# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum



By Colorado Natural Heritage Program
For
The Colorado Rare Plant Conservation Initiative
June 2011

#### **Colorado Rare Plant Conservation Initiative Members**

David Anderson, Colorado Natural Heritage Program (CNHP)

Rob Billerbeck, Colorado Natural Areas Program (CNAP)

Leo P. Bruederle, University of Colorado Denver (UCD)

Lynn Cleveland, Colorado Federation of Garden Clubs (CFGC)

Carol Dawson, Bureau of Land Management (BLM)

Michelle DePrenger-Levin, Denver Botanic Gardens (DBG)

Brian Elliott, Environmental Consulting

Mo Ewing, Colorado Open Lands (COL)

Tom Grant, Colorado State University (CSU)

Jill Handwerk, Colorado Natural Heritage Program (CNHP)

Tim Hogan, University of Colorado Herbarium (COLO)

Steve Kettler, U.S. Fish and Wildlife Service (USFWS)

Andrew Kratz, U.S. Forest Service (USFS)

Sarada Krishnan, Colorado Native Plant Society (CoNPS), Denver Botanic Gardens

Brian Kurzel, Colorado Natural Areas Program

Eric Lane, Colorado Department of Agriculture (CDA)

Paige Lewis, The Nature Conservancy (TNC)

Ellen Mayo, U.S. Fish and Wildlife Service

Mitchell McGlaughlin, University of Northern Colorado (UNC)

Jennