, and provides a variety of resources for their conservation.
6. Integrate the PGCN into other statewide conservation planning and protection efforts in addition to the SWAP. Examples include the Statewide Forest Assessment, Colorado Conservation Partnership, Colorado Conservation Summit, federal management plan revisions, and local planning efforts.
7. Improve scientific understanding of the distribution, natural history, response to climate change, and status of PGCN through inventory, research and monitoring.
8. Adopt measures for ex situ (off site) conservation in case native populations are extirpated.

Long-term Recommendations (5-10 years)

1. Update the ***Biodiversity Scorecard*** every five years and address climate change and other emerging impacts in future iterations.
2. Update the ***Colorado Rare Plant Conservation Strategy and any rare plant component of Colorado's SWAP*** every five years, starting in 2014, and include consideration of other plant species groups such as vulnerable vascular plant species (ranked G3 by CNHP and NatureServe) and non-vascular plants (lichens, mosses, and liverworts).

3. Develop conservation action plans for all high priority B2 Important Plant Areas, working with local experts, land trusts, and land managers.
4. Assess status of threats, protection/conservation, and viability of Colorado's PGCN every five years.

Important Plant Areas

Over 200 Important Plant Areas (IPAs) have been identified by the Colorado Natural Heritage Program and recognized by RPCI (Figure 4). These IPAs are based on CNHP's Potential Conservation Areas, and include the highest quality locations for PGCN. IPAs represent our best estimate of the areas needed to support the continued existence of Colorado's most imperiled

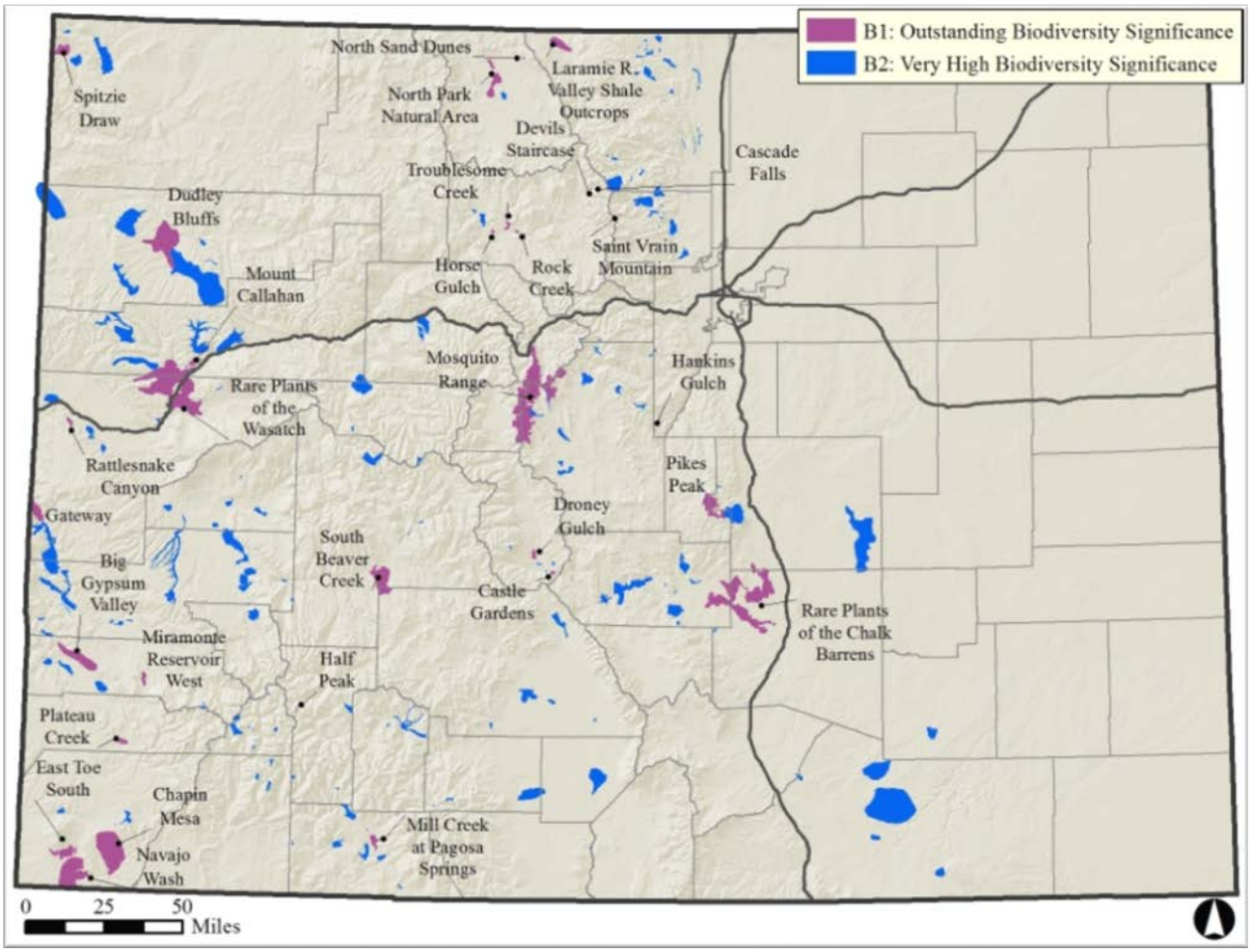

Figure 4. Important Plant Areas for PGCN. To improve map readability, only the B1 Important Plant Areas are labeled.

plant species in places where they currently occur. Potential distribution shifts in response to climate change are not incorporated in this iteration. Although IPAs do not carry any regulatory authority, they can provide guidance on opportunities for conservation, and highlight places where public land managers and private landowners can help conserve plant species and habitats. These IPAs are ranked by CNHP on a scale as having either Outstanding Biodiversity Significance (B1) or Very High Significance (B2).

Priority Research and Survey Efforts Needed

Research

Very little is known about the life history and reproductive biology of most Colorado's PGCN. Additionally, some species need taxonomic work, including golden columbine (*Aquilegia chrysantha* var. *rydbergii*) and boat-shaped bugseed (*Corispermum navicula*), among others (Table 3). Increased collaboration with academic institutions will help address the key research needs of Colorado's imperiled plants.

Recommended research and research-related activities include:

- Prioritize research needs for Colorado's PGCN annually (for example, during Annual Colorado Rare Plant Technical Committee Symposia, Biodiversity Scorecard updates, etc.) and share priorities with the academic community and other partners.

- Support and conduct research that seeks to better understand how human activities, such as dust from energy development, ORV use, or herbicide application may impact PGCN, and inform mitigation of the impacts of these activities (e.g., through use of Best Management Practices, reintroductions, etc.).

- Conduct systematic and genetic research on those PGCN for which there are taxonomic questions. Conduct analyses for plant chemicals that could be effective in medicines.

- Support and conduct species-specific research to answer basic questions about the natural history of PGCN, including response to climate change. Priorities include reproductive biology (e.g., pollination, breeding system, and seed dispersal mechanisms), life history (e.g., germination requirements and survival to reproduction), and ecology (e.g., edaphic or soil requirements and mycorrhizal relationships), as well as other important ecological processes needed for their survival (e.g., fire or other disturbance). Priority research needs

for climate change include response to, and tolerable thresholds for, increasing temperatures, and both increasing and decreasing moisture availability.

- Model how species' habitat and distributions may shift in response to climate change.

Survey

A number of PGCN are in particular need of focused field surveys to inform understanding of distribution, level of rarity and imperilment, and status. These include Cronquist milkvetch (*Astragalus cronquistii*), Mancos milkvetch (*Astragalus humillimus*), Comb Wash buckwheat (*Erigonum clavellatum*), and Piceance bladderpod (*Lesquerella parviflora*).

Recommended surveys and survey-related actions include the following. See Part 7 for monitoring recommendations.

- Prioritize survey needs for PGCN annually (for example, during Annual Colorado Rare Plant Technical Committee Symposia, Biodiversity Scorecard updates, etc.).

- Conduct targeted surveys of Colorado's PGCN to fill data gaps and increase knowledge about geographic range, distribution, population size, condition, threats, and status. Document the occurrence and distribution of PGCN with CNHP occurrence records, voucher specimens, and photographs.

- Evaluate recommended conservation actions for PGCN (species and occurrences) through targeted site visits and existing database information.

- Periodically update Important Plant Areas for all PGCN to guide conservation actions, and assess status of IPAs in terms of climate change. Conduct field visits of existing and potential additional IPAs as identified by the CNHP.

- Secure funding to help update and maintain CNHP's database to enhance the ability to keep the Colorado Rare Plant Conservation Strategy and any rare plant component of Colorado's SWAP current.

- Acquire fine-scale data necessary for high-precision modeling of the rarest PGCN and conduct modeling to inform targeted surveys.

Part 6: PRIORITIES, THREATS, AND CONSERVATION ACTIONS FOR PGCN AND THEIR HABITATS

The following tables contain detailed conservation priorities, threats, and conservation actions for species (Table 3) and habitats (Table 4). Part 1 of this document describes the process used for generating these tables. These data are housed within an Access database within the Colorado Natural Heritage Program (www.cnhp.colostate.edu).

Table 3. Plants of Greatest Conservation Need – Priorities, Threats, and Conservation Actions. Sorted by Scientific Name.

Aletes humilis

Population Status		Population Trend		Distribution	Type	Habitat	Primary
High	D	Stable	D	Southern Rocky Mountains	P	Cliff and Canyon	☑
						Ponderosa Pine	☐

Larimer aletes

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Natural Factors	Habitat is limited	Research and Monitoring	Research critical life history/habitat components	M
Natural Factors	Habitat is limited	Research and Monitoring	Monitor populations for early detection of potential threats	M
Non-consumptive Disturbance	Recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L

Aletes latilobus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Colorado Plateau	P	Cliff and Canyon	☑
					Desert Shrub	☐

Canyonlands aletes

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Natural Factors	Limited habitat availability	Protected Area Management	Monitor populations for early detection of potential threats	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Aletes macdougalii ssp. breviradiatus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑
					Sandy Areas	☐

Mesa Verde aletes

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M

Aliciella sedifolia

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	☑
					Meadow Tundra	☑

Stonecrop gilia

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Indirect Consumptive Use (Mortality)	Grazing by domestic sheep	Compatible Resource Use	Implement compatible grazing management	H
Lack of knowledge	Response to management/disturbance poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Natural Factors	Small population size	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Protected Area Management	Write and implement travel management plan	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Anticlea vaginatus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon	☑

Alcove death camas

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	L

Aquilegia chrysantha var. rydbergii

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Declining	D	Southern Rocky Mountains	P	Mountain Streams	☑
						Seeps and Springs	☑
						Douglas Fir	☐

Golden columbine

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Taxonomic status is unclear	Research and Monitoring	Taxonomic work is needed	H
Natural Factors	Populations are small and declining	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Habitat Degradation	Fragmentation	Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area, Special Interest Area)	M
Invasive or Exotic Species	Invasive plants (weeds and garden varieties that could hybridize)	Invasive Species Control and Prevention	Control non-natives	M
Lack of knowledge	Reproductive and/or pollination biology and specific habitat parameters unknown	Research and Monitoring	Research critical life history/habitat components	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Asclepias uncialis ssp. uncialis

Dwarf milkweed

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Central Shortgrass Prairie	P	Shortgrass Prairie	☑
				Southern Rocky Mountains	O	Pinyon-Juniper	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Conversion to cropland	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Natural Factors	Population limited by unknown biological requirements	Research and Monitoring	Research critical life history/habitat components	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Incompatible Grazing	Voluntary Standards	Implement Best Management Practices for livestock grazing	M
Non-consumptive Disturbance	Off-road vehicular travel	Compatible Resource Use	Manage use to be compatible with biodiversity	M
Habitat Conversion	Energy Development	Voluntary Standards	Implement Best Management Practices for energy development and mining	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus anisus

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Southern Rocky Mountains	P	Sagebrush	☑

Gunnison milkvetch

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Response to fire and other disturbances unknown	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Basic life cycle unknown	Research and Monitoring	Research critical life history/habitat components	M
Habitat Degradation	Altered fire regime (potential for increased fire extent due to cheatgrass)	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L
Indirect Consumptive Use (Mortality)	Grazing	Voluntary Standards	Implement Best Management Practices for livestock grazing	L
Invasive or Exotic Species	Invasive plants (especially cheatgrass)	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

Astragalus cronquistii

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Unknown	D	Colorado Plateau	P	Desert Shrub	☑

Cronquist milkvetch

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus debequaeus

DeBeque milkvetch

Tier 2 Plants

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Southern Rocky Mountains	P	Barrens	☑
				Utah High Plateau	P	Pinyon-Juniper	☑
				Colorado Plateau	O	Desert Shrub	☐
						Sagebrush	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Biology and ecology poorly known	Research and Monitoring	Research critical life history/habitat components	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus deterior

Cliff-palace milkvetch

Tier 1 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Cliff and Canyon	☑
All known occurrences are historical.						

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Protected Area Management	Manage public use to be compatible with biodiversity	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Response to disturbance unknown	Research and Monitoring	Research species/habitat response to management or disturbance	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus equisolensis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑

Horseshoe milkvetch

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation		Land Protection (Public, Private), Easements, and Resource Rights	Expand existing Palisade ACEC	H
Non-consumptive Disturbance	Recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Astragalus humillimus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Cliff and Canyon	☑

Mancos milkvetch

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Threats are poorly understood	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus iodopetalus

Violet milkvetch

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Colorado Plateau	P	Sagebrush	☑
			Southern Rocky Mountains	P	Mixed Forest	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

Astragalus lonchocarpus var. hamiltonii

Hamilton milkvetch

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Pinyon-Juniper	☑
					Desert Shrub	☐

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus microcymbus

Skiff milkvetch

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Southern Rocky Mountains	P	Sagebrush	☑
						Pinyon-Juniper	☐

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Natural Factors	Herbivory (e.g.,rabbits)	Research and Monitoring	Research species/habitat response to management or disturbance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

Astragalus missouriensis var. humistratus

Missouri milkvetch

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Deciduous Oak	☑
					Ponderosa Pine	☑
					Foothill/Mountain Grassland	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus naturitensis	Population Status		Population Trend	Distribution	Type	Habitat	Primary
	Low	D	Unknown	Colorado Plateau	P	Cliff and Canyon	☑
				Southern Rocky Mountains	P	Pinyon-Juniper	☑
Naturita milkvetch				Utah High Plateau	O	Sagebrush	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Resource Extraction	Oil and gas drilling (including roads, pipelines, dust, etc.)	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus osterhoutii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Sagebrush	☑

Kremmling milkvetch

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area, Acrea of Critical Environmental Concern))	H
		Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus piscator

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Colorado Plateau	P	Sandy Areas	☑
					Desert Shrub	☐
					Pinyon-Juniper	☐

Fisher Towers milkvetch

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation		Land Protection (Public, Private), Easements, and Resource Rights	Expand existing Palisade ACEC	H
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Astragalus rafaelensis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑

San Rafael milkvetch

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	No threats documented	Research and Monitoring	Determine threat status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus schmolliae

Schmoll milkvetch

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Colorado Plateau	P	Pinyon-Juniper	☑
Rapidly declining							

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	H
Invasive or Exotic Species	Invasive plants	Research and Monitoring	Examine impact of post-fire management strategies	H
Lack of knowledge	Population status in areas outside National Park is poorly understood	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Invasive plants - especially musk thistle and cheatgrass moving into burned areas	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Lack of knowledge	Current threats are poorly understood on lands outside of the National Park	Research and Monitoring	Research species/habitat response to management or disturbance	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	L
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Astragalus tortipes

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Colorado Plateau	P	Desert Shrub	☐

Sleeping Ute milkvetch

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Conversion to cropland?	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Lack of knowledge	Response to disturbance	Research and Monitoring	Research species/habitat response to management or disturbance	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Boechera crandallii

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	P	Sagebrush	☑
				Sandy Areas	☐

Crandall's rock-cress

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Special Interestl Area)	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Boechera glareosa

Population Status	Population Trend	Habitat	Primary
Unknown	Unknown	Barrens	☑

NA

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Botrychium lineare

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Declining	D	Southern Rocky Mountains	P	Aspen Forest	☑
						Foothill/Mountain Grassland	☑
						Mixed Conifer	☐

Narrowleaf grape fern

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
		Research and Monitoring	Monitor population status	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Details of habitat unknown	Research and Monitoring	Determine habitat requirements	M

Botrychium tax. nov. "furcatum"

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	X	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑
					Spruce-Fir	☐

Fork-leaved moonwort

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Caesalpinia repens

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Sandy Areas	☑
Desert Shrub	☐

Creeping rush-pea

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Camissonia eastwoodiae

Population Status	Population Trend	Distribution	Type
Low	Unknown	Colorado Plateau	P

Habitat	Primary
Saltbrush Fans and Flats	☑
Pinyon-Juniper	☐

Eastwood evening primrose

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Carex stenoptila

Small-winged sedge

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Mountain Streams	☑
					Shrub-dominated Wetlands	☑
					Spruce-Fir	☑
					Aspen Forest	☐
					Exposed Rock	☐
					Rocky Mtn Bristlecone Pine	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Lack of knowledge	Threats unknown	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	M
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	M
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Recreation?	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Castilleja puberula

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Shrub Tundra	☑

Downy Indian-paintbrush

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Species Management	Maintain/update comprehensive species database	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L
Non-consumptive Disturbance	Recreation	Voluntary Standards	Implement Best Management Practices for recreation management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Cirsium perplexans

Adobe thistle

Tier 2 Plants

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Stable	D	Colorado Plateau	P	Sagebrush	☑
				Southern Rocky Mountains	P	Saltbrush Fans and Flats	☐
				Utah High Plateau	P		

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Most occurrences in disturbed areas and very few in natural settings; reasons unknown	Research and Monitoring	Research species/habitat response to management or disturbance	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
		Education and Communication	Educate land owners, managers, and those engaged in weed control about avoiding impacts to native thistles	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Bio-control of non-native Cirsium species	Invasive Species Control and Prevention	Design weed control activites to avoid native thistles and develop methods for mitigating impacts from bio-control agents such as introduced weevils	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution of natural occurrences	M
Lack of knowledge	Biology and ecology are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	L
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Cirsium scapanolepis

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Mixed Conifer	☑
Foothill/Mountain Grassland	☐
Mixed Forest	☐

Mountain-slope thistle

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Invasive or Exotic Species	Bio-control of non-native Cirsium species	Invasive Species Control and Prevention	Educate land owners, managers, and those engaged in weed control about avoiding impacts to native thistles	H
Invasive or Exotic Species	Bio-control of non-native Cirsium species	Invasive Species Control and Prevention	Design weed control activites to avoid native thistles and develop methods for mitigating impacts from bio-control agents such as introduced weevils	H
Lack of knowledge	Taxonomy	Research and Monitoring	Taxonomic work	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Bio-control of non-native Cirsium species	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M

Cleome multicaulis

Population Status		Population Trend		Distribution	Type
Medium	D	Declining	D	Southern Rocky Mountains	P

Habitat	Primary
Grass/Forb Dominated Wetlands	☑
Playas	☐

Slender spiderflower

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
		Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
		Research and Monitoring	Monitor population status	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Inventory historical range	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Corispermum navicula

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	☑
					Sandy Areas	☐

Boat-shaped bugseed

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Taxonomic work is needed	Research and Monitoring	Taxonomy	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Cryptantha gypsophila

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Colorado Plateau	P	Barrens	☑
			Southern Rocky Mountains	O	Pinyon-Juniper	☑

Gypsum Valley cat's- eye

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Oil and gas pipelines, roads, dust, etc.	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Non-consumptive Disturbance	Motor-powered recreation	Compatible Resource Use	Support off-road travel restrictions on public land	H
Resource Extraction	Oil and gas drilling and uranium mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Delphinium ramosum var. alpestre

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑

Colorado larkspur

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Delphinium robustum

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Cliff and Canyon	☑
Aspen Forest	☐

Wahatoya Creek larkspur

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Lack of knowledge	Biology, ecology, and detailed habitats are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Threats unknown	Research and Monitoring	Research species/habitat response to management or disturbance	M

Descurainia kenheilii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	X	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑

Heil's tansy mustard

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Dicoria wetherillii

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Unknown	☐

Wetherill's dicoria

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Distribution, status, habitat, biology/ecology, taxonomy, and threats are all unknown	Research and Monitoring	Basic research on all aspects of this species' conservation are needed	H

Draba exunguiculata

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Stable	D	Southern Rocky Mountains	P	Exposed Rock (alpine)	☐
						Meadow Tundra	☐

Clawless draba

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Numbers and distribution are poorly known	Research and Monitoring	Conduct field inventory to refine known distribution and abundance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M
Lack of knowledge	Biology, ecology, and habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	L
Natural Factors	Trampling by mountain goats	Research and Monitoring	Research species/habitat response to management or disturbance	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Draba graminea

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	☑
					Shrub Tundra	☐

San Juan whitlow-grass

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	L

Draba grayana

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	☐

Gray's Peak whitlow-grass

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Species Management	Maintain/update comprehensive species database	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Numbers and distribution are poorly known	Research and Monitoring	Conduct field inventory to refine known distribution and abundance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M
Lack of knowledge	Biology, ecology, and habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	L
Natural Factors	Trampling by mountain goats	Research and Monitoring	Research species/habitat response to management or disturbance	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Draba malpighiacea

Population Status	Population Trend	Distribution Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	Aspen Forest	☐
			Spruce-Fir	☐

Whitlow-grass

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Taxonomic status is uncertain	Research and Monitoring	Taxonomic work is needed	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Draba smithii

Smith whitlow-grass

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Cliff and Canyon	☑
					Aspen Forest	☐
					Mixed Forest	☐
					Upland Shrub	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Numbers and distribution are poorly known	Research and Monitoring	Conduct field inventory to refine known distribution and abundance	M
Lack of knowledge	Biology, ecology, and habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Draba weberi

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Mountain Streams	☑

Weber's draba

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Natural system modification (hydrological) - dam construction	Education and Communication	Educate dam operator about avoiding and/or mitigating impacts	M
Lack of knowledge	Biology, ecology, and habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Work with land manager to post No Trespassing signage	M

Erigeron kachinensis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
High	D	Unknown	Colorado Plateau	P	Cliff and Canyon	☑

Kachina daisy

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Maintain natural hydrologic regime	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Erigeron wilkenii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon	☑
					Pinyon-Juniper	☐

Wilken fleabane

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Threats poorly known	Research and Monitoring	Research species/habitat response to management or disturbance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Eriogonum brandegeei

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Stable	D	Southern Rocky Mountains	P	Barrens	☑
						Sagebrush	☐

Brandegee wild buckwheat

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Inform BLM travel management plan.	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Eriogonum clavellatum	Population Status		Population Trend	Distribution	Type	Habitat	Primary
	Low	D	Unknown	Colorado Plateau	P	Desert Shrub	☑
						Saltbrush Fans and Flats	☐

Comb Wash buckwheat

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Eriogonum coloradense

Colorado wild buckwheat

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Foothill/Mountain Grassland	☑
					Shrub Tundra	☑
					Meadow Tundra	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Biology and ecology are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Incompatible grazing?	Compatible Resource Use	Implement compatible grazing management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Eriogonum pelinophilum

Clay-loving wild buckwheat

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Declining	D	Colorado Plateau	P	Desert Shrub	☑
Rapidly declining							

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (extend existing ACEC)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Conversion to cropland	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads	Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Biology and ecology poorly known	Research and Monitoring	Determine minimum viable population requirements; transition probabilities between different plant stages; and viable seed production	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Eutrema edwardsii ssp. penlandii

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Southern Rocky Mountains	P	Meadow Tundra	☑

Penland alpine fen mustard

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., state Natural Area)	H
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	M
Resource Extraction	Mining	Voluntary Standards	Implement Best Management Practices for mining	M

Gaura neomexicana ssp. coloradensis

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Declining	D	Central Shortgrass Prairie Front Range	P	Eastern Plains Streams	☑
						Grass/Forb Dominated Wetlands	☑
						Seeps and Springs	☐
						Shrub-dominated Wetlands	☐

Colorado butterfly plant

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	H
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Gutierrezia elegans

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Barrens	☑
					Sagebrush	☐

Lone Mesa snakeweed

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Non-consumptive Disturbance	Infrastructure development for Park visitor use	Protected Area Management	Design public improvements to be compatible with biodiversity	H
Resource Extraction	Oil and gas drilling and seismic testing	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Water storage	Protected Area Management	Manage public use to be compatible with biodiversity	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	L

Hackelia besseyi

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	P	Mixed Conifer	☑

Bessey's stickseed

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Biology, ecology, and habitat poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Hackelia gracilenta

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Stable	D	Colorado Plateau	P	Pinyon-Juniper	☑
						Mixed Forest	☐

Mesa Verde stickseed

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L

Herrickia horrida

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Pinyon-Juniper	☑
					Cliff and Canyon	☐

Canadian River spiny aster

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Threats poorly known	Research and Monitoring	Research species/habitat response to management or disturbance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Ipomopsis aggregata ssp. weberi	Population Status		Population Trend	Distribution	Type	Habitat	Primary
	Low	D	Unknown	Southern Rocky Mountains	P	Mixed Conifer	☑

Rabbit Ears gilia

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Lack of knowledge	Genetics of isolated populations poorly understood	Research and Monitoring	Genetic studies to determine the isolation and genetic diversity of disparate occurrences	H
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Recreation	Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area)	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Indirect Consumptive Use (Mortality)	Grazing and trampling by native and non-native ungulates	Compatible Resource Use	Implement compatible grazing management	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	L
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	L
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	L
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L
Lack of knowledge	Reproductive and/or pollination biology unknown	Research and Monitoring	Research critical life history/habitat components	L
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Ipomopsis globularis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑
					Exposed Rock (alpine)	☐

Globe gilia

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Monitor occurrences for weed invasion and control promptly	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Lack of knowledge	Response to change is poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Biology, ecologyk, and specific habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Resource Extraction	Mining			M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Ipomopsis polyantha

Pagosa skyrocket

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Southern Rocky Mountains	P	Barrens	☑
Rapidly declining						Ponderosa Pine	☐

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Commerical and industrial development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads and Utilities	Voluntary Standards	Implement Best Management Practices for transportation and utility construction and maintenance	H
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	H
		Education and Communication	Implement landowner outreach/education program	M
		Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	M
Lack of knowledge	Biology, ecology, and specific habitat is poorly known	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge		Species Management	Seed banking for future restoration work	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lepidium crenatum

Alkaline pepperwort

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Colorado Plateau	P	Desert Shrub	☑
			Southern Rocky Mountains	P	Sagebrush	☐
			Utah-Wyoming Rocky Mountains	P		

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Threats poorly known	Research and Monitoring	Research species/habitat response to management or disturbance	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lesquerella calcicola

Rocky Mountain bladderpod

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Central Shortgrass Prairie	P	Barrens	☑
			Southern Rocky Mountains	O	Ponderosa Pine	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Resource Extraction	Mining (coal, sand/gravel, etc.)	Education and Communication	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Overhead utility lines and towers	Voluntary Standards	Implement Best Management Practices for urban development, landscaping, etc.	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lesquerella congesta

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Utah High Plateau	P	Barrens	☑

Dudley Bluffs bladderpod

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Utility and pipeline construction	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Response to change	Research and Monitoring	Investigate how plants respond to layers of dust deposited during resource extraction	H
Resource Extraction	Oil and gas drilling, and oil shale mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Lesquerella parviflora

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Utah High Plateau	P	Barrens	☑
				Southern Rocky Mountains	O	Cliff and Canyon	☐

Piceance bladderpod

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Resource Extraction	Oil and gas drilling, and oil shale mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Invasive plants (including leafy spurge)	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lesquerella pruinosa

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	☑
					Foothill/Mountain Grassland	☐

Pagosa bladderpod

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lesquerella vicina

Good-neighbor bladderpod

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑
			Southern Rocky Mountains	P	Desert Shrub	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Non-consumptive Disturbance	Recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Recreation	Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M

Limnorchis zothecina

Alcove bog orchid

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon	☑
					Seeps and Springs	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lomatium concinnum

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Colorado Plateau	P	Sagebrush	☑
				Southern Rocky Mountains	O	Barrens	☐

Colorado desert-parsley

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Non-consumptive Disturbance	Recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

Lupinus crassus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑
			Southern Rocky Mountains	P	Barrens	☐

Payson lupine

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Incompatible Grazing	Compatible Resource Use	Implement compatible grazing management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Lygodesmia doloresensis

Dolores River skeletonplant

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑
					Desert Shrub	☐

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Expand existing Palisade ACEC	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Machaeranthera coloradoensis

Colorado tansy-aster

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Foothill/Mountain Grassland	☑
					Exposed Rock	☐
					Meadow Tundra	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Additional information on habitat is needed	Research and Monitoring	Research critical habitat components	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Mentzelia rhizomata

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	☑
			Utah High Plateau	P		

Roan Cliffs blazing star

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern, state Natural Area)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Resource Extraction	Oil and gas drilling, and oil shale mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Mertensia humilis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Sagebrush	☑

Rocky Mountain bluebells

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Mimulus gemmiparus

Budding monkey flower

Tier 1 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Cliff and Canyon	☑
					Seeps and Springs	☑
					Grass/Forb Dominated Wetlands	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Lack of knowledge	Restoration techniques are poorly understood	Research and Monitoring	Restoration techniques (e.g., storage of propagules and reintroduction of plants)	L
Lack of knowledge	Threats and response to change are known	Research and Monitoring	Research species/habitat response to management or disturbance	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Nuttallia chrysantha

Golden blazing star

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Low	D	Declining	D	Central Shortgrass Prairie	P	Barrens	☑
				Southern Rocky Mountains	O	Pinyon-Juniper	☐

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Lack of knowledge	Taxonomy is poorly understood	Research and Monitoring	Taxonomic work	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Resource Extraction	Mining (coal, sand/gravel, etc.)	Education and Communication	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Overhead utility lines and towers	Voluntary Standards	Implement Best Management Practices for urban development, landscaping, etc.	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Nuttallia densa

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Pinyon-Juniper	☑
					Upland Shrub	☐

Arkansas Canyon stickleaf

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Non-consumptive Disturbance	Recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Implement landowner outreach/education program	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oenothera acutissima

Narrow-leaf evening primrose

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Grass/Forb Dominated Wetlands	☑
					Sagebrush	☐
			Wyoming Basin	O		

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Maintain and restore natural hydrologic regime	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oenothera harringtonii

Arkansas Valley evening primrose

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Central Shortgrass Prairie	P	Barrens	☑
					Shortgrass Prairie	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Implement landowner outreach/education program	M
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	M
Non-consumptive Disturbance	Motor-powered recreation or other off-road vehicular travel	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Resource Extraction	Mining (coal, sand/gravel, etc.)	Voluntary Standards	Implement Best Management Practices for energy development and mining	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oonopsis foliosa var. monocephala	Population Status		Population Trend	Distribution	Type	Habitat	Primary
	Medium	D	Unknown	Central Shortgrass Prairie	P	Shortgrass Prairie	☑
				Southern Rocky Mountains	O		

Rayless goldenweed

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Non-consumptive Disturbance	Motor-powered recreation or other off-road vehicular travel	Compliance and Enforcement	Manage off-road travel	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oonopsis puebloensis

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Central Shortgrass Prairie	P	Barrens	☑
						Shortgrass Prairie	☑

Pueblo goldenweed

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Implement landowner outreach/education program	H
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Non-consumptive Disturbance	Motor-powered recreation or other off-road vehicular travel	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Resource Extraction	Mining (limestone)	Education and Communication	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Overhead utility lines and towers	Voluntary Standards	Implement Best Management Practices for urban development, landscaping, etc.	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Opuntia heacockiae

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Pinyon-Juniper	☑

Heacock's prickly-pear

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Taxonomy is poorly understood	Research and Monitoring	Taxonomic work is needed	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Oreocarya osterhoutii

Population Status		Population Trend		Distribution	Type
Low	D	Stable	D	Colorado Plateau	P

Habitat	Primary
Barrens	☑
Desert Shrub	☐

Osterhout cat's-eye

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oreoxis humilis

Population Status		Population Trend		Distribution	Type	Habitat	Primary
High	D	Stable	D	Southern Rocky Mountains	P	Exposed Rock (alpine)	☐
						Meadow Tundra	☐

Pikes Peak spring parsley

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Taxonomy is poorly understood	Research and Monitoring	Assess taxonomic status and relationship to Oreoxis alpina	M
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Non-consumptive Disturbance	Non-motorized recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oxybaphus rotundifolius	Population Status		Population Trend		Distribution	Type	Habitat	Primary
	Medium	D	Declining	D	Central Shortgrass Prairie	P	Barrens	☑

Round-leaf four o'clock

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Implement landowner outreach/education program	H
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Non-consumptive Disturbance	Motor-powered recreation or other off-road vehicular travel	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Resource Extraction	Mining (limestone)	Education and Communication	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Overhead utility lines and towers	Voluntary Standards	Implement Best Management Practices for urban development, landscaping, etc.	M
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Oxytropis besseyi var. obnapiformis

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Wyoming Basin	P	Sagebrush	☑
			Utah High Plateau		Pinyon-Juniper	☐

Bessey locoweed

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	M

Pediocactus knowltonii

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Colorado Plateau	P	Pinyon-Juniper	☑

Knowlton cactus

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Direct Consumptive Use (Mortality)	Gathering/Collecting	Compliance and Enforcement	Enforce collecting regulations	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon crandallii ssp. procumbens

Population Status	Population Trend	Distribution	Type
Unknown	Unknown	Southern Rocky Mountains	P

Crandall's beardtongue

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Taxonomy is poorly understood	Research and Monitoring	Taxonomic work is needed	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Penstemon debilis

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Southern Rocky Mountains	P	Barrens	☑
				Utah High Plateau	P		

Parachute penstemon

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Reproductive and/or pollination biology unknown	Research and Monitoring	Research pollinator biology	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon degeneri

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Pinyon-Juniper	☑
					Foothill/Mountain Grassland	☐

Degener beardtongue

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon fremontii var. glabrescens

Fremont's beardtongue

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah High Plateau	P	Sagebrush	☑
			Wyoming Basin	O		

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon gibbensii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Wyoming Basin	P	Barrens	☑
			Utah-Wyoming Rocky Mountains	O	Pinyon-Juniper	☐

Gibben's beardtongue

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Non-consumptive Disturbance	Motor-powered recreation and other off-road vehicular travel	Voluntary Standards	Implement Best Management Practices for travel management	H
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Penstemon grahamii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Wyoming Basin	P	Barrens	☑
					Pinyon-Juniper	☐

Graham beardtongue

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Resource Extraction	Oil and gas drilling and seismic exploration	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon penlandii

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Southern Rocky Mountains	P	Sagebrush	☑
						Upland Shrub	☐

Penland penstemon

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area, Acrea of Critical Environmental Concern))	H
		Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	H
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Non-consumptive Disturbance	Motor-powered recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon scariosus var. albifluvis

White River penstemon

Tier 1 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Wyoming Basin	P	Barrens	☑
			Utah High Plateau	O	Desert Shrub	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Penstemon scariosus var. cyanomontanus

Plateau penstemon

Tier 2 Plants

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Utah-Wyoming Rocky Mountains	P	Pinyon-Juniper	☑
						Desert Shrub	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
		Research and Monitoring	Monitor population status	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Incompatible Grazing	Compatible Resource Use	Implement compatible grazing management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Penstemon teucrioides	Population Status	Population Trend	Distribution	Type	Habitat	Primary
	Unknown	Unknown	Southern Rocky Mountains	P	Sagebrush	☑

Germander beardtongue

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Taxonomy is poorly understood	Research and Monitoring	Taxonomic work is needed	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Phacelia formosula

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Southern Rocky Mountains	P	Barrens	☑

North Park phacelia

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	H
		Land Protection (Public, Private), Easements, and Resource Rights	Expand existing ACECs and create new ACEC in Larimer County	H
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Lack of knowledge	Taxonomy of Larimer County population is poorly understood	Research and Monitoring	Taxonomic work is needed for Larimer County population	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
		Capacity Building and Cooperation	Coordinate with related agencies to align goals, policies, measures of success, etc.	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads and Powerlines	Voluntary Standards	Implement Best Management Practices for transportation and powerline corridors	M
Indirect Consumptive Use (Mortality)	Incompatible grazing?	Research and Monitoring	Research species/habitat response to management or disturbance	M
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Phacelia submutica

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Utah High Plateau	P	Barrens	☑
			Southern Rocky Mountains	O		

DeBeque phacelia

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Non-consumptive Disturbance	Motor-powered recreation	Voluntary Standards	Implement Best Management Practices for recreation management	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Lack of knowledge	Population dynamics and vulnerability to disturbance are poorly known	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Biology and ecology are poorly known	Research and Monitoring	Conduct studies on demography and reproductive biology	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Physaria alpina

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	☐

Avery Peak twinpod

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	M

Physaria bellii

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Central Shortgrass Prairie	P	Barrens	☑
				Front Range	P		

Bell's twinpod

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads or Railroads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Physaria obcordata

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Utah High Plateau	P	Barrens	☑

Piceance twinpod

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Utility and pipeline construction	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Response to change	Research and Monitoring	Investigate how plants respond to layers of dust deposited during resource extraction	H
Resource Extraction	Oil and gas drilling, and oil shale mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Physaria pulvinata

Cushion bladderpod

Tier 1 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	☑
					Deciduous Oak	☐
					Ponderosa Pine	☐
					Sagebrush	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution on private land	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Non-consumptive Disturbance	Infrastructure development for Park visitor use at Lone Mesa	Protected Area Management	Design public improvements to be compatible with biodiversity	H
Resource Extraction	Oil and gas drilling and seismic testing	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Water storage	Protected Area Management	Manage public use to be compatible with biodiversity	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Physaria rollinsii

Rollins twinpod

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Barrens	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Physaria scrotiformis

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Unknown	Unknown	Southern Rocky Mountains	P	Barrens	☐
				Meadow Tundra	☐
				Spruce-Fir	☐

West Silver bladderpod

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Potentilla rupincola

Population Status	Population Trend	Distribution	Type	Habitat	Primary
Medium D	Unknown	Southern Rocky Mountains	P	Cliff and Canyon	☑
					☐

Rocky Mountain cinquefoil

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	L
Invasive or Exotic Species	Invasive plants	Research and Monitoring	Monitor populations for introduction of new weeds	L
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Ptilagrostis porteri

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Declining	D	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	☑

Porter feathergrass

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Research Natural Area, Special Interest Area)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Land Protection (Public, Private), Easements, and Resource Rights	Establish in-stream flow rights	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	H
Resource Extraction	Mining (peat, placer)	Education and Communication	Educate miners about avoiding and/or mitigating impacts	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	M
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	M
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	M
Lack of knowledge	Response to change is poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Restoration methods are poorly understood	Research and Monitoring	Seed banking and identification of effective restoration methods	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Puccinellia parishii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	☑

Parish's alkali grass

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Maintain natural hydrologic regime	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

Salix arizonica

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Shrub-dominated Wetlands	☑

Arizona willow

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Indirect Consumptive Use (Mortality)	Incompatible Grazing	Compatible Resource Use	Implement compatible grazing management	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Saussurea weberi

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑

Weber saussurea

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history (e.g., is species rhizomatous?)/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	M
Resource Extraction	Mining	Voluntary Standards	Implement Best Management Practices for mining	M
Non-consumptive Disturbance	Non-motorized recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Sclerocactus glaucus

Colorado hookless cactus

Tier 1 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Desert Shrub	☑
			Utah High Plateau	P		
			Southern Rocky Mountains	O		

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Degradation	Roads, powerlines, and pipelines	Voluntary Standards	Implement Best Management Practices for energy development and transportation projects	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Sclerocactus mesae-verdae

Mesa Verde hookless cactus

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Colorado Plateau	P	Barrens	☑
					Saltbrush Fans and Flats	☐

Tier 1 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Direct Consumptive Use (Mortality)	Gathering/Collecting	Compliance and Enforcement	Enforce collecting regulations	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M
Natural Factors	Insect herbivory	Research and Monitoring	Monitor population status	M
Direct Consumptive Use (Mortality)	Gathering/Collecting	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Sisyrinchium pallidum

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	☑

Pale blue-eyed-grass

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Special Interest Area, Research Natural Area, Area of Critical Environmental Concern, state Natural Area)	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	H
Resource Extraction	Peat mining	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Resource Extraction	Peat mining	Voluntary Standards	Implement Best Management Practices for mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Non-consumptive Disturbance	Recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Spiranthes diluvialis

Ute ladies'-tresses

Tier 1 Plants

Population Status		Population Trend	
Low	D	Declining	D

Distribution	Type
Front Range	P
Southern Rocky Mountains	P
Central Shortgrass Prairie	O
Utah-Wyoming Rocky Mountains	O

Habitat	Primary
Grass/Forb Dominated Wetlands	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Protected Area Management	Manage public use to be compatible with biodiversity	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Compliance and Enforcement	Enforce 404 wetlands regulations	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrologic regime	H
		Research and Monitoring	Monitor population status	M
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Telesonix jamesii

James telesonix

Tier 2 Plants

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Cliff and Canyon	☑
					Meadow Tundra	☐
					Mixed Conifer	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Non-consumptive Disturbance	Recreation	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M

Thalictrum heliophilum

Sun-loving meadow rue

Tier 2 Plants

Population Status		Population Trend		Distribution	Type	Habitat	Primary
Medium	D	Stable	D	Utah High Plateau	P	Barrens	☑
				Southern Rocky Mountains	O		

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
		Research and Monitoring	Monitor population status	H
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Monitor for the presence of noxious weeds and implement weed control immediately if detected	H
Resource Extraction	Oil and gas drilling, and oil shale mining	Voluntary Standards	Implement Best Management Practices for energy development and mining	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Response to change poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Biology and ecology are poorly known	Research and Monitoring	Research critical life history/habitat components	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Thelypodiopsis juniperorum

Juniper tumble mustard

Tier 2 Plants

Population Status	Population Trend
Unknown	Unknown

Distribution	Type
Colorado Plateau	P
Southern Rocky Mountains	O
Utah High Plateau	O

Habitat	Primary
Pinyon-Juniper	☑
Sagebrush	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	M
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L
Resource Extraction	Oil and gas drilling	Voluntary Standards	Implement Best Management Practices for energy development and mining	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Thelypodium paniculatum

Population Status	Population Trend
Unknown	Unknown

Habitat	Primary
Grass/Forb Dominated Wetlands	☑

Northwestern thelypody

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	H
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Townsendia fendleri

Population Status		Population Trend
Low	D	Unknown

Distribution	Type
Central Shortgrass Prairie	P
Southern Rocky Mountains	P

Habitat	Primary
Barrens	☑

Fendler's townsend‑daisy

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	M
Indirect Consumptive Use (Mortality)	Grazing	Compatible Resource Use	Implement compatible grazing management	L

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 3. - Continued.

Townsendia glabella

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Low	D	Unknown	Southern Rocky Mountains	P	Barrens	☑
			Colorado Plateau	O		

Gray's townsend‑daisy

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	H
Habitat Degradation	Roads	Voluntary Standards	Implement Best Management Practices for transportation projects	H
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M

Townsendia rothrockii

Population Status		Population Trend	Distribution	Type	Habitat	Primary
Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra	☑
					Spruce-Fir	☐

Rothrock townsend‑daisy

Tier 2 Plants

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barriers, poor dispersal capacity, and/or restriction to rare habitat features	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	H
Climate	Habitat shifting and alteration due to climate change	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	H
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown	Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	H
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	H
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Threats and response to change are poorly understood	Research and Monitoring	Research species/habitat response to management or disturbance	M
Lack of knowledge	Biology, ecology, and detailed habitat are poorly known	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	M
Lack of knowledge	Population status unknown	Research and Monitoring	Monitor population status	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

Table 4. Key Plant Habitats – Priorities, Threats, and Conservation Actions Sorted by Priority (High, Medium, Low), Habitat Type, and Habitat Name.

Very High Priority — **Shrub Tundra** — **Alpine**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Eriogonum coloradense	Colorado wild buckwheat	☑
Plants	Castilleja puberula	Downy Indian-paintbrush	☑
Plants	Draba graminea	San Juan whitlow-grass	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Legislation, Policies and Regulations	Reduce CO2 emissions	H
Climate	Habitat shifting and alteration due to climate change	Research and Monitoring	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define conservation needs	H

Very High Priority — **Exposed Rock (alpine)** — **Alpine**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Oreoxis humilis	Pikes Peak spring parsley	☐
Plants	Aliciella sedifolia	Stonecrop gilia	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Physaria alpina	Avery Peak twinpod	☐
Plants	Draba exunguiculata	Clawless draba	☐
Plants	Ipomopsis globularis	Globe gilia	☐
Plants	Draba grayana	Gray's Peak whitlow-grass	☐
Plants	Draba graminea	San Juan whitlow-grass	☑

Very High Priority — **Meadow Tundra** — **Alpine**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Botrychium tax. nov. "furcatum"	Fork-leaved moonwort	☑
Plants	Descurainia kenheilii	Heil's tansy mustard	☑
Plants	Eutrema edwardsii ssp. penlandii	Penland alpine fen mustard	☑
Plants	Oreoxis humilis	Pikes Peak spring parsley	☐
Plants	Aliciella sedifolia	Stonecrop gilia	☑
Plants	Physaria scrotiformis	West Silver bladderpod	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Draba exunguiculata	Clawless draba	☐
Plants	Delphinium ramosum var. alpestre	Colorado larkspur	☑
Plants	Machaeranthera coloradoensis	Colorado tansy-aster	☐
Plants	Eriogonum coloradense	Colorado wild buckwheat	☐
Plants	Ipomopsis globularis	Globe gilia	☑
Plants	Telesonix jamesii	James telesonix	☐
Plants	Townsendia rothrockii	Rothrock townsend-daisy	☑
Plants	Saussurea weberi	Weber saussurea	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Legislation, Policies and Regulations	Reduce CO2 emissions	H
Climate	Habitat shifting and alteration due to climate change	Research and Monitoring	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define conservation needs	H
Habitat Degradation	Altered native vegetation	Recreation Management	Implement compatible recreation management and trail network to avoid development of social trails and trampling of sensitive vegetation	L

Table 4. - Continued.

Very High Priority **Barrens** **Sparsely Vegetated**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Corispermum navicula	Boat-shaped bugseed	☑
Plants	Eriogonum brandegeei	Brandegee wild buckwheat	☑
Plants	Physaria pulvinata	Cushion bladderpod	☑
Plants	Phacelia submutica	DeBeque phacelia	☑
Plants	Lesquerella congesta	Dudley Bluffs bladderpod	☑
Plants	Penstemon gibbensii	Gibben's beardtongue	☑
Plants	Cryptantha gypsophila	Gypsum Valley cat's- eye	☑
Plants	Gutierrezia elegans	Lone Mesa snakeweed	☑
Plants	Sclerocactus mesae-verdae	Mesa Verde hookless cactus	☑
Plants	Boechera glareosa	NA	☑
Plants	Phacelia formosula	North Park phacelia	☑
Plants	Ipomopsis polyantha	Pagosa skyrocket	☑
Plants	Penstemon debilis	Parachute penstemon	☑
Plants	Physaria obcordata	Piceance twinpod	☑
Plants	Physaria scrotiformis	West Silver bladderpod	☐
Plants	Penstemon scariosus var. albifluvis	White River penstemon	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Oenothera harringtonii	Arkansas Valley evening primrose	☑
Plants	Physaria bellii	Bell's twinpod	☑
Plants	Lomatium concinnum	Colorado desert-parsley	☐
Plants	Astragalus debequaeus	DeBeque milkvetch	☑
Plants	Townsendia fendleri	Fendler's townsend-daisy	☑
Plants	Nuttallia chrysantha	Golden blazing star	☑
Plants	Penstemon grahamii	Graham beardtongue	☑
Plants	Townsendia glabella	Gray's townsend-daisy	☑
Plants	Oreocarya osterhoutii	Osterhout cat's-eye	☑
Plants	Lesquerella pruinosa	Pagosa bladderpod	☑
Plants	Lupinus crassus	Payson lupine	☐
Plants	Lesquerella parviflora	Piceance bladderpod	☑
Plants	Oonopsis puebloensis	Pueblo goldenweed	☑
Plants	Mentzelia rhizomata	Roan Cliffs blazing star	☑
Plants	Lesquerella calcicola	Rocky Mountain bladderpod	☑
Plants	Physaria rollinsii	Rollins twinpod	☑
Plants	Oxybaphus rotundifolius	Round-leaf four o'clock	☑
Plants	Thalictrum heliophilum	Sun-loving meadow rue	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	H
Habitat Degradation	Oil and gas development	Compatible Resource Use	Implement compatible mining practices	H

Table 4. - Continued.

High Priority **Pinyon-Juniper** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Lygodesmia doloresensis	Dolores River skeletonplant	☑
Plants	Penstemon gibbensii	Gibben's beardtongue	☐
Plants	Cryptantha gypsophila	Gypsum Valley cat's- eye	☑
Plants	Astragalus lonchocarpus var. hamiltonii	Hamilton milkvetch	☑
Plants	Pediocactus knowltonii	Knowlton cactus	☑
Plants	Hackelia gracilenta	Mesa Verde stickseed	☑
Plants	Astragalus schmolliae	Schmoll milkvetch	☑
Plants	Astragalus microcymbus	Skiff milkvetch	☐
Plants	Erigeron wilkenii	Wilken fleabane	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Nuttallia densa	Arkansas Canyon stickleaf	☑
Plants	Oxytropis besseyi var. obnapiformis	Bessey locoweed	☐
Plants	Herrickia horrida	Canadian River spiny aster	☑
Plants	Astragalus debequaeus	DeBeque milkvetch	☑
Plants	Penstemon degeneri	Degener beardtongue	☑
Plants	Asclepias uncialis ssp. uncialis	Dwarf milkweed	☐
Plants	Camissonia eastwoodiae	Eastwood evening primrose	☐
Plants	Astragalus piscator	Fisher Towers milkvetch	☐
Plants	Nuttallia chrysantha	Golden blazing star	☐
Plants	Lesquerella vicina	Good-neighbor bladderpod	☑
Plants	Penstemon grahamii	Graham beardtongue	☐
Plants	Opuntia heacockiae	Heacock's prickly-pear	☑
Plants	Astragalus equisolensis	Horseshoe milkvetch	☑
Plants	Thelypodiopsis juniperorum	Juniper tumble mustard	☑
Plants	Aletes macdougalii ssp. breviradiatus	Mesa Verde aletes	☑
Plants	Astragalus naturitensis	Naturita milkvetch	☑
Plants	Lupinus crassus	Payson lupine	☑
Plants	Penstemon scariosus var. cyanomontanus	Plateau penstemon	☑
Plants	Astragalus rafaelensis	San Rafael milkvetch	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Planning and Zoning	Promote zoning that concentrates use and protects habitat	M
Habitat Degradation	Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.)	Compatible Resource Use	Implement compatible grazing management	M
Habitat Degradation	Oil and gas development	Compatible Resource Use	Implement compatible mining practices	M

High Priority **Douglas Fir** **Forestlands**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Aquilegia chrysantha var. rydbergii	Golden columbine	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered fire regime	Maintain or Restore Natural Processes	Restore natural fire regime	M
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	L

Table 4. - Continued.

High Priority **Eastern Plains Streams** **Riparian/Wetlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	☑

Tier 2 Species

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered hydrological regime (aquifer)	Maintain or Restore Natural Processes	Reduce ground-water pumping	H
Habitat Degradation	Altered hydrological regime (surface)	Maintain or Restore Natural Processes	Adjust operation of dam	M
Habitat Degradation	Decreased water quality	Maintain or Restore Natural Processes	Improve erosion and excess sedimentation conditions	M
Invasive or Exotic Species	Invasive plants - tamarisk and Russian Olive	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Pollution	Herbicide/pesticide spraying or runoff	Voluntary Standards	Implement Best Management Practices for agricultural production	M
Pollution	Nutrient loads	Voluntary Standards	Implement Best Management Practices for agricultural production	M

High Priority **Grass/Forb Dominated Wetlands** **Riparian/Wetlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Mimulus gemmiparus	Budding monkey flower	☐
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	☑
Plants	Spiranthes diluvialis	Ute ladies'-tresses	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Oenothera acutissima	Narrow-leaf evening primrose	☑
Plants	Thelypodium paniculatum	Northwestern thelypody	☑
Plants	Sisyrinchium pallidum	Pale blue-eyed-grass	☑
Plants	Puccinellia parishii	Parish's alkali grass	☑
Plants	Ptilagrostis porteri	Porter feathergrass	☑
Plants	Cleome multicaulis	Slender spiderflower	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrological regime	H
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	H
Indirect Consumptive Use	Incompatible grazing	Compatible Resource Use	Implement compatible grazing management	M

High Priority **Mountain Streams** **Riparian/Wetlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Draba weberi	Weber's draba	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Aquilegia chrysantha var. rydbergii	Golden columbine	☑
Plants	Carex stenoptila	Small-winged sedge	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Adjust operation of dam and ditches	L
Invasive or Exotic Species	Invasive animals	Invasive Species Control and Prevention	Control non-native fish	L

Table 4. - Continued.

High Priority **Playas** **Riparian/Wetlands**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Cleome multicaulis	Slender spiderflower	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Conversion to cropland	Maintain or Restore Habitat	Restore native prairie	H
Lack of knowledge	Complete distribution in Colorado unknown	Research and Monitoring	Conduct field inventory to refine known distribution	H
Habitat Degradation	Replace ephemeral playa with longer-term water catchment	Maintain or Restore Habitat	Restore playa	M

High Priority **Shrub-dominated Wetlands** **Riparian/Wetlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Salix arizonica	Arizona willow	☑
Plants	Carex stenoptila	Small-winged sedge	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.)	Maintain or Restore Habitat	Manage grazing for compatible vegetation height, structure, etc.	H
Invasive or Exotic Species	Invasive plants - tamarisk	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Adjust operation of dam and ditches	M
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M

High Priority **Seeps and Springs** **Riparian/Wetlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Mimulus gemmiparus	Budding monkey flower	☑
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Limnorchis zothecina	Alcove bog orchid	☐
Plants	Aquilegia chrysantha var. rydbergii	Golden columbine	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Invasive or exotic species	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Habitat Degradation	Invasive or exotic species	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Restore natural hydrological regime	M

Table 4. - Continued.

High Priority **Sand Dunes Complex (Shrubland)** **Shrublands**

Tier 1 Species **Tier 2 Species**

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Conversion to cropland	Maintain or Restore Habitat	Re-seed native species	H

High Priority **Desert Shrub** **Shrublands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Aletes latilobus	Canyonlands aletes	☐
Plants	Eriogonum pelinophilum	Clay-loving wild buckwheat	☑
Plants	Sclerocactus glaucus	Colorado hookless cactus	☑
Plants	Lygodesmia doloresensis	Dolores River skeletonplant	☐
Plants	Astragalus lonchocarpus var. hamiltonii	Hamilton milkvetch	☐
Plants	Astragalus tortipes	Sleeping Ute milkvetch	☐
Plants	Penstemon scariosus var. albifluvis	White River penstemon	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Lepidium crenatum	Alkaline pepperwort	☑
Plants	Eriogonum clavellatum	Comb Wash buckwheat	☑
Plants	Caesalpinia repens	Creeping rush-pea	☐
Plants	Astragalus cronquistii	Cronquist milkvetch	☑
Plants	Astragalus debequaeus	DeBeque milkvetch	☐
Plants	Astragalus piscator	Fisher Towers milkvetch	☐
Plants	Lesquerella vicina	Good-neighbor bladderpod	☐
Plants	Oreocarya osterhoutii	Osterhout cat's-eye	☐
Plants	Penstemon scariosus var. cyanomontanus	Plateau penstemon	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	M

Table 4. - Continued.

High Priority — Sagebrush — Shrublands

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Eriogonum brandegeei	Brandegee wild buckwheat	☐
Plants	Physaria pulvinata	Cushion bladderpod	☐
Plants	Astragalus osterhoutii	Kremmling milkvetch	☑
Plants	Gutierrezia elegans	Lone Mesa snakeweed	☐
Plants	Penstemon penlandii	Penland penstemon	☑
Plants	Astragalus microcymbus	Skiff milkvetch	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Cirsium perplexans	Adobe thistle	☑
Plants	Lepidium crenatum	Alkaline pepperwort	☐
Plants	Oxytropis besseyi var. obnapiformis	Bessey locoweed	☑
Plants	Lomatium concinnum	Colorado desert-parsley	☑
Plants	Boechera crandallii	Crandall's rock-cress	☑
Plants	Astragalus debequaeus	DeBeque milkvetch	☐
Plants	Penstemon fremontii var. glabrescens	Fremont's beardtongue	☑
Plants	Penstemon teucrioides	Germander beardtongue	☑
Plants	Astragalus anisus	Gunnison milkvetch	☑
Plants	Thelypodiopsis juniperorum	Juniper tumble mustard	☐
Plants	Oenothera acutissima	Narrow-leaf evening primrose	☐
Plants	Astragalus naturitensis	Naturita milkvetch	☐
Plants	Mertensia humilis	Rocky Mountain bluebells	☑
Plants	Astragalus iodopetalus	Violet milkvetch	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered native vegetation (low forb and grass diversity)	Restore Habitat	Re-seed native species	H
Habitat Degradation	Altered native vegetation (low forb and grass diversity)	Compatible Resource Use	Implement compatible grazing management	H
Habitat Degradation	Oil and gas pipelines	Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	H
Habitat Degradation	Fragmentation	Voluntary Standards	Implement Best Management Practices for energy development and mining (reduce footprint and/or extend implementation timeline)	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	M
Habitat Degradation	Altered native vegetation (juniper encroachment)	Maintain or Restore Habitat	Remove trees/shrubs	M
Habitat Degradation	Altered fire regime	Maintain or Restore Natural Processes	Restore natural fire regime	M
Habitat Degradation	Overhead utility lines and towers	Voluntary Standards	Implement Best Management Practices for energy development and mining (bury or consolidate lines)	M

High Priority — Upland Shrub — Shrublands

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Penstemon penlandii	Penland penstemon	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Nuttallia densa	Arkansas Canyon stickleaf	☐
Plants	Draba smithii	Smith whitlow-grass	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	H
Habitat Degradation	Altered fire regime	Maintain or Restore Natural Processes	Restore natural fire regime	M
Habitat Degradation	Recreation	Recreation Management	Implement compatible recreation management	M

Table 4. - Continued.

High Priority **Saltbrush Fans and Flats** **Shrublands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Sclerocactus mesae-verdae	Mesa Verde hookless cactus	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Cirsium perplexans	Adobe thistle	☐
Plants	Eriogonum clavellatum	Comb Wash buckwheat	☐
Plants	Camissonia eastwoodiae	Eastwood evening primrose	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	M

High Priority **Deciduous Oak** **Shrublands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Physaria pulvinata	Cushion bladderpod	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Astragalus missouriensis var. humistratus	Missouri milkvetch	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	M

Table 4. - Continued.

High Priority **Cliff and Canyon** **Sparsely Vegetated**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Mimulus gemmiparus	Budding monkey flower	☑
Plants	Aletes latilobus	Canyonlands aletes	☑
Plants	Astragalus deterior	Cliff-palace milkvetch	☑
Plants	Astragalus humillimus	Mancos milkvetch	☑
Plants	Erigeron wilkenii	Wilken fleabane	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Limnorchis zothecina	Alcove bog orchid	☑
Plants	Anticlea vaginatus	Alcove death camas	☑
Plants	Herrickia horrida	Canadian River spiny aster	☐
Plants	Telesonix jamesii	James telesonix	☑
Plants	Erigeron kachinensis	Kachina daisy	☑
Plants	Aletes humilis	Larimer aletes	☑
Plants	Astragalus naturitensis	Naturita milkvetch	☑
Plants	Lesquerella parviflora	Piceance bladderpod	☐
Plants	Potentilla rupincola	Rocky Mountain cinquefoil	☑
Plants	Draba smithii	Smith whitlow-grass	☑
Plants	Delphinium robustum	Wahatoya Creek larkspur	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Maintain or restore natural hydrological regime	M

High Priority **Exposed Rock** **Sparsely Vegetated**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Machaeranthera coloradoensis	Colorado tansy-aster	☐
Plants	Carex stenoptila	Small-winged sedge	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Cave/mine closures	Compliance and Enforcement	Manage recreation and/or permitted activities (e.g., rock climing, grazing leases)	M
Non-consumptive Disturbance	Non-motorized recreation (including caving and climbing)	Compliance and Enforcement	Manage recreation and/or permitted activities (e.g., rock climing, grazing leases)	M

Table 4. - Continued.

Medium Priority **Mixed Forest** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Hackelia gracilenta	Mesa Verde stickseed	☐
Plants	Cirsium scapanolepis	Mountain-slope thistle	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Draba smithii	Smith whitlow-grass	☐
Plants	Astragalus iodopetalus	Violet milkvetch	☐

Medium Priority **Rocky Mtn Bristlecone Pine** **Forestlands**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Carex stenoptila	Small-winged sedge	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Legislation, Policies and Regulations	Reduce CO2 emissions	M
Climate	Habitat shifting and alteration due to climate change	Research and Monitoring	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define conservation needs	M

Medium Priority **Mixed Conifer** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Cirsium scapanolepis	Mountain-slope thistle	☑

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Hackelia besseyi	Bessey's stickseed	☑
Plants	Telesonix jamesii	James telesonix	☐
Plants	Botrychium lineare	Narrowleaf grape fern	☐
Plants	Ipomopsis aggregata ssp. weberi	Rabbit Ears gilia	☑

Table 4. - Continued.

Medium Priority **Aspen Forest** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Draba malpighiacea	Whitlow-grass	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Botrychium lineare	Narrowleaf grape fern	☑
Plants	Carex stenoptila	Small-winged sedge	☐
Plants	Draba smithii	Smith whitlow-grass	☐
Plants	Delphinium robustum	Wahatoya Creek larkspur	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered fire regime	Maintain or Restore Natural Processes	Restore natural fire regime	H
Natural Factors	Eradication of aspen sprouts by browsing animals	Maintain or Restore Natural Processes	Manage natural herbivory	H
Disease	Sudden Aspen Death	Research and Monitoring	Condtinue research on causes and management options	M
Disease	Sudden Aspen Death	Species Management	Stimulate clone regeneration through burning, cutting, or other methods before root systems become too weak to respond.	M

Medium Priority **Ponderosa Pine** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Physaria pulvinata	Cushion bladderpod	☐
Plants	Ipomopsis polyantha	Pagosa skyrocket	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Aletes humilis	Larimer aletes	☐
Plants	Astragalus missouriensis var. humistratus	Missouri milkvetch	☑
Plants	Lesquerella calcicola	Rocky Mountain bladderpod	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	H
Habitat Degradation	Altered native vegetation (increased tree density)	Maintain or Restore Habitat	Remove trees/shrubs	H
Habitat Degradation	Altered fire regime	Maintain or Restore Natural Processes	Restore natural fire regime	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Implement Purchase/Transfer Development Rights program for habitat protection	M
Habitat Degradation	Fragmentation	Planning and Zoning	Promote zoning that concentrates use and protects habitat	M
Habitat Degradation	Roads or Railroads	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

Medium Priority **Spruce-Fir** **Forestlands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Botrychium tax. nov. "furcatum"	Fork-leaved moonwort	☐
Plants	Physaria scrotiformis	West Silver bladderpod	☐
Plants	Draba malpighiacea	Whitlow-grass	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Townsendia rothrockii	Rothrock townsend-daisy	☐
Plants	Carex stenoptila	Small-winged sedge	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Habitat shifting and alteration due to climate change	Legislation, Policies and Regulations	Reduce CO2 emissions	M
Climate	Habitat shifting and alteration due to climate change	Research and Monitoring	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define conservation needs	M

Table 4. - Continued.

Medium Priority **Shortgrass Prairie** **Grasslands**

Tier 1 Species

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Oenothera harringtonii	Arkansas Valley evening primrose	☑
Plants	Asclepias uncialis ssp. uncialis	Dwarf milkweed	☑
Plants	Oonopsis puebloensis	Pueblo goldenweed	☑
Plants	Oonopsis foliosa var. monocephala	Rayless goldenweed	☑

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)	Legislation, Policies and Regulations	Reduce CO2 emissions	H
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose	H
Habitat Conversion	Conversion to cropland	Maintain or Restore Habitat	Avoid destruction of large tracts of native habitat (e.g., ski area development, sod-busting)	H
Habitat Degradation	Altered animal community (loss of herbivores, esp. BTPD complexes, predators, pollintors, etc.)	Education and Communication	Implement landowner outreach/education program	H
Habitat Degradation	Roads or Railroads (super slab)	Research and Monitoring	Research habitat response to management	H
Indirect Consumptive Use	Grazing	Maintain or Restore Habitat	Maintain appropriate patch size and habitat mosaic	H
Habitat Degradation	Altered native vegetation (woody encroachment, seral stage imbalance, etc.)	Compatible Resource Use	Implement compatible grazing management	M
Habitat Conversion	Conversion to cropland	Maintain or Restore Habitat	Restore native prairie	L
Habitat Degradation	Natural system modification (terrestrial) - windbreaks, agricultural methods such as tilling, pitting	Maintain or Restore Habitat	Discourage planting windbreaks	L
Habitat Degradation	Overhead utility lines and towers	Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	L
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	L

Medium Priority **Foothill/Mountain Grassland** **Grasslands**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Cirsium scapanolepis	Mountain-slope thistle	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Machaeranthera coloradoensis	Colorado tansy-aster	☑
Plants	Eriogonum coloradense	Colorado wild buckwheat	☑
Plants	Penstemon degeneri	Degener beardtongue	☐
Plants	Astragalus missouriensis var. humistratus	Missouri milkvetch	☐
Plants	Botrychium lineare	Narrowleaf grape fern	☑
Plants	Lesquerella pruinosa	Pagosa bladderpod	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered native vegetation	Compatible Resource Use	Manage grazing to maintain full suite of native grassland species	M
Habitat Degradation	Invasive or exotic species	Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M

Table 4. - Continued.

Medium Priority **Sandy Areas** **Sparsely Vegetated**

Tier 1 Species

Group	Species	Common Name	Primary
Plants	Corispermum navicula	Boat-shaped bugseed	☐

Tier 2 Species

Group	Species	Common Name	Primary
Plants	Boechera crandallii	Crandall's rock-cress	☐
Plants	Caesalpinia repens	Creeping rush-pea	☑
Plants	Astragalus piscator	Fisher Towers milkvetch	☑
Plants	Aletes macdougalii ssp. breviradiatus	Mesa Verde aletes	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Recreation (motorized)	Recreation Management	Implement compatible recreation management	M

Part 7: STRATEGIES FOR MONITORING SPECIES, HABITATS, AND SUCCESS OF CONSERVATION ACTIONS

Species and Habitats

Nineteen PGCN are currently being monitored to help understand long-term trends and/or impacts of various land use activities (Box 1). Priorities for additional species monitoring are G1 ranked PGCN, and those with suspected downward trends. PGCN most in need of population status monitoring include:

1. Sleeping Ute milkvetch (*Astragalus tortipes*)
2. Boat-shaped bugseed (*Corispermum navicula*)
3. Gypsum Valley cateye (*Cryptantha gypsophila*)
4. Narrow-lead evening primrose (*Oenothera acutissima*)
5. Pikes Peak spring parsley (*Oreoxis humilis*)
6. Sun-loving meadowrue (*Thalictrum heliophilum*)

Recommended monitoring actions include:

- Prioritize monitoring needs for PGCN annually (for example, during Annual Colorado Rare Plant Technical Committee Symposia, Biodiversity Scorecard updates, etc.), and share priorities with the scientific and academic communities.

- Support existing and establish new monitoring projects for priority species (for example, CNAP's Rare Plant Monitoring Stewards Program) and provide results to appropriate land managers to facilitate adaptive management for the long-term survival of PGCN.

- Ensure monitoring studies have adequate funding to address key questions in a scientifically rigorous manner, use consistent methodology, and effectively inform adaptive management.

- Devise a monitoring schedule to ensure that all PGCN populations are monitored at appropriate and cost effective intervals in order to quickly detect population declines and ensure occurrence persistence.

- Periodically update Natural Heritage ranks and the Biodiversity Scorecard to record changes in conservation status of rare plants.

Box 1. PGCN currently being monitored in Colorado (with lead organization/agency responsible for monitoring). Species are listed in alphabetical order by scientific name.

1. Larimer aletes *(Aletes humilis):* The Nature Conservancy
2. DeBeque milkvetch *(Astragalus debequeus):* Bureau of Land Management
3. Skiff milkvetch *(Astragalus microcymbus):* Bureau of Land Management, Denver Botanic Gardens
4. Kremmling milkvetch *(Astragalus osterhoutii):* Bureau of Land Management
5. Brandegee's buckwheat *(Eriogonum brandegei):* Bureau of Land Management, Denver Botanic Gardens
6. Clay-loving wild buckwheat *(Eriogonum pelinophilum):* Bureau of Land Management, Colorado Natural Heritage Program, Colorado Natural Areas Program
7. Colorado butterfly plant *(Gaura neomexicana*ssp. *coloradensis):* City of Fort Collins
8. Pagosa skyrocket *(Ipomopsis polyantha):* Colorado Natural Heritage Program
9. Dudley Bluffs bladderpod *(Lesquerella congesta):* Colorado Natural Areas Program
10. Frosty bladderpod *(Lesquerella pruinosa):* Colorado Natural Heritage Program, The Nature Conservancy
11. Narrow-leaf evening primrose *(Oenothera acutissima):* Bureau of Land Management
12. Parachute penstemon *(Penstemon debilis):* Bureau of Land Management, Colorado Natural Areas Program
13. Graham's penstemon *(Penstemon grahamii):* Bureau of Land Management
14. Penland's penstemon *(Penstemon penlandii)*: Denver Botanic Gardens
15. North Park phacelia *(Phacelia formosula):* Bureau of Land Management
16. Bell's twinpod *(Physaria bellii):* City of Boulder, Colorado Natural Areas Program, Denver Botanic Gardens, City of Fort Collins, The Nature Conservancy
17. Piceance twinpod *(Physaria obcordata):* Colorado Natural Areas Program
18. Colorado hookless cactus *(Sclerocactus glaucus):* Bureau of Land Management, Denver Botanic Gardens
19. Ute ladies'-tresses *(Spiranthes diluvialis):* City of Boulder, City of Fort Collins

Success of Conservation Actions

Conserving Colorado's PGCN means that they are adequately protected, with low threats and high viability. Four fundamental questions over the long term are:

- *How are Colorado's PGCN doing?*
- *Do we understand the challenges to the status of these plants and how to address them?*
- *Are the conservation actions we are taking having the intended effects?*
- *Is there adequate capacity to achieve our goals?*

These four questions can be answered by monitoring indicators that gauge the status of the PGCN and their primary threats. Tracking progress towards goals and evaluating the effectiveness of conservation actions will provide the feedback needed to adjust priorities and objectives. Measuring results provides the basis for adaptive management in this conservation approach.

A framework for measuring success of conservation actions is proposed below. These indicators should be measured or assessed every five years unless greater urgency is identified.

Viability Status

Viability status can be evaluated by monitoring:

- Proportion of all imperiled plant species with good to excellent viability scores (measured by the proportion of A or B ranked occurrences of each species in CNHP's database).
- Proportion of all imperiled plant species with viable seeds in seed bank.

Threat Status

Threat status can be evaluated by monitoring:

- Number of PGCN with average to low threat ranks in the Biodiversity Scorecard for Colorado (CNHP and TNC 2011). Presently, there are at least 43 species with high threat ranks. This number should decrease overtime.

Protection/Conservation Status

Protection and conservation status can be evaluated by monitoring:

- Proportion of all Important Plant Areas with conservation action plans completed with local stakeholder involvement. There are currently five areas with conservation action plans.
- Proportion of Important Plant Areas with land trusts or agencies working on habitat conservation.
- Proportion of occurrences of PGCN with on-the-ground habitat protection (e.g., conservation easements, special designations, management agreements, etc.).
- Success in obtaining state legislation to conserve PGCN.
- Success in obtaining a long-term program and funding mechanism to support a rare plant conservation program in Colorado.

Part 8: COORDINATION, REVIEW, AND REVISION

Coordination, review, and revision will follow the process outlined in the Colorado SWAP, Section 4.3, which states:

> In the near term, CWCS review and incorporation of new information will be performed in traditional fashion using similar procedures to this initial effort, at an interval of not less than 5 years, and no more than 10. This timeframe will allow the effects of the Strategy and the operational or action plans and activities that flow from it to be adequately expressed and evaluated before extensive modification. As described elsewhere, a future vision of adopting a more aggressive adaptive management strategy, with the CWCS residing on a database platform (vs. a fixed text document), allowing ongoing updates to reflect changes in species and habitat status, conservation accomplishments as they occur (i.e., a "living" strategy). This will facilitate ongoing communication and coordination among conservation partners and the incorporation of information they gain through their normal operations. Thus, updates and review of the CWCS would be a continuous, rather than a punctuated process. Oversight and maintenance of such a systems approach would be accomplished *via* pooled resources of collaborating entities, including an oversight committee of those collaborators. Given current fiscal, logistical, and technological constraints, contributors to the CWCS who recommended this approach typically acknowledged it as a longer-term vision rather than necessarily an initiative to be undertaken in the immediate future.

As the goal for Colorado's SWAP is to fully incorporate rare plant conservation in the next iteration, future revision of this Addendum will be subject to whatever process the CDOW ultimately employs in updating the SWAP. Coordination among conservation partners, agencies, and other interested parties for conservation of Colorado's rare plants will continue to be led by the RPCI.

REFERENCES

Anderson, D.G. (2006, July 3). *Mentzelia chrysantha* Engelmann ex Brandegee (golden blazing star): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mentzeliachrysantha.pdf [accessed April 2011].

Beatty, B.L., W.F. Jennings, and R.C. Rawlinson (2003, November 12). *Botrychium ascendens* W.H. Wagner (trianglelobe moonwort), *B. crenulatum* W.H. Wagner (scalloped moonwort), and *B. lineare* W.H. Wagner (narrowleaf grapefern): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf [accessed April 2011].

California Native Plant Society. 1992. Policy on appropriate application of ex situ conservation techniques. http://www.cnps.org/archives/ex_situ.htm.

Center for Native Ecosystems, Colorado Native Plant Society, and S.L. O'Kane, Jr. 2005. Petition to list DeBeque phacelia *(Phacelia submutica*) as Threatened or Endangered and designate Critical Habitat under the Endangered Species Act. Submitted to the Secretary of the United States Department of the Interior and the Director of the USDI Fish and Wildlife Service.

Center for Plant Conservation. 1991. Genetic sampling guidelines for conservation collections of endangered plants. Pages 225-238 in D.A. Falk and K.E. Holsinger, editors, Genetics and Conservation of Rare Plants. Oxford University Press, New York.

Colorado Conservation Trust. 2007. Colorado Conservation at a Crossroads. 2007 Land Conservation Report. Colorado Conservation Trust, Boulder. 24 pp.

Colorado Division of Wildlife. 2006. Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plans. Colorado Division of Wildlife, Denver. 328 pp. http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/.

Colorado Native Plant Society. 1997. Rare Plants of Colorado, 2nd edition. Falcon Press, Helena, Montana and the Rocky Mountain Nature Association, Estes Park, Colorado in cooperation with the Colorado Native Plant Society. 108 pp.

Colorado Natural Heritage Program. 2010. Biodiversity Tracking and Conservation System (BIOTICS). ColoradNatural Heritage Program, Colorado State University, Fort Collins.

Colorado Natural Heritage Program and The Nature Conservancy. 2011. *A Biodiversity Scorecard for Colorado.* Colorado Natural Heritage Program, Colorado State University, Fort Collins and The Nature Conservancy, Boulder. Unpublished report to The Nature Conservancy. 133 pp.

Convention on Biological Diversity. 2008. Plant Conservation Report: A Review of Progress in Implementing the Global Strategy for Plant Conservation. UNEP/CBD/COP/9/INF/25. 50 pp.

Elliott, B., S. Panjabi, B. Neely, R. Rondeau, B. Kurzel, and M. Ewing. 2008. Best Management Practices: Practices Developed to Reduce the Impacts of Oil and Gas Development Activities

to Plants of Concern. Unpublished report on file at The Nature Conservancy, Boulder, Colorado. 10 pp.

Enquist, C. and D. Gori. 2008. A Climate Change Vulnerability Assessment for Biodiversity in New Mexico, Part I: Implications of Recent Climate Change on Conservation Priorities in New Mexico. 68 pp.

Groves, C.R. 2003. Drafting a Conservation Blueprint: A Practitioner's Guide to Planning for Biodiversity. The Nature Conservancy, Island Press, Washington, DC. 457 pp.

Hansen, A. R. Knight, S. Powell, K. Brown, P. Gude, and K. Jones. 2005. Effects of Exurban Development on Biodiversity: Patterns, Mechanisms and Research Needs. Ecological Applications (15:6): 1893-1905.

Joyce, L.A. 2008. Personal communication. Rocky Mountain Research Station, U.S. Forest Service, Fort Collins, Colorado.

Kram, M., B. Neely and S. Panjabi. 2008. Rare Plant Conservation Planning Workshop: Middle Park Priority Action Area. Prepared by The Nature Conservancy and the Colorado Natural Heritage Program. Unpublished report prepared for the National Fish and Wildlife Foundation. 14 pp.

Loarie, S.R., B.E. Carter, K. Hayhoe, S. McMahon, R. Moe, C.A. Knight, and D.D. Ackerly. 2008.

Climate change and the future of California's endemic flora. *PLoS One* 3(6): e2502. doi: 10.1371/journal. pone.0002502.

Marinelli, J., editor. 2005. Plant: The Ultimate Visual Reference to Plants and Flowers of the World. DK Publishing, New York. 512 pp.

Martland, L. 2008. Legislative Research Regarding Plant Protection across the United States. Unpublished report on file at the Colorado Department of Agriculture and The Nature Conservancy, Denver.

Menges, E. S., E.O. Guerrant Jr., and S. Hamzé. 2004. Effects of seed collection on the extinction risk of perennial plants. In Guerrant Jr. E.O., Kayri Havens, and Mike Maunder eds., *Ex situ* plant conservation. Pp. 305-324. Island Press, Washington.

Millennium Ecosystem Assessment. 2005.Ecosystems and Human Well-Being: Current State and Trends: Findings of the Condition and Trends Working Group (Series Volume I). Island Press. 948 pp.

Neely, B., S. Panjabi, E. Lane, P. Lewis, C. Dawson, A. Kratz, B. Kurzel, T. Hogan, J. Handwerk, S. Krishnan, J. Neale, and N. Ripley. 2009. Colorado Rare Plant Conservation Strategy. Developed by the Colorado Rare Plant Conservation Initiative. The Nature Conservancy, Boulder, Colorado. 117 pp.

Prior-Magee, J.S., K.G. Boykin, D.F. Bradford, W.G. Kepner, J.H. Lowry, D.L. Schrupp, K.A. Thomas, and B.C. Thompson, Editors. 2007. Southwest Regional Gap Analysis Project Final Report. U.S. Geological Survey, Gap Analysis Program, Moscow, ID.

Roberson, E. 2008. Medicinal Plants at Risk. Center for Biological Diversity, Tucson, Arizona. 16 pp.

Saunders, S., C. Montgomery, T. Easley, and T. Spencer. 2008. Hotter and Drier: The West's Changed Climate. Rocky Mountain Climate Organization and Natural Resources Defense Council. 54 pp.

Schneider, S.H., S. Semenov, A. Patwardhan, I. Burton, C.H.D. Magadza, M. Oppenheimer, A.B. Pittock, A. Rahman, J.B. Smith, A. Suarez, and F. Yamin. 2008. Assessing key vulnerabilities and the risk from climate change. Pages 779-810 in Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, editors). Cambridge University Press, Cambridge, UK.

Scott, M., D.D. Goble, J.A. Weins, D.S. Wilcove, M. Bean, and T. Male. 2005. Recovery of imperiled species under the Endangered Species Act: The need for a new approach. *Frontiers in Ecology and the Environment* 2(7): 383-389.

Souza, D.M. 2003. Endangered Plants. Franklin Watts, A Division of Scholastic, New York. 63 pp.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, U.S. Fish and Wildlife Service and U.S. Forest Service by the Colorado Natural Heritage Program, Fort Collins.

Stein, B.A., and K. Gravuer. 2008. Hidden in Plain Sight: The Role of Plants in State Wildlife Action Plans. NatureServe, Arlington, Virginia. 28 pp.

Stein, B.A., L.S. Kutner, and J.S. Adams, editors. 2000. Precious Heritage: The Status of Biodiversity in the United States. The Nature Conservancy & Association for Biodiversity Information. Oxford University Press, New York. 399 pp.

Theobald, D.M., G. Wilcox, S.E. Linn, N. Peterson, and M. Lineal. 2008. Colorado Ownership, Management, and Protection v7 database. Human Dimensions of Natural Resources and Natural Resource Ecology Lab, Colorado State University, Fort Collins, CO. 15 September. www.nrel.colostate.edu/projects/comap.

Tollefson, C. 2008. Secretary Kempthorne Announces New Conservation Mechanism for Threatened and Endangered Species. Press release. U.S. Fish and Wildlife Service, Washington, DC. United Nations Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report on Climate Change. http://www.ipcc.ch/ipccreports/assessments-reports.htm.

Weber, W. A. and R. C. Wittmann. 1992. Catalog of the Colorado Flora: A Biodiversity Baseline. University of Colorado Museum. University Press of Colorado, Boulder, Colorado. Electronic version, revised March 11, 2000. http://cumuseum.colorado.edu/Research/Botany/Databases/catalog.html.

APPENDIX A: TAXONOMIES OF THREATS AND CONSERVATION ACTIONS FOR SPECIES AND HABITATS

Table A1. Threat taxonomy for species

General Threat	Specific Threat
Climate	Habitat shifting and alteration due to climate change
	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)
Direct Consumptive Use (Mortality)	Hunting, trapping, fishing
	Poisoning
	Gathering
	Scientific research
	Collision (e.g., auto, turbine, aircraft)
Habitat Conversion	Housing, urban, and ex-urban development
	Conversion to cropland
	Recreation area developments
	Water storage
	Commercial and industrial development
	Commercial hog farm or feedlot
Habitat Degradation	Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals
	Natural system modification (terrestrial) - windbreaks, agricultural methods such as tilling, pitting
	Natural system modification - wetland filling
	Altered fire regime
	Altered hydrological regime (surface or aquifer)
	Decreased water quality
	Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.)
	Fragmentation
	Altered animal community (loss of herbivores, predators, pollinators)
	Trail development
	Roads or Railroads
	Overhead utility lines and towers
	Oil and gas pipelines
	Cave/mine closures

General Threat	Specific Threat
Indirect Consumptive Use (Mortality)	Forest and woodland management
	Grazing
	Water use (e.g., de-watering of streams)
Invasive or Exotic Species	Invasive plants
	Invasive plants - tamarisk
	Invasive animals
	Pathogen - chytrid fungus
	Pathogen - sylvatic plague
	Introduced genetic material
	Problematic native species
Lack of knowledge	Complete distribution in Colorado unknown
	Population status unknown
	Reproductive and/or pollination biology unknown
	Phenological response to climate change of species itself and/or inter-dependent species unknown
	Response to climate change of ecological systems and processes unknown
Natural Factors	Scarcity (leading to inbreeding depression)
	Herbivory (e.g., resource competition, changes in habitat structure)
	Altered animal community (change in herbivores, predators, pollinators, etc.)
Non-consumptive Disturbance	Motor-powered recreation
	Non-motorized recreation
	Scientific research
	Flight paths
	Proximal non-recreation disturbance
Organizational capacity and management	Lack of coordination
	Lack of funding
	Lack of common goals
	Confused or gaps in authorities
	Legislation/policy changes
Pollution	Chemicals and toxins
	Herbicide/pesticide spraying or runoff
	Nutrient loads
	Solid waste
	Waste or residual materials (mine tailings, excess sediment loads, etc.)
	Air pollution
	Radioactive materials
	Salt
	Light pollution
	Septic system failures

General Threat	Specific Threat
Resource Extraction	Oil and gas drilling
	Mining (coal, sand/gravel, etc.)
	Water use, management
	Wind energy

Table A2. Conservation Action taxonomy for species

General Action	Specific Action
Capacity Building and Cooperation	Develop partnerships among agencies, NGOs, and stakeholders
	Coordinate with related agencies to align goals, policies, measures of success, etc.
	Engage in collaborative, proactive planning and conservation programs
	Develop collaborative management agreements
Compatible Resource Use	Implement compatible logging practices
	Implement compatible grazing management
Compliance and Enforcement	Monitor water quality standards
	Enforce wildlife and habitat protection laws
	Enforce hunting, fishing, collecting regulations
	Enforce 404 wetlands regulations
	Enforce state/federal/local pollution standards
	Identify and control point-source and non-point source pollution
	Manage recreation and/or permitted activities (e.g., rock climbing, grazing leases)
	Manage off-road travel
Economic Incentives	Promote ecotourism
	Promote green building, development, and lifestyle
	Increase efficiency of water use
	Provide economic assistance for private land habitat improvements and/or species conservation
Education and Communication	Publish educational material/sponsor educational programs to raise public awareness
	Improve knowledge of species, habitats, problems, via professional meetings and other venues
	Improve communication among researchers and policy/decision-makers

General Action	Specific Action
Education and Communication, cont.	Implement landowner outreach/education program
	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species
Ex-situ Conservation	Create captive breeding program
	Create gene-banking program
	Seed banking (incl. protocols, collection, and cultivation)
Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones
	Implement integrated weed/pest management plan
	Control bullfrogs
	Control non-native fish
	Avoid transfer of chytrid fungus
	Dust for fleas to prevent plague outbreaks
Land Protection (Public, Private), Easements, and Resource Rights	Create protected park, preserve, wildlife area
	Expand existing protected park, preserve, wildlife area
	Purchase habitat for conservation purpose
	Acquire conservation easement for habitat protection
	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area)
	Implement Purchase/Transfer Development Rights program for habitat protection
	Establish in-stream flow rights
	Acquire water rights
	Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection)
Legislation, Policies and Regulations	Regulate lethal control methods
	Establish mitigation requirements for developments and other projects that impact species/habitats
	Encourage use of Farm Bill programs
	Develop uniform and effective regulations regarding collection of plants on public lands.
	Establish state-wide rare plant policy
Maintain or Restore Habitat	Restore native prairie
	Restore riparian vegetation
	Plant trees/shrubs

General Action	Specific Action
Maintain or Restore Habitat, cont.	Remove infrastructure (e.g., roads, dams)
	Restore sagebrush
	Re-seed native species
	Manage grazing for compatible vegetation height, structure, etc.
	Implement streambank or in-stream restoration/improvements
	Remove trees/shrubs
	Improve erosion and excess sedimentation conditions
	Discourage introduction of non-native ornamental species
	Maintain linkages and connectivity (e.g., wildife over/under passes, habitat corridors, wildlife-friendly fences)
	Maintain appropriate patch size and habitat mosaic
	Manage caves/mines for native bats
	Avoid destruction of large tracts of native habitat (e.g., ski area development, sod-busting)
	Coordinate on ecologically sensitive design of recreational facilities
	Reduce CO2 emissions
Maintain or Restore Natural Processes	Restore natural fire regime
	Remove dam
	Adjust operation of dam
	Remove road(s)
	Manage for balance of interspecific interactions (predator, prey, pollinator, dispersor, etc.)
	Manage natural herbivory
	Improve erosion and excess sedimentation conditions
	Maintain linkages and connectivity
Planning and Zoning	Write management plan for species or habitat
	Promote zoning that concentrates use and protects habitat
	Promote consideration of biodiversity issues in transportation and land use planning processes
	Prepare climate change adaptation strategy to define in situ and ex situ conservation needs
	Prepare climate change adaptation strategy to identify and address barriers to species movement and habitat shifting

General Action	Specific Action
Protected Area Management	Write and implement management plan
	Manage public use to be compatible with biodiversity
	Alter management of park, preserve, wildlife area
Research and Monitoring	Follow established protocols for species research (e.g., to avoid spread of disease, trampling, overcollecting, etc.)
	Conduct field inventory to refine known distribution
	Research critical life history/habitat components
	Fill data gaps (e.g., basic research, expand museum and herbarium collections, write species assessments etc.)
	Develop and ground-truth habitat and species distribution models
	Research species/habitat response to management or disturbance
	Monitor population status
	Conduct primary research on rare plant and pollinator responses to changing climate
	Model ecological system response to projected climate changes and prepare adaptation plan
Species Management	Reintroduce extirpated native species
	Provide artificial nesting boxes/platforms
	Maintain genetic connection/integrity within and between populations
	Maintain comprehensive species database
	Develop collaborative management agreements
	Write and implement management/recovery plan
	Manage caves/mines for native bats
	Develop proactive conservation program to prevent species from becoming a concern in the future
	Implement existing management/recovery plan
	Provide artificial/hand pollination
Voluntary Standards	Implement Best Management Practices for transportation projects
	Implement Best Management Practices for energy development and mining
	Implement Best Management Practices for water resource development
	Implement Best Management Practices for livestock grazing
	Implement Best Management Practices for forestry

General Action	Specific Action
Voluntary Standards, cont.	Implement Best Management Practices for agricultural production
	Implement Best Management Practices for urban development, landscaping, etc.

Table A3. Threat taxonomy for habitats

General Threat	Specific Threat
Climate	Habitat shifting and alteration due to climate change
	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)
Habitat Conversion	Housing, urban, and ex-urban development
	Conversion to cropland
	Recreation area developments
	Water storage
	Commercial and industrial development
	Commercial hog farm or feedlot
Habitat Degradation	Natural system modification (hydrological) - dam construction, riprap, levees, bank stabilization, channelization, irrigation canals
	Natural system modification (terrestrial) - windbreaks, agricultural methods such as tilling, pitting
	Natural system modification - wetland filling
	Altered fire regime
	Altered hydrological regime (surface or aquifer)
	Decreased water quality
	Altered native vegetation (riparian area deforestation, woody encroachment, chaining sagebrush, seral stage imbalance, etc.)
	Fragmentation
	Altered animal community (loss of herbivores, predators, pollinators, etc.)
	Trail development
	Roads or Railroads
	Overhead utility lines and towers
	Oil and gas pipelines
	Cave/mine closures
Indirect Consumptive Use	Forest and woodland management
	Grazing
	Water use (e.g., de-watering of streams)

General Threat	Specific Threat
Invasive or Exotic Species	Invasive plants
	Invasive plants - tamarisk
	Invasive animals
	Introduced genetic material
	Problematic native species (species originally found in ecosystem but out of balance or released due to humans)
Lack of knowledge	Complete distribution in Colorado unknown
	Status unknown
Natural Factors	Scarcity
	Herbivory (e.g., resource competition, changes in habitat structure)
	Altered animal community (change in herbivores, predators, pollinators, etc.)
Non-consumptive Disturbance	Motor-powered recreation
	Non-motorized recreation
	Proximal non-recreation disturbance
Organizational capacity and management	Lack of coordination
	Lack of funding
	Lack of common goals
	Legislation/policy changes
Pollution	Chemicals and toxins
	Herbicide/pesticide spraying or runoff
	Nutrient loads
	Solid waste
	Waste or residual materials (mine tailings, excess sediment loads, etc.)
	Air pollution
	Radioactive materials
	Salt
	Septic system failures
Resource Extraction	Oil and gas drilling
	Mining (coal, sand/gravel, etc.)
	Water use, management
	Wind energy

Table A4. Conservation Action taxonomy for habitats

General Action	Specific Action
Capacity Building and Cooperation	Develop partnerships among agencies, NGOs, and stakeholders
	Coordinate with related agencies to align goals, policies, measures of success, etc.
	Engage in collaborative, proactive planning and conservation programs
	Develop collaborative management agreements
Compatible Resource Use	Implement compatible logging practices
	Implement compatible grazing management
Compliance and Enforcement	Monitor water quality standards
	Enforce 404 wetlands regulations
	Enforce state/federal/local pollution standards
	Identify and control point-source and non-point source pollution
Economic Incentives	Promote ecotourism
	Promote green building, development, and lifestyle
	Increase efficiency of water use
	Provide economic assistance for private land habitat improvements and/or species conservation
	Reduce ground-water pumping
Education and Communication	Publish educational material/sponsor educational programs to raise public awareness
	Improve knowledge of habitats, problems, via professional meetings and other venues
	Improve communication among researchers and policy/decision-makers
	Implement landowner outreach/education program
	Educate development industries about avoiding and/or mitigating habitat impacts
Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones
	Implement integrated weed/pest management plan
	Control bullfrogs
	Control non-native fish
	Avoid transfer of chytrid fungus
	Dust for fleas to prevent plague outbreaks
Land Protection (Public, Private), Easements, and Resource Rights	Create protected park, preserve, wildlife area
	Expand existing protected park, preserve, wildlife area
	Purchase habitat or Acquire conservation easement for conservation purpose

General Action	Specific Action
Land Protection (Public, Private), Easements, and Resource Rights, cont.	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area)
	Implement Purchase/Transfer Development Rights program for habitat protection
	Establish in-stream flow rights
	Acquire water rights
	Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection)
Legislation, Policies and Regulations	Establish mitigation requirements for developments and other projects that impact species/habitats
	Encourage use of Farm Bill programs
	Reduce CO2 emissions
Maintain or Restore Habitat	Restore native prairie
	Restore riparian vegetation
	Plant trees/shrubs
	Remove infrastructure (e.g., roads, dams)
	Restore sagebrush
	Re-seed native species
	Manage grazing for compatible vegetation height, structure, etc.
	Implement stream bank or in-stream restoration/improvements
	Remove trees/shrubs
	Improve erosion and excess sedimentation conditions
	Discourage introduction of non-native ornamental species
	Maintain linkages and connectivity (e.g., wildlife over/under passes, habitat corridors, wildlife-friendly fences)
	Maintain appropriate patch size and habitat mosaic
	Manage caves/mines for native bats
	Avoid destruction of large tracts of native habitat (e.g., ski area development, sod-busting)
	Coordinate on ecologically sensitive design of recreational facilities
	Reduce CO2 emissions
Maintain or Restore Natural Processes	Restore natural fire regime
	Remove dam
	Adjust operation of dam
	Remove road(s)
	Manage for predator/prey balance

General Action	Specific Action
Maintain or Restore Natural Processes, cont.	Manage natural herbivory
	Improve erosion and excess sedimentation conditions
	Maintain linkages and connectivity
	Reduce ground-water pumping
Planning and Zoning	Write management plan for species or habitat
	Promote zoning that concentrates use and protects habitat
	Promote consideration of biodiversity issues in transportation and land use planning processes
Protected Area Management	Write and implement management plan
	Manage public use to be compatible with biodiversity
	Alter management of park, preserve, wildlife area
Research and Monitoring	Conduct field inventory to refine known distribution
	Fill data gaps
	Ground-truth habitat distribution model(s)
	Research habitat response to management
	Monitor habitat status
Voluntary Standards	Implement Best Management Practices for transportation projects
	Implement Best Management Practices for energy development and mining
	Implement Best Management Practices for water resource development
	Implement Best Management Practices for livestock grazing
	Implement Best Management Practices for forestry
	Implement Best Management Practices for agricultural production
	Implement Best Management Practices for urban development, landscaping, etc.

APPENDIX B: CLIMATE CHANGE VULNERABILITY INDEX (CCVI)

The CCVI uses a scoring system that integrates a species' predicted exposure to climate change within an assessment area and three sets of factors associated with climate change sensitivity, each supported by published studies: 1) indirect exposure to climate change, 2) species-specific factors (including dispersal ability, temperature and precipitation sensitivity, physical habitat specificity, interspecific interactions, and genetic factors), and 3) documented response to climate change (when available). The Index is a Microsoft Excel-based tool that facilitates a fairly rapid assessment of the vulnerability of a species to climate change within a defined geographic study area, and highlights the relative importance of factors contributing to that vulnerability.

The Index divides vulnerability into two components: 1) the **exposure** to climate change across the range of the species within the assessment area, and 2) the **sensitivity** of the species to climate change. A highly sensitive species will not suffer if the climate where it occurs remains stable. Similarly, an adaptable species would presumably not decline even in the face of significant changes in temperature and/or precipitation. Exposure to climate change is measured by examining the magnitude of predicted temperature and moisture change across the range of the species within the assessment area. In this analysis, exposure was calculated in GIS using data from the Climate Wizard (http://climatewizard.org). In the Index, sensitivity is assessed by scoring species against 20 factors of indirect exposure to climate change and species-specific sensitivity. For each factor, species were scored on a sliding scale from greatly increasing, to having no effect on, to decreasing vulnerability. The six possible scores are Extremely Vulnerable, Highly Vulnerable, Moderately Vulnerable, Not Vulnerable/Presumed Stable, Not Vulnerable/Increase Likely, and Insufficient Evidence.

Scoring Category Definitions and Assumptions Used in Completing CCVIs for Colorado Plants of Greatest Conservation Need

OVER-ARCHING ASSUMPTION: Favorable conditions will generally shift northward in latitude and upward in elevation. It is possible that species that are closely associated with micro-climate conditions will not necessarily follow this rule. However, for the purposes and scale of this rapid assessment, spatially explicit micro-climate conditions were not considered.

Section A – Exposure to Local Climate Change

Temperature: percent of species known range/distribution that is expected to experience temperature increase, in categories defined by the CCVI. All of Colorado falls within the top 2 categories: >5 degrees warmer and 5.1-5.5 degrees warmer. This was a GIS calculation using

CNHP Element Occurrence Records and the ensemble average climate model from Climate Wizard, with the medium emissions scenario. Analysis period was to 2050.

AET:PET Moisture Metric: This index integrates projected temperature and precipitation changes to indicate how much drying will take place. This metric was created by NatureServe as part of the CCVI. We used a GIS calculation to determine the percent of each species' range/distribution (represented by EORs) that fall within each rating category. Categories are:

< -0.119
-0.097 - -0.119
-0.074 - -0.096
-0.051 - -0.073
-0.028 - -0.050
>-0.028

Section B – Indirect Exposure to Climate Change

1. **Exposure to sea level rise**: not applicable to Colorado. We rated all species 'Neutral.'

2a. **Distribution relative to natural barriers**: degree to which species' vulnerability is influenced by its ability to shift range/distribution in response to climate change. Scoring categories ***for both natural barriers and anthropogenic barriers*** are:

Greatly Increase Vulnerability:	Barriers completely OR almost completely surround the current distribution such that the species' range in the assessment area is unlikely to be able to shift significantly with climate change, or the direction of climate change-caused shift in the species' favorable climate envelope is fairly well understood and barriers prevent a range shift in that direction. See *Neutral* for species in habitats not vulnerable to climate change.
	Examples for natural barriers: lowland terrestrial species completely surrounded by high mountains (or bordered closely and completely on the north side by high mountains); cool-water stream fishes for which barriers would completely prevent access to other cool-water areas if the present occupied habitat became too warm as a result of climate change; most nonvolant species that exist only on the south side of a very large lake in an area where habitats are expected to shift northward with foreseeable climate change.
	Examples for anthropogenic barriers: species limited to small habitats within intensively developed urban or agricultural landscapes through which the species cannot pass, A specific example of this category is provided by the quino checkerspot butterfly (*Euphydryas editha quino*), a resident of northern Baja California and southern California; warming climates are forcing this butterfly northward, but urbanization in San Diego blocks its movement (Parmesan 1996, Nature 382:765).
Increase Vulnerability:	Barriers border the current distribution such that climate change-caused distributional shifts in the assessment area are likely to be greatly but not completely or almost completely impaired.
	Examples for natural barriers: certain lowland plant or small mammal species whose ranges are mostly (50-90%) bordered by high mountains or a large lake.
	Examples for anthropogenic barriers: most streams inhabited by a fish species have dams that would prevent access to suitable habitat if the present occupied habitat became too warm as a result of climate change; intensive urbanization surrounds 75% of the range of a salamander species.

Somewhat Increase Vulnerability:	Barriers border the current distribution such that climate change-caused distributional shifts in the assessment area are likely to be significantly but not greatly or completely impaired.
	Examples for natural barriers: certain lowland plant or small mammal species whose ranges are partially but not mostly bordered by high mountains or a large lake.
	Examples for anthropogenic barriers: 10-50% of the margin of a plant species' range is bordered by intensive urban development; 25% of the streams occupied by a fish species include dams that are likely to impede range shifts driven by climate change.
Neutral:	Significant barriers do not exist for this species, OR small barriers exist in the assessment area but likely would not significantly impair distributional shifts with climate change, OR substantial barriers exist but are not likely to contribute significantly to a reduction or loss of the species' habitat or area of occupancy with projected climate change in the assessment area.
	Examples of species in this category: most birds (for which barriers do not exist); terrestrial snakes in extensive plains or deserts that may have small barriers that would not impede distributional shifts with climate change; small alpine-subalpine mammal (e.g., ermine, snowshoe hare) in extensive mountainous wilderness area lacking major rivers or lakes; fishes in large deep lakes or large main-stem rivers that are basically invulnerable to projected climate change and lack dams, waterfalls, and significant pollution; a plant whose climate envelope is shifting northward and range is bordered on the west by a barrier but for which no barriers exist to the north.

We rated all species tied to specific substrates (i.e., barrens and cliff/canyon species) 'Increase' since the edge of these substrates will function as a barrier to plant movement. We rated all alpine species that occur below 12,500 feet (i.e., could still shift upward in elevation) 'Increase' and all alpine species that only occur above 12,500 feet 'Greatly Increase.' All other species were evaluated individually based on spatial relationship (viewed in GIS) among known EOs, extent of modeled range/habitat (described below), and natural barriers (e.g., edge of habitat; surrounding mountains, canyons).

Previously developed models were available for: *Astragalus anisus*, *Astragalus debequaeus*, *Astragalus humillimus*, *Astragalus tortipes*, *Lesquerella congesta*, *Nuttallia chrysantha*, *Oenothera harringtonii*, *Oonopsis puebloensis*, *Oxybaphus rotundifolius*, *Penstemon grahamii*, *Phacelia submutica*, *Physaria obcordata*, and *Sclerocactus mesa-verdae*. For other species, we developed models using minimum convex polygons (defined by EORs and buffered by 50% of the polygon area) and SWReGAP vegetation. Vegetation types that intersected with EORs and overlapped the buffered minimum convex polygons were selected; all others were filtered out. Models were further constrained by elevation (defined in GIS by EOR distribution, and buffered on maximum and minimum ends by 10% of the elevation range). For barrens species, models were also constrained by SWReGAP geology. Geological types that overlapped EORs and overlapped the buffered minimum convex polygons were selected; all others were filtered out.

2b. **Distribution relative to anthropogenic barriers**: We rated all species individually based on the spatial relationship among known EOs, extent of modeled range/potential habitat (described above), and non-natural barriers (e.g., urban development, cropland). The natural and non-

natural land cover used in this analysis was developed by reclassifying SWReGAP land cover categories. Definitions of scoring categories are listed above.

3. **Impact of land use changes resulting from human responses to climate change**: This factor is intended to identify species that might be further threatened by strategies designed to mitigate or adapt to climate change (e.g., renewable energy projects such as wind-farms, solar arrays, biofuels production, hydro-power; tree-planting for carbon offsets). We made the assumptions that:

- Tree planting for carbon offsets is not likely in Colorado;
- Wind development is most likely to occur on the eastern plains and Front Range;
- Solar array development is potential for any grassland or shrubland habitat on both east and west slopes;
- Significant hydro-power development is not likely in Colorado;
- Natural gas drilling should be included here based on on-going political "clean fuel" dialogue, and the assumption that natural gas drilling could increase because of this.

Definitions of scoring categories are:

Increase Vulnerability:	The natural history/requirements of the species are known to be incompatible with mitigation-related land use changes that are likely to very likely to occur within its current and/or potential future range. This includes (but is not limited to) the following: ✓ Species requiring open habitats within landscapes likely to be reforested or afforested. If the species requires openings within forests that are created/maintained by natural processes (e.g., fire), and if those processes have a reasonable likelihood of continuing to operate within its range, a lesser impact category may be appropriate. ✓ Bird and bat species whose migratory routes, foraging territory, or lekking sites include existing and/or suitable wind farm sites. If numerous wind farms already exist along the species' migratory route, negative impacts have been found in relevant studies; if such studies exist but negative impacts have not been found, a lesser impact category may be appropriate. ✓ Greater than 20% of the species' range within the assessment area occurs on marginal agricultural land, such as CRP land or other open areas with suitable soils for agriculture ("prime farmland", etc.) that are not currently in agricultural production OR > 50% of the species' range within the assessment area occurs on any non-urbanized land with suitable soils, where there is a reasonable expectation that such land may be converted to biofuel production. ✓ The species occurs in one or more river/stream reaches not yet developed for hydropower, but with the potential to be so developed. ✓ Species of deserts or other permanently open, flat lands with potential for placement of solar arrays. ✓ Species dependent on dynamic shoreline habitats (e.g., active dunes or salt marshes) likely to be destroyed by human fortifications against rising sea levels.
Somewhat Increase Vulnerability:	The natural history/requirements of the species are known to be incompatible with mitigation-related land use changes that *may possibly* occur within its current and/or potential future range, including any of the above (under Increase).

Neutral:	The species is unlikely to be significantly affected by mitigation-related land use changes that may occur within its current and/or potential future range, including any of the above; OR it is unlikely that any mitigation-related land use changes will occur within the species' current and/or potential future range.
Somewhat Decrease Vulnerability:	The species is likely to benefit from mitigation-related land use changes that may occur within its current and/or potential future range. This includes (but is not limited to) the following: ✓ Forest-associated species currently found within a landscape with < 40% forest cover, where increases in forest cover may occur as a result of reforestation or afforestation projects. ✓ Species currently subject to a higher frequency of fires than experienced historically, where there may now be greater incentive to control such fires. ✓ Species occurring on unprotected lands which may be protected and managed for conservation due to their carbon storage and/or sequestration ability.
Decrease Vulnerability:	The species is likely to benefit from mitigation-related land use changes that are likely to very likely to occur within its current and/or potential future range, including any of the above (under Somewhat Decrease).

We rated species that occupy primarily barrens and grasslands 'Increase' based on the potential for wind, solar, and biofuels. One exception to this is *Corispermum navicula,* which we rated 'Neutral' based on the assumption that these resources would not likely be developed in sand dune habitats. We rated shrubland species 'Increase' based on the potential for wind and solar, with the exception of *Eriogonum brandegei*, which occurs on erodible, steep slopes that are not as likely to be developed for these resources. Species listed in the RPCI strategy as being particularly threatened by oil and gas development were rated 'Increase' based on potential for natural gas. Alpine species, wetland species, and cliff/canyon species that are restricted to seeps were rated 'Neutral' based on assumption that these habitat types would be less likely to be developed in most mitigation scenarios. One exception to this general assumption is *Cleome multicaulis,* which we rated 'Increase' based on the potential for solar thermal plants in adjacent habitat, which could alter local hydrologic regimes. We rated forest species 'Somewhat Decrease' based on the assumption that forest management may be improved in the future in the interest of carbon sequestration. However, we rated Pinyon-juniper species 'Neutral' based on the assumption that the PJ woodlands would have less carbon value than montane/subalpine forests.

Section C - Sensitivity

1. **Dispersal and movement**: *Mimulus gemmiparus* was rated 'Greatly Increase' because it propagates vegetatively within a very narrowly distributed habitat. The *Botrychium* species were rated 'Increase.' According to Beatty et al. (2003), dispersal of *Botrychium lineare* spores probably occurs over short distances via gravity. They suggested that though spores may also travel long distances via wind, effective long-distance dispersal would require specific conditions and isolation, fragmentation, and small population size are likely still important dispersal factors. *Eriogonum pelinophilum* was rated 'Increase' based on the fact that nearly all known plants are older, the species apparently reproduces infrequently, and most seedlings do not survive (P. Lyon, pers. comm.). This rating was extrapolated to *E. clavellatum*, since it is similar in this

respect. *Nuttallia chrysantha* was rated 'Somewhat Increase' based on potential for dispersal by animals and wind, but limited long-term seed viability (Anderson 2006). *Eriogonum* species were given a split rating of 'Somewhat Increase' and 'Neutral' based on U.S. Forest Service species assessment for *E. coloradense* (Anderson 2004), which indicated potential for effective dispersal by animals, water and wind. This information was extrapolated to *E. brandegei*, as it is similar in this respect. *Ptilagrostis*, *Puccinellia, Machaeranthera*, and the *Cirsiums* were rated 'Neutral' based on their ability to efficiently disperse via wind. All other species were rated 'Increase' due to the fact that they reproduce primarily by seeds that fall close to the parent plant.

Definitions of scoring categories are:

Greatly Increase Vulnerability:	Species is characterized by severely restricted dispersal or movement capability. This category includes species represented by sessile organisms that almost never disperse more than a few meters per dispersal event. Examples include: plants with large or heavy propagules for which the disperser is extinct or so rare as to be ineffective; species with dispersal limited to vegetative shoots, buds, or similar structures that do not survive (at least initially) if detached from the parent.
Increase Vulnerability:	Species is characterized by highly restricted dispersal or movement capability. This category includes species that rarely disperse through unsuitable habitat more than about 10 meters per dispersal event, and species in which dispersal beyond a very limited distance (or outside a small isolated patch of suitable habitat) periodically or irregularly occurs but is dependent on highly fortuitous or rare events. Examples include: plants dispersed ballisticly; plant or animal species with free-living propagules or individuals that may be carried more than 10 meters by a tornado or unusually strong hurricane or large flood but that otherwise rarely disperse more than 10 meters; plants that do not fit criteria for Greatly Increase but lack obvious dispersal adaptations (i.e., propagules lack any known method for moving more than 10 meters away from the source plant).
Somewhat Increase Vulnerability:	Species is characterized by limited but not severely or highly restricted dispersal or movement capability. A significant percentage (at least approximately 5%) of propagules or individuals disperse approximately 10-100 meters per dispersal event (rarely farther), or dispersal capability likely is consistent with one of the following examples. Examples include; species that exist in small isolated patches of suitable habitat but regularly disperse or move among patches that are up to 100 meters (rarely farther) apart; many ant-dispersed plant species; plants whose propagules are dispersed primarily by small animals (e.g., some rodents) that typically move propagules approximately 10-100 meters from the source (propagules may be cached or transported incidentally on fur or feathers); plants dispersed by wind with low efficiency (e.g., species with inefficiently plumed seeds and/or that occur predominantly in forests).
Neutral:	Species is characterized by moderate dispersal or movement capability. A significant percentage (at least approximately 5%) of propagules or individuals disperse approximately 100-1,000 meters per dispersal event (rarely farther), or dispersal capability likely is consistent with one of the following examples. Examples include: species whose individuals exist in small isolated patches of suitable habitat but regularly disperse or move among patches that are 100-1,000 meters (rarely farther) apart; many plant species dispersed by wind with high efficiency (e.g., species with efficiently plumed seeds or very small propagules that occur predominantly in open areas); plant and animal species whose propagules or individuals are dispersed by small animals (e.g., rodents, grouse) that regularly but perhaps infrequently move propagules approximately 100-1,000 meters from the source).

Somewhat Decrease Vulnerability:	Species is characterized by good dispersal or movement capability. Species has propagules or dispersing individuals that readily move 1-10 kilometers from natal or source areas (rarely farther), or dispersal capability likely is consistent with one of the following examples. Examples include: plant species regularly dispersed up to 10 km (rarely farther) by large or mobile animals (e.g., plant has seeds that are cached, regurgitated, or defecated 1-10 kilometers from the source by birds [e.g., corvids, songbirds that eat small fleshy fruits] or mammals or that are transported on fur of large mobile animals such as most Carnivora or ungulates).
Decrease Vulnerability:	Species is characterized by excellent dispersal or movement capability. Species has propagules or dispersing individuals that readily move more than 10 kilometers from natal or source areas, or dispersal capability likely is consistent with one of the following examples. Examples include: plant or animal species whose individuals often or regularly are dispersed more than 10 kilometers by migratory or otherwise highly mobile animals, air or ocean currents, or humans, including species that readily become established outside their native ranges as a result of intentional or unintentional translocations by humans.

2. **Sensitivity to temperature and moisture changes**: This factor pertains to the breadth of temperature and precipitation conditions, at both broad and local scales, within which a species is known to be capable of reproducing, growing, or otherwise existing. Species with narrow environmental tolerances/requirements may be more vulnerable to habitat loss from climate change than are species that thrive under diverse conditions.

(a.i.) **historical thermal niche**: This factor measures large-scale temperature variation that a species has experienced in recent historical times (i.e., the past 50 years), as approximated by mean seasonal temperature variation (difference between highest mean monthly maximum temperature and lowest mean monthly minimum temperature). It is a proxy for species' temperature tolerance at a broad scale. This factor was calculated in GIS by assessing the relationship between EORs and historical temperature variation data downloaded from NatureServe.

Definitions of scoring categories are:

Greatly Increase Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced **very small (< 37° F/20.8° C)** temperature variation in the past 50 years. Includes cave obligates and species occurring in thermally stable groundwater habitats.
Increase Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced **small (37 - 47° F/20.8 - 26.3° C)** temperature variation in the past 50 years.
Somewhat Increase Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced **slightly lower than average (47.1 - 57° F/26.3 - 31.8° C)** temperature variation in the past 50 years.
Neutral:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced **average (57.1 - 77° F/31.8 - 44.0° C)** temperature variation in the past 50 years.
Somewhat Decrease Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced **greater than average (> 77° F/43.0° C)** temperature variation in the past 50 years.

(a.ii.) **physiological thermal niche**: This factor assesses the degree to which a species is restricted to relatively cool or cold environments that are thought to be vulnerable to loss or significant reduction as a result of climate change. Alpine and cliff/canyon species were rated 'Increase' based on the assumption that these habitats are likely to be reduced as Colorado becomes warmer, and presumably drier. All others were rated 'Neutral.' Definitions of scoring categories are:

Greatly Increase Vulnerability:	Species is completely or almost completely (> 90% of occurrences or range) restricted to relatively cool or cold environments that may be lost or reduced in the assessment area as a result of climate change.
Increase Vulnerability:	Species is moderately (50-90% of occurrences or range) restricted to relatively cool or cold environments that may be lost or reduced in the assessment area as a result of climate change.
Somewhat Increase Vulnerability:	Species is somewhat (10-50% of occurrences or range) restricted to relatively cool or cold environments that may be lost or reduced in the assessment area as a result of climate change.
Neutral:	Species distribution is not significantly affected by thermal characteristics of the environment in the assessment area, or species occupies habitats that are thought to be not vulnerable to projected climate change.
Somewhat Decrease Vulnerability:	Species shows a preference for environments toward the warmer end of the spectrum.

(b.i.) **historical hydrological niche**: This factor measures large-scale precipitation variation that a species has experienced in recent historical times (i.e., the past 50 years), as approximated by mean annual precipitation variation across occupied cells within the assessment area. Ratings for this factor were calculated in GIS by overlaying the species' Element Occurrence Records on mean annual precipitation data (1951-2006) from Climate Wizard, and subtracting the lowest pixel value from the highest value.

Definitions of scoring categories are:

Greatly Increase Vulnerability:	Considering the range of mean annual precipitation across occupied cells, the species has experienced **very small (< 4 inches/100 mm)** precipitation variation in the past 50 years.
Increase Vulnerability:	Considering the range of mean annual precipitation across occupied cells, the species has experienced **small (4 - 10 inches/100 - 254 mm)** precipitation variation in the past 50 years.
Somewhat Increase Vulnerability:	Considering the range of mean annual precipitation across occupied cells, the species has experienced **slightly lower than average (11 - 20 inches/255 - 508 mm)** precipitation variation in the past 50 years.
Neutral:	Considering the range of mean annual precipitation across occupied cells, the species has experienced **average (21 - 40 inches/509 - 1,016 mm)** precipitation variation in the past 50 years.
Somewhat Decrease Vulnerability:	Considering the range of mean annual precipitation across occupied cells, the species has experienced **greater than average (> 40 inches/1,016 mm)** precipitation variation in the past 50 years.

(b.ii.) **physiological hydrological niche**: This factor pertains to a species' dependence on a narrowly defined precipitation/hydrologic regime, including strongly seasonal precipitation patterns and/or specific aquatic/wetland habitats (e.g., certain springs, vernal pools, seeps, seasonal standing or flowing water) or localized moisture conditions that may be highly vulnerable to loss or reduction with climate change. Definitions of scoring categories are:

Greatly Increase Vulnerability:	Completely or almost completely (>90% of occurrences or range) dependent on a specific aquatic/wetland habitat or localized moisture regime that is highly vulnerable to loss or reduction with climate change AND the expected direction of moisture change (drier or wetter) is likely to reduce the species' distribution, abundance, or habitat quality. If this second condition is not met (e.g., species dependent on springs tied to a regional aquifer that would not be expected to change significantly with climate change), the species should be scored as Neutral. Examples for Greatly Increase include plants that are exclusively or very strongly associated with localized moist microsites (e.g., "hanging gardens" in arid landscapes).
Increase Vulnerability:	Moderately (50-90% of occurrences or range) dependent on a strongly seasonal hydrologic regime and/or a specific aquatic/wetland habitat or localized moisture regime that is highly vulnerable to loss or reduction with climate change AND the expected direction of moisture change (drier or wetter) is likely to reduce the species' distribution, abundance, or habitat quality. If this second condition is not met, the species should be scored as Neutral. Examples for Increase include certain plants whose life cycles are highly synchronized with Mediterranean precipitation patterns in areas vulnerable to large changes in the amount and seasonal distribution of precipitation. Also included are desert or semidesert plants that frequently occur in but are not restricted to or almost restricted to moisture-accumulating microsites, as well as plants (and animals that depend on these species) for which >50% of populations occur in areas such as sandy soils that are sensitive to changes in precipitation.

Somewhat Increase Vulnerability:	Somewhat (10-50%) dependent on a strongly seasonal hydrologic regime and/or a specific aquatic/wetland habitat or localized moisture regime that is highly vulnerable to loss or reduction with climate change AND the expected direction of moisture change (drier or wetter) is likely to reduce the species' distribution, abundance, or habitat quality. If this second condition is not met, the species should be scored as Neutral. Examples: plants (and animals that depend on these species) for which 10-50% of populations occur in areas such as sandy soils that are sensitive to changes in precipitation; certain plants with ranges restricted to seasonal precipitation environments (e.g., summer rainfall deserts) and which have a moderate degree of adaptation to that seasonality.
Neutral:	Species has little or no dependence on a strongly seasonal hydrologic regime and/or a specific aquatic/wetland habitat or localized moisture regime that is highly vulnerable to loss or reduction with climate change OR hydrological requirements are not likely to be significantly disrupted in major portion of the range.
Somewhat Decrease Vulnerability:	Species has very broad moisture regime tolerances OR would benefit by the predicted change in hydrologic regime. Examples include water-limited species that could increase with increasing precipitation or arid-adapted species that could increase in areas with decreasing moisture availability.

Most of the rare plants are already adapted to wide variations in wet versus dry years. Wetland species, cliff/canyon species restricted to seeps, alpine species that prefer wetter micro-sites, and *Aquilegia chrysantha* were rated 'Greatly Increase.' Alpine species that are not restricted to wetter micro-sites were rated 'Neutral.' All other species were rated 'Increase' based on the assumption that most areas within Colorado will get drier (note that there is much less agreement among climate models on predictions for precipitation than there is for temperature). Photosynthetic pathways are unknown for the rare plants, but in all cases where pathways were known for other species in these Genera, those species were C3 (i.e., more vulnerable to decline under drying conditions than C4 plants would be).

(c .) **dependence on specific disturbance regime**: This factor pertains to a species' response to specific disturbance regimes such as fires, floods, severe winds, pathogen outbreaks, or similar events. Definitions of scoring categories are:

Increase Vulnerability:	Strongly affected by specific disturbance regime, and climate change is likely to change the frequency, severity, or extent of that disturbance regime in a way that reduces the species' distribution, abundance, or habitat quality. For example, many sagebrush-associated species in regions predicted to experience increased fire frequency/intensity would be scored here due to the anticipated deleterious effects of increased fire on their habitat.
Somewhat Increase Vulnerability:	Moderately affected by specific disturbance regime, and climate change is likely to change the frequency, severity, or extent of that disturbance regime in a way that reduces the species' distribution, abundance, or habitat quality, OR strongly affected by specific disturbance regime, and climate change is likely to change that regime in a way that causes minor disruption to the species' distribution, abundance, or habitat quality. For example, plants in a riverscour community that are strongly tied to natural erosion and deposition flood cycles, which may shift position within the channel rather than disappear as a result of climate change.
Neutral:	Little or no response to a specific disturbance regime, or climate change is unlikely to change the frequency, severity, or extent of that disturbance regime in a way that affects the range or abundance of the species.

Somewhat Decrease Vulnerability:	Moderately affected by specific disturbance regime, and climate change is likely to change the frequency, severity, or extent of that disturbance regime in a way that increases the species' distribution, abundance, or habitat quality. Many fire-adapted plants can be scored here if a predicted increase in fire frequency/intensity is anticipated to be beneficial.
Decrease Vulnerability:	Strongly affected by specific disturbance regime, and climate change is likely to change the frequency, severity, or extent of that disturbance regime in a way that increases the species' distribution, abundance, or habitat quality (e.g.,in areas predicted to experience increased fire frequency, invasive grasses that have a strong positive response to fire (e.g., ecosystem function-altering) could be scored here.

Species that primarily inhabit forest habitats were rated 'Increase' based on the assumption that these systems will be likely to experience more frequent and intense disturbance events (e.g., fire, insect outbreaks) under projected climate change scenarios. One exception to this is *Ipomopsis aggregata* ssp. *weberi,* which was rated 'Neutral' based on increasing numbers in the wake of landscape-scale beetle kill. Species that inhabit shrublands and Pinyon-juniper were rated 'Somewhat Increase' based on the assumption that these habitats would be more likely to burn under climate change scenarios due to increased temperatures and increase in weedy understory (especially cheatgrass). *Spiranthes diluvialis* was rated 'Somewhat Increase' based on potential for flooding. All other species were rated 'Neutral.'

(d.) **dependence on ice, ice-edge, or snow covered habitats**: Alpine species rated 'Somewhat Increase;' all other species rated 'Neutral.' Definitions of scoring factors are:

Greatly Increase Vulnerability:	Highly dependent (>80% of subpopulations or range) on ice- or snow-associated habitats; or found almost exclusively on or near ice or snow during at least one stage of the life cycle.
Increase Vulnerability:	Moderately dependent (50-80% of subpopulations or range) on ice- or snow-associated habitats; or often found most abundantly on or near ice or snow but also regularly occurs away from such areas.
Somewhat Increase Vulnerability:	Somewhat (10-49% of subpopulations or range) dependent on ice- or snow-associated habitats, or may respond positively to snow or ice but is not dependent on it. For example, certain alpine plants are often associated with long-lasting snowbeds but also commonly occur away from such areas; certain small mammals experience increased survival and may develop relatively large populations under winter snow cover but do not depend on snow cover. Species that benefit from a minimum thickness of ice or snowpack for winter insulation should also be scored here.
Neutral:	Little dependence on ice- or snow-associated habitats (may be highly dependent in up to 10% of the range).

3. **Restriction to uncommon geological features or derivatives** - This factor pertains to a species' need for a particular soil/substrate, geology, water chemistry, or specific physical feature (e.g., caves, cliffs, active sand dunes) for reproduction, feeding, growth, or otherwise existing for one or more portions of the life cycle (e.g., normal growth, shelter, reproduction, seedling establishment). It focuses on the commonness of suitable conditions for the species on the landscape, as indicated by the commonness of the features themselves combined with the degree

of the species' restriction to them. Climate envelopes may shift away from the locations of fixed (within at least a 50 year timeframe) geological features or their derivatives, making species tied to these uncommon features potentially more vulnerable to habitat loss from climate change than are species that thrive under diverse conditions. Definitions of scoring categories are:

Increase Vulnerability:	**Very highly dependent** upon, i.e., more or less endemic to (> 85% of occurrences found on) a particular highly uncommon geological feature or derivative (e.g., soil, water chemistry). Such features often have their own endemics. Examples include serpentine (broad and strict) endemic plants, plants of calcareous substrates where such substrates are uncommon (e.g., California, southeastern U.S.), plants restricted to one or a few specific rock strata, organisms more or less restricted to inland sand dunes or shale barrens, obligate cave-dwelling organisms, and springsnails restricted to springs with high dissolved CO2. This category could also include fish species that require a highly uncommon substrate particle size for their stream bottoms, such as the Colorado pikeminnow (*Ptychocheilus lucius*) that spawns only on rare cobble bars cleared of debris by strong upstream currents.
Somewhat Increase Vulnerability:	**Moderately to highly dependent** upon a particular geological feature or derivative, i.e., (1) an indicator of but not an endemic to (65-85% of occurrences found on) the types of features described under Increase, OR (2) more or less restricted to a geological feature or derivative that is not highly uncommon within the species' range, but is not one of the dominant types. Examples of the latter include species more or less restricted to active coastal sand dunes, cliffs, salt flats (including shorebirds that require sodic soils), inland waters within a particular salinity range, and non-dominant rock types such as occasional igneous rock intrusions within a landscape mostly dominated by sedimentary and/or metamorphic rocks. This category could also include fish species that require a specific substrate particle size for their stream bottoms, if that type of stream bottom is not one of the dominant types within the species' range.
Neutral:	Having a **clear preference** for (> 85% of occurrences found on) a certain geological feature or derivative, where the feature is among the dominant types within the species' range. For example, red spruce prefers acidic, organic soils (not uncommon within its range), although it is occasionally found on other soil types. Many species whose habitat descriptions specify one pH category (acidic, neutral, or basic) and/or one soil particle size (e.g., rocky, sandy, or loamy) will probably fall here, upon confirmation that the substrate type is not particularly uncommon within the species' range.
Somewhat Decrease Vulnerability:	**Somewhat flexible but not highly generalized** in dependence upon geological features or derivatives, i.e., found on a subset of the dominant substrate/water chemistry types within its range. Most habitat descriptions that mention more than one type of relatively widespread geological feature should probably go here; however, if all types mentioned are uncommon within the species' range, Somewhat Increase may be appropriate. This category also encompasses species not strongly tied to any specific geological feature or derivative, such as many birds and mammals.
Decrease Vulnerability:	**Highly generalized** relative to dependence upon geological features or derivatives, i.e., the species is described as a generalist and/or a significant proportion of its occurrences have been documented on substrates or in waters that represent opposite ends of the spectrum of types within the assessment region (e.g., many occurrences known from both acidic and basic soils or waters, or from both sandy and clay soils). Species such as common yarrow (*Achillea millefolium*) and coyote (*Canis latrans*) should be assigned to this category.

Species that are tied primarily to barrens habitats were rated 'Increase.' *Ipomopsis globularis* and *Saussurea weberi* were also rated 'Increase' based on their restriction to calcareous substrates. Cliff/canyon species were rated 'Somewhat Increase.' Species that have more than two habitat types as primary habitats were rated 'Somewhat Decrease' based on the assumption that species occupying multiple suitable habitat types will be better able to shift their range/distribution in response to changing habitat conditions. All others were rated 'Neutral.'

4. **Reliance on specific interactions** - The primary impact of climate change on many species may occur via effects on synchrony with other species on which they depend, rather than through direct physiological stress.

(a) **Dependence on other species to generate habitat**: rated 'Neutral' for all species. Definitions of scoring categories are:

Greatly Increase Vulnerability:	Required habitat generated primarily by one species, and that species is highly to extremely vulnerable to climate change within the assessment area.
Increase Vulnerability:	Required habitat generated primarily by one species, and that species is at most moderately vulnerable to climate change within the assessment area. See examples of species requiring other species to generate habitat under Greatly Increase Vulnerability. If the climate change vulnerability of the habitat-generating species is unknown, check both Greatly Increase and Increase Vulnerability.
Somewhat Increase Vulnerability:	Required habitat generated primarily by one or more of not more than a few species. For example, a certain degree of specificity exists between particular cactus species and certain nurse plants; burrowing owls (*Athene cunicularia*) depend on excavations made by relatively few species of burrowing mammals; certain plant species depend on large grazing animals to generate disturbance required for establishment and early growth.
Neutral:	Required habitat generated by more than a few species, or does not involve species-specific processes.

(b) **Dietary versatility**: not applicable to plants.

(c) **Pollinator versatility**: *Oenothera harringtonii* was rated 'Increase' because it is primarily pollinated by the sphinx moth (Spackman Panjabi 2004). The *Penstemon* species and the *Sclerocactus* species were rated 'Somewhat Increase' based on the need for pollinators, which are thought to be comprised of several genera and species. *Astragalus* species were rated 'Neutral' based on the USFS species assessments for *Astragalus anisus* and *A. missouriensis* var. *humistratus*, which indicated some western *Astragalus* species are visited by over 27 species of bees. This rating was extrapolated to the other *Astragalus* species. Note that pollinators of these Colorado *Astragalus* species have not been identified, so this extrapolation is based on an untested assumption. *Ptilagrostis*, *Puccinellia*, and the *Botrychium* species were rated 'Neutral' because they are wind pollinated. *Townsendia glabella* was rated 'Neutral' based on its

similarities with *A. missouriensis* and *Ipomopsis polyantha* (P. Lyon, pers. comm.). All others were rated either 'Neutral' based on species assessments (also Tepedino 2009 for *Physaria obcordata*), or 'Unknown.'

Definitions of scoring categories are:

Increase Vulnerability:	Completely or almost completely dependent on one species for pollination (> 90% of effective pollination accomplished by 1 species) or, if no observations exist, morphology suggests very significant limitation of potential pollinators (e.g., very long corolla tube).
Somewhat Increase Vulnerability:	Completely or almost completely dependent on 2-4 species for pollination (> 90% of effective pollination accomplished by 2-4 species) or, if no observations exist, morphology suggests conformation to a specific "pollination syndrome" (e.g., van der Pijl 1961, Evolution 15: 44-59, http://www.fs.fed.us/wildflowers/pollinators/syndromes.shtml).
Neutral:	Pollination apparently flexible; five or more species make significant contributions to pollination or, if no observations exist, morphology does not suggest pollinator limitation or pollination syndrome.

(d) **Dependence on other species for propagule dispersal**: All species were rated 'Neutral.' Definitions for scoring categories are:

Increase Vulnerability:	Completely or almost completely (roughly > 90%) dependent on a single species for propagule dispersal. For example, whitebark pine would fit here because Clark's nutcracker is the primary dispersal agent.
Somewhat Increase Vulnerability:	Completely or almost completely (roughly > 90%) dependent on a small number of species for propagule dispersal. For example, a freshwater mussel for which only a few species of fish can disperse larvae.
Neutral:	Disperses on its own (most animals) OR propagules can be dispersed by more than a few species.

(e) **Other inter-specific interactions**: This factor refers to interactions unrelated to habitat, seedling establishment, diet, pollination, or propagule dispersal. Here an inter-specific interaction can include mutualism, parasitism, commensalism, or predator-prey relationship.

Definitions for scoring categories are:

Increase Vulnerability:	Requires an interaction with a single other species for persistence.
Somewhat Increase Vulnerability:	Requires an interaction with a one member of a small group of taxonomically related species for persistence. Could also include cases where specificity is not known for certain, but is suspected. Many Orchidaceae will be in this category because of their requirement for a specific fungal partner for germination (Tupac Otero and Flanagan 2006, TREE 21: 64-65).
Neutral:	Does not require an interspecific interaction or, if it does, many potential candidates for partners are available.

The *Astragalus* species were rated 'Increase' based on their known symbiotic relationship with *Rhizobium* bacteria to fix nitrogen. One exception to this is *A. osterhoutii,* which apparently does not share this symbiotic relationship (C. Dawson, pers. comm.). All others were rated either 'Neutral' based on species assessments, or 'Unknown.'

5. **Genetic factors** – Rated 'Unknown' for all species.

6. **Phenological response** – Rated 'Unknown' for all species.

Section D – Documented or modeled response to climate change

All species rated 'Unknown' for each factor in this section.

Results of the CCVI analysis for PGCN

Of the 121 species scored, 107 were Extremely Vulnerable or Highly Vulnerable (Table B1). Scoring factors are summarized by number of species receiving each possible score in Table B2. Table B3 details the results of the CCVI analysis by species. See Part 3 (Problems Affecting the Species) of this document for discussion.

Table B1. Summary of climate change vulnerability scores for PGCN.

Index Score	Number of PGCN
Extremely Vulnerable	103
Highly Vulnerable	4
Moderately Vulnerable	2
Presumed Stable	1
Insufficient Evidence	11

Table B2. Number of PGCN in each scoring category, by exposure and sensitivity factors. *These factors are calculated as percent of range (e.g., a species range may have 80% in one category and 20% in another category). Number of species column reflects number of species for which the greatest percentage of the range falls within the scoring category.

Scoring Factor	Score	Number of Species
Exposure to temperature increase*	>5.5	94
	5.5 – 5.1	16
	Unknown distribution	11
Exposure to reduction in moisture*	<-.119	5
	0.119	42
	0.096	48
	0.073	14
	0.05	1
	Unknown distribution	11
Natural Barriers	Greatly Increase	5
	Increase	81

Scoring Factor	Score	Number of Species
	Somewhat Increase	8
	Neutral	18
	Unknown	9
Anthropogenic Barriers	Greatly Increase	2
	Increase	12
	Somewhat Increase	29
	Neutral	66
	Unknown	12
Climate Change Mitigation	Increase	58
	Somewhat Increase	1
	Neutral	52
	Somewhat Decrease	6
	Unknown	4
Dispersal	Greatly Increase	1
	Increase	111
	Somewhat Increase	2
	Neutral	5
	Somewhat Decrease	0
	Decrease	0
	Unknown	2
Historical Thermal Niche	Greatly Increase	0
	Increase	0
	Somewhat Increase	1
	Neutral	75
	Somewhat Decrease	34
	Unknown	11
Physiological Thermal Niche	Greatly Increase	0
	Increase	30

Scoring Factor	Score	Number of Species
	Somewhat Increase	0
	Neutral	88
	Somewhat Decrease	0
	Unknown	3
Historical Hydrological Niche	Greatly Increase	33
	Increase	48
	Somewhat Increase	17
	Neutral	12
	Somewhat Decrease	0
	Unknown	11
Physiological Hydrological Niche	Greatly Increase	19
	Increase	88
	Somewhat Increase	1
	Neutral	11
	Somewhat Decrease	0
	Unknown	2
Disturbance Regime	Increase	0
	Somewhat Increase	44
	Neutral	75
	Somewhat Decrease	0
	Decrease	0
	Unknown	2
Dependence on Ice/Snow	Greatly Increase	1
	Increase	0
	Somewhat Increase	15
	Neutral	103
	Unknown	2
Physical Habitat Restriction	Increase	31

Scoring Factor	Score	Number of Species
	Somewhat Increase	13
	Neutral	66
	Somewhat Decrease	9
	Decrease	0
	Unknown	2
Dependence on Other Species to Generate Habitat	Greatly Increase	0
	Increase	0
	Somewhat Increase	0
	Neutral	119
	Unknown	2
Pollinator Versatility	Increase	1
	Somewhat Increase	13
	Neutral	49
	Unknown	58
Dependence on Other Species for Propagule Dispersal	Increase	0
	Somewhat Increase	0
	Neutral	117
	Unknown	4
Other Species Interactions (e.g., mutualisms)	Increase	15
	Somewhat Increase	2
	Neutral	17
	Unknown	87

Table B3. Climate Change Vulnerability Index results for PGCN. GI = Greatly Increase; Inc = Increase; SI = Somewhat Increase; N = Neutral; SD = Somewhat Decrease; D = Decrease; U = Unknown; EV = Extremely Vulnerable; HV = Highly Vulnerable; MV = Moderately Vulnerable; PS = Presumed Stable; IE = Insufficient Evidence to score.

NatureServe		Temperature Scope		Hamon AET:PET Moisture Metric Scope					Natural barriers	Anthropogenic barriers	Climate Change mitigation	Dispersal/Movement	Historical thermal niche	Physiological thermal niche	Historical hydrological niche	Physiological hydrological niche	Dependence on disturbance	Dependence on Ice/snow	Physical habitat specificity	Depend on other spp for habitat	Pollinators	Depend on other spp for dispersal	Other spp interaction(s)	Vulnerability Score
Species	**Common Name**	% >5.5F	% 5.1 – 5.5 F	% < -0.119	-0.097 --0.119	-0.074 – -0.096	-0.051 - -0.073	-0.028 - -0.05																
Aletes humilis	Larimer Aletes	60	40			100			Inc	N	SD	Inc	N	Inc	Inc	Inc	N	N	SI	U	N	N	N	**EV**
Aletes latilobus	Canyonlands aletes	100					100		Inc	Inc	Inc	Inc	N	Inc	GI	Inc	N	N	SI	N	U	N	U	**EV**
Aletes macdougalii ssp. Breviradiatus	Mesa Verde aletes	100				100			N	SI-N	N	Inc	N	N	GI	Inc	SI	N	N	N	U	N	U	**EV**
Aliciella sedifolia	Stonecrop gilia	100				93	7		GI	N	N	Inc	N	Inc	GI	GI	N	SI	N	N	U	N	U	**EV**
Anticlea vaginatus	Alcove death camas	100			100				Inc	N	N	Inc	N	Inc	GI	GI	N	N	SI	N	U	N	U	**EV**
Aquilegia chrysantha var. rydbergii	Golden columbine	100			100				N	N	N	Inc	SI	N	Inc	GI	N	N	SD	N	SI	N	N	**EV**
Asclepias uncialis ssp. uncialis	Dwarf milkweed	23	77		71	29			N	SI	Inc	Inc	SD	N	Inc	Inc	N	N	N	N	N	N	N	**EV**
Astragalus anisus	Gunnison milkvetch	100		45	55				SI	SI	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	N	N	Inc	**EV**
Astragalus cronquistii	Cronquist milkvetch	100					28	72	N	N	Inc	Inc	N	N	Inc	Inc	SI	N	N	N	N	N	Inc	**EV**
Astragalus debequaeus	DeBeque milkvetch	100				99	1		Inc	N	Inc	Inc	SD	N	Inc	Inc	N	N	SD	U	N	N	Inc	**EV**
Astragalus deterior	Cliff-palace milkvetch	100				100			Inc	Inc-SI	N	Inc	N	Inc	Inc	Inc	N	N	SI	N	N	N	Inc	**EV**
Astragalus equisolensis	Horseshoe milkvetch	100				100			SI-N	N	N	Inc	N	N	Inc	Inc	SI	N	N	N	N	N	Inc	**EV**
Astragalus humillimus	Mancos milkvetch	100					100		Inc	N	Inc	Inc	N	Inc	GI	Inc	N	N	SI	N	N	N	Inc	**EV**
Astragalus iodopetalus	Violet milkvetch	41	59		59	41			N	SI	Inc	Inc	N	N	GI	Inc	SI	N	N	N	N	N	Inc	**EV**

NatureServe		Temperature Scope		Hamon AET:PET Moisture Metric Scope					Natural barriers	Anthropogenic barriers	Climate Change mitigation	Dispersal/Movement	Historical thermal niche	Physiological thermal niche	Historical hydrological niche	Physiological hydrological niche	Dependence on disturbance	Dependence on Ice/snow	Physical habitat specificity	Depend on other spp for habitat	Pollinators	Depend on other spp for dispersal	Other spp interaction(s)	Vulnerability Score
Species	**Common Name**	% >5.5F	% 5.1 – 5.5 F	% < -0.119	-0.097 --0.119	-0.074 – -0.096	-0.051 - -0.073	-0.028 - -0.05																
Astragalus lonchocarpus var. hamiltonii	Hamilton milkvetch	100			100				Inc	SI	N	Inc	SD	N	GI	Inc	SI	N	N	N	N	N	Inc	EV
Astragalus microcymbus	Skiff milkvetch	100		97	3				SI-N	SI-N	Inc	Inc	SD	N	GI	Inc	SI	N	N	N	N	N	Inc	EV
Astragalus missouriensis var. humistratus	Missouri milkvetch		100		100				Inc-SI	N	Inc	Inc	SD	N	Inc	Inc	SI	N	SD	N	N	N	Inc	EV
Astragalus naturitensis	Naturita milkvetch	100				98	2		Inc-SI-N	SI-N	N	Inc	SD	Inc	Inc	Inc	SI	N	SI	N	N	N	Inc	EV
Astragalus osterhoutii	Kremmling milkvetch	100			100				Inc-SI	Inc-SI	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	N	N	N	EV
Astragalus piscator	Fisher Towers milkvetch	100				100			N	N	Inc	Inc	N	N	GI	Inc	SI	N	N	N	N	N	Inc	EV
Astragalus rafaelensis	San Rafael milkvetch	100				91	9		Inc	N	N	Inc	N	N	GI	Inc	SI	N	N	N	N	N	Inc	EV
Astragalus schmolliae	Schmoll milkvetch	100				100			Inc	N	N	Inc	N	N	Inc	Inc	SI	N	N	N	N	N	Inc	EV
Astragalus tortipes	Sleeping Ute milkvetch	100					100		Inc-SI	Inc-SI	Inc	Inc	N	N	GI	Inc	SI	N	N	N	N	N	Inc	EV
Boechera crandallii	Crandall's rock cress	100		36	63	1			N	N	Inc	Inc	SD	N	SI	Inc	SI	N	N	N	N	N	N	EV
Boechera glareosa		100			100				Inc	N	Inc	Inc	N	N	GI	Inc	N	N	Inc	N	U	N	U	EV
Botrychium furcatum	Fork-leaved moonwort								Inc	U	N	Inc	U	Inc	U	N	N	SI	N	N	N	N	U	IE
Botrychium lineare	Narrowleaf grape fern	100		7		93			Inc	N	SD	Inc	N	N	SI	SI	SI	N	SD	N	N	N	U	HV
Caesalpinia repens	Creeping rush-pea								U	U	U	Inc	U	U	U	Inc	N	N	N	N	U	U	U	IE
Camissonia eastwoodiae	Eastwood evening primrose	100				42	50	8	N	N	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	U	N	U	EV

NatureServe		Temperature Scope		Hamon AET:PET Moisture Metric Scope					Natural barriers	Anthropogenic barriers	Climate Change mitigation	Dispersal/Movement	Historical thermal niche	Physiological thermal niche	Historical hydrological niche	Physiological hydrological niche	Dependence on disturbance	Dependence on Ice/snow	Physical habitat specificity	Depend on other spp for habitat	Pollinators	Depend on other spp for dispersal	Other spp interaction(s)	Vulnerability Score
Species	**Common Name**	% >5.5F	% 5.1 – 5.5 F	% < -0.119	-0.097 --0.119	-0.074 – -0.096	-0.051 - -0.073	-0.028 - -0.05																
Carex stenoptila	Small-winged sedge	79	21	9	35	56			N	N	N	Inc	N	N	N	GI	N	N	SD	N	U	N	U	**MV**
Castilleja puberla	Downy Indian-paintbrush	90	10		0.5	90	8	1.5	Inc	N	N	Inc	N	Inc	N	N	N	SI	N	N	U	N	U	**EV**
Cirsium perplexans	Adobe thistle	100			62	38			N	N	Inc	N	SD	N	SI	Inc	SI	N	N	N	N	N	N	**HV**
Cirsium scapanolepis	Mountain-slope thistle								U	U	SD	N	U	N	U	Inc	SI	N	SD	N	U	N	U	**IE**
Cleome multicaulis	Slender spiderflower	2	98			46	54		GI	N	Inc	Inc	SD	N	GI	GI	N	N	N	N	U	N	U	**EV**
Corispermum navicula	Boat-shaped bugseed	100			33	67			Inc	N	N	Inc	N	N	GI	Inc	N	N	Inc	N	U	N	U	**EV**
Cryptantha gypsophila	Gypsum Valley cat's-eye	100			8	84	8		Inc	N	Inc	Inc	N	N	Inc	Inc	SI	N	Inc	N	U	N	U	**EV**
Delphinium ramosum var. alpestre	Colorado larkspur	94	6	3	46	48	3		Inc	N	N	Inc	N	Inc	SI	N	N	SI	N	N	U	N	U	**EV**
Delphinium robustum	Wahatoya Creek larkspur								Inc	U	U	Inc	U	Inc	U	Inc	N	N	SI	N	N	N	N	**IE**
Descurainia kenheilii	Heil's tansy mustard	100					100		Inc	N	N	Inc	N	Inc	GI	N	N	SI	N	N	U	N	U	**EV**
Dicoria wetherillii	Wetherill's dicoria								U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**IE**
Draba exunguiculata	Clawless draba	100			32	52	16		Inc	N	N	Inc	N	Inc	SI	N	N	SI	N	N	N	N	N	**EV**
Draba graminea	San Juan whitlow-grass	100				75	25		Inc	N	N	Inc	N	Inc	SI	GI	N	GI	N	N	N	N	N	**EV**
Draba grayana	Gray's Peak whitlow-grass	77	23		33	66	1		Inc	N	N	Inc	N	Inc	N	N	N	SI	N	N	N	N	N	**EV**
Draba malpighiacea	Whitlow-grass	100				100			Inc	N	SD	Inc	N	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Draba smithii	Smith Whitlow-grass	54	46	1	26	35	14	24	Inc	N	Inc	Inc	N	Inc	N	Inc	N	N	SI	N	N	N	N	**EV**
Draba weberi	Weber's draba	100				100			GI	N	N	Inc	N	Inc	GI	GI	N	SI	N	N	N	N	N	**EV**

NatureServe		Temperature Scope		Hamon AET:PET Moisture Metric Scope					Natural barriers	Anthropogenic barriers	Climate Change mitigation	Dispersal/Movement	Historical thermal niche	Physiological thermal niche	Historical hydrological niche	Physiological hydrological niche	Dependence on disturbance	Dependence on Ice/snow	Physical habitat specificity	Depend on other spp for habitat	Pollinators	Depend on other spp for dispersal	Other spp interaction(s)	Vulnerability Score
Species	**Common Name**	% >5.5F	% 5.1 – 5.5 F	% < -0.119	-0.097 --0.119	-0.074 – -0.096	-0.051 - -0.073	-0.028 - -0.05																
Erigeron kachinensis	Kachina daisy	100				100			Inc	SI	N	Inc	N	Inc	GI	GI	N	N	SI	N	U	N	U	**EV**
Erigeron wilkenii	Wilken fleabane	100			100				Inc	N	N	Inc	N	Inc	GI	Inc	N	N	SI	N	N	U	U	**EV**
Eriogonum brandegei	Brandegee wild buckwheat	100		86	14				Inc	N	N	SI-N	N	N	Inc	Inc	N	N	Inc	N	N	N	N	**EV**
Eriogonum clavellatum	Comb Wash buckwheat	100					99.5	0.5	N	SI	Inc	Inc	N	N	GI	Inc	SI	N	N	N	U	N	U	**EV**
Eriogonum coloradense	Colorado wild buckwheat	100		33	27	15	25		Inc	N	N	SI-N	N	Inc	N	Inc	N	SI	N	N	N	N	N	**EV**
Eriogonum pelinophilum	Clay-loving wild buckwheat	100				48	52		Inc	Inc-SI	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Eutrema edwardsii ssp. penlandii	Penland alpine fen mustard	100			28	72			Inc	N	N	Inc	N	Inc	N	GI	N	SI	N	N	U	N	U	**EV**
Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	47	53		47	53			Inc	GI-Inc	N	Inc	N	N	Inc	GI	N	N	SD	N	U	N	U	**EV**
Gutierrezia elegans	Lone Mesa snakeweed	100			100				Inc	SI	Inc	Inc	N	N	GI	Inc	N	N	Inc	N	U	N	U	**EV**
Hackelia besseyi	Bessey's stickseed								U	U	SD	Inc	U	N	U	Inc	SI	N	N	N	U	N	U	**IE**
Hackelia gracilenta	Mesa Verde stickseed	100				100			N	SI	N	Inc	N	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Herrickia horrida	Canadian River spiny aster		100		13	87			SI-N	N	N	Inc	N	N	GI	Inc	SI	N	N	N	U	N	U	**EV**
Ipomopsis aggregata ssp. Weberi	Rabbit Ears gilia	100			65	35			N	N	SD	Inc	SD	N	N	Inc	N	N	N	N	N	N	N	**PS**
Ipomopsis globularis	Globe gilia	100			45	55			Inc	N	N	Inc	N	Inc	Inc	N	N	SI	Inc	N	N	N	U	**EV**
Ipomopsis polyantha	Pagosa skyrocket		100		100				Inc	Inc	Inc	Inc	SD	N	GI	Inc	N	N	Inc	N	N	N	U	**EV**
Lepidium crenatum	Alkaline pepperwort	100		24	25	51			SI	SI	Inc	Inc	N	N	SI	Inc	SI	N	N	N	U	N	U	**EV**
Lesquerella calcicola	Rocky Mountain bladderpod	17	83		38	62			Inc	SI	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**

NatureServe		Temperature Scope		Hamon AET:PET Moisture Metric Scope					Natural barriers	Anthropogenic barriers	Climate Change mitigation	Dispersal/Movement	Historical thermal niche	Physiological thermal niche	Historical hydrological niche	Physiological hydrological niche	Dependence on disturbance	Dependence on Ice/snow	Physical habitat specificity	Depend on other spp for habitat	Pollinators	Depend on other spp for dispersal	Other spp interaction(s)	Vulnerability Score
Species	**Common Name**	% >5.5F	% 5.1 – 5.5 F	% < -0.119	-0.097 --0.119	-0.074 – -0.096	-0.051 - -0.073	-0.028 - -0.05																
Lesquerella congesta	Dudley Bluffs bladderpod	100			100				Inc	Inc	Inc	Inc	N-SD	N	GI	Inc	N	N	Inc	N	SI	N	U	**EV**
Lesquerella parviflora	Piceance bladderpod	100		75	24	1			Inc	N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Lesquerella pruinosa	Pagosa bladderpod		100	1	95	4			Inc	SI	Inc	Inc	SD	N	Inc	Inc	N	N	Inc	N	N	N	N	**EV**
Lesquerella vicina	Good-neighbor bladderpod	100		6	49	42	3		Inc	Inc	N	Inc	N	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Limnorchis zothecina	Alcove bog orchid	100			100				Inc	N	N	Inc	SD	Inc	GI	GI	N	N	SI	N	U	N	U	**EV**
Lomatium concinnum	Coloado desert-parsley	100		42	9	49			SI	Inc-SI	Inc	Inc	N	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Lupinus crassus	Payson lupine	100		3		97			SI-N	SI-N	N	Inc	SD	N	SI	Inc	SI	N	N	N	U	N	U	**HV**
Lygodesmia doloresensis	Dolores River skeletonplant	100				98	2		SI	SI	N	Inc	SD	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Machaeranthera coloradoensis	Colorado tansy-aster	99	1	3	17	52	28		Inc	N	Inc	N	N	N	N	Inc	N	N	N	N	U	N	U	**HV**
Mentzelia rhizomata	Roan Cliffs blazing star	100		2	93	5			Inc	N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Mertensia humilis	Rocky Mountain bluebells	100			76	24			Inc-SI-N	SI-N	Inc	Inc	N	N	SI	Inc	SI	N	N	N	U	N	U	**EV**
Mimulus gemmiparus	Budding monkey flower	100				71	29		Inc	N	N	GI	N	Inc	SI	GI	N	N	SI	N	N	N	U	**EV**
Nuttallia chrysantha	Golden blazing star	71	29	10	28	62			Inc	SI-N	Inc	Inc-SI	N	N	Inc	Inc	N	N	Inc	N	N	N	U	**EV**
Nuttallia densa	Arkansas Canyon stickleaf	100		1.5	98.5				Inc-SI	SI-N	N	Inc	N	N	Inc	Inc	SI	N	N	N	U	N	U	**EV**
Oenothera acutissima	Narrow-leaf evening primrose	100		4	70	26			N	N	N	Inc	N	N	Inc	GI	N	N	N	N	U	N	U	**EV**
Oenothera harringtonii	Arkansas Valley evening primrose	1	99		17	83			Inc	SI-N	Inc	Inc	SD	N	Inc	Inc	N	N	Inc	N	Inc-N	N	U	**EV**

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Oonopsis foliosa var. monocephala	Rayless goldenweed		100		80	20			N	N	Inc	Inc	SD	N	Inc	Inc	N	N	N	N	U	N	U	**EV**
Oonopsis puebloensis	Pueblo goldenweed	1	99		5	95			Inc	SI-N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Opuntia heacockiae	Heacock's prickly-pear								U	U	N	Inc	U	N	U	Inc	SI	N	N	N	U	N	U	**IE**
Oreocarya osterhoutii	Osterhout's cat's-eye	100				61	39		Inc	Inc-SI	Inc	Inc	SD	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Oreoxis humilis	Pikes Peak spring parsely	100			18	3	79		Inc	N	N	Inc	N	Inc	Inc	N	N	SI	N	N	N	N	U	**EV**
Oxybaphus rotundifolius	Round-leaf four o'clock	7	93		21	79			Inc	SI-N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Oxytropis besseyi var. obnapiformis	Bessey locoweed	100			36	64			N	N	Inc	Inc	SD	N	SI	Inc	SI	N	N	N	U	N	U	**EV**
Pediocactus knowltonii	Knowlton cactus								U	U	N	Inc	U	N	U	Inc	SI	N	N	N	U	N	U	**IE**
Penstemon crandallii ssp. procumbens	Crandall's beardtongue								U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**IE**
Penstemon debilis	Parachute penstemon	100			92	8			Inc	N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	SI	N	U	**EV**
Penstemon degeneri	Degener beardtongue	100		29	71				N	N	N	Inc	N	N	Inc	Inc	SI	N	N	N	SI	N	U	**EV**
Penstemon fremontii var. glabrescens	Fremont's beardtongue	100		29	55	16			N	N	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	SI	N	U	**EV**
Penstemon gibbensii	Gibben's beardtongue	100				100			Inc	N	Inc	Inc	SD	N	GI	Inc	N	N	Inc	N	SI	N	U	**EV**
Penstemon grahamii	Graham beardtonuge	100					100		Inc	N	Inc	Inc	SD	N	GI	Inc	N	N	Inc	N	SI	N	U	**EV**
Penstemon penlandii	Penland penstemon	100			100				Inc-SI	Inc-SI	Inc	Inc	SD	N	GI	Inc	SI	N	N	N	SI	N	U	**EV**

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Penstemon scariosus var. albifluvis	White River penstemon	100					100		Inc	N	Inc	Inc	SD	N	GI	Inc	N	N	Inc	N	SI	N	U	**EV**
Penstemon scariosus var. cyanomontanus	Plateau penstemon	100			100				Inc	N	N	Inc	N	N	Inc	Inc	SI	N	N	N	SI	N	U	**EV**
Penstemon teucrioides	Germander beardtongue								U	U	Inc	Inc	U	N	U	Inc	SI	N	N	N	SI	N	U	**IE**
Phacelia formosula	North Park phacelia	100			99	1			Inc	U	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Phacelia submutica	DeBeque phacelia	100			4	95	1		Inc	Inc-SI	Inc	Inc	SD	N	GI	Inc	N	N	Inc	N	U	N	U	**EV**
Physaria alpina	Avery Peak twinpod	100			2	98			Inc	N	N	Inc	N	Inc	Inc	N	N	SI	N	N	U	N	U	**EV**
Physaria bellii	Bell's twinpod	42	58				100		Inc	SI	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Physaria obcordata	Piceance twinpod	100			100				Inc	N	Inc	Inc	SD	N	Inc	Inc	N	N	Inc	N	N	N	U	**EV**
Physaria pulvinata	Cushion bladderpod	100			100				Inc	SI-N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Physaria rollinsii	Rollins twinpod	100		22	34	37	7		Inc	SI-N	Inc	Inc	SD	N	SI	Inc	N	N	Inc	N	U	N	U	**EV**
Physaria scrotiformis	West Silver bladderpod	100				100			Inc	N	Inc	Inc	N	N	GI	Inc	N	N	SD	N	U	N	U	**EV**
Potentilla rupincola	Rocky Mountain cinquefoil	93	7			100			Inc	N	SI-N	Inc	N	Inc	N	Inc	N	N	SI	N	N	N	SI	**EV**
Ptilagrostis porteri	Porter's feathergrass	100		7	45	44	4		Inc-SI	N	N	N	N	N	N	GI	N	N	N	N	N	N	U	**MV**
Puccinellia parishii	Parish's alkali grass	100			100				Inc	SI	N	N	N	N	GI	GI	N	N	N	N	N	N	U	**EV**
Salix arizonica	Arizona willow		100		100				GI-Inc	N	N	Inc	N	N	GI	GI	N	N	N	N	N	N	SI	**EV**
Saussurea weberi	Weber saussurea	100			8	92			Inc	N	N	Inc	N	Inc	SI	N	N	SI	N	N	N	N	U	**EV**
Sclerocactus glaucus	Colorado hookless cactus	100		0.5	1	12	86.5		Inc-SI	SI-N	Inc	Inc	SD	N	Inc	Inc	SI	N	N	N	SI	N	U	**EV**

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Sclerocactus mesa-verde	Mesa Verde hookless cactus	100					100		Inc	N	Inc	Inc	N	N	GI	Inc	N	N	Inc	N	SI	N	U	**EV**
Sisyrinchium pallidum	Pale blue-eyed grass	100		26	74				Inc	N	N	Inc	N	N	N	GI	N	N	N	N	U	N	U	**EV**
Spiranthes diluvialis	Ute ladies' tresses	88	12		67	33			GI-Inc	GI-Inc	N	Inc	SD	N	SI	GI	SI	N	N	N	U	N	U	**EV**
Telesonix jamesii	James telesonix	100			23	53	24		Inc	N	N	Inc	N	Inc	SI	Inc	N	N	SD	N	N	N	U	**EV**
Thalictrum heliophilum	Sun-loving meadow rue	100		72	28				Inc	N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	N	N	U	**EV**
Thelypodiopsis juniperorum	Juniper tumble mustard	100			83	17			Inc-SI	SI-N	N	Inc	N	N	SI	Inc	SI	N	N	N	N	N	N	**EV**
Thelypodium paniculatum	Northwestern thelypody								U	U	N	Inc	U	N	U	GI	N	N	N	N	U	N	U	**IE**
Townsendia fendleri	Fendler's townsend-daisy	100		25	73	2			Inc	N	Inc	Inc	N	N	Inc	Inc	N	N	Inc	N	U	N	U	**EV**
Townsendia glabella	Gray's townsend-daisy	47	53		77	23			Inc	SI-N	Inc	Inc	SD	N	SI	Inc	N	N	Inc	N	N	N	U	**EV**
Townsendia rothrockii	Rothrock townsend-daisy	100		16	42	31	11		Inc	N	N	Inc	N	Inc	N	N	N	SI	N	N	N	N	U	**EV**

Colorado Natural Heritage Program
Campus Delivery 1474, Colorado State University, Fort Collins, CO 80523; www.cnhp.colostate.edu

Colorado Natural Areas Program
Colorado State Parks, 1313 Sherman Street, Denver, CO 80203; www.parks.state.co.us

The Nature Conservancy
2424 Spruce Street, Boulder, CO 80302; www.tnc.org

Ipomopsis polyantha, Pagosa skyrocket.
David G. Anderson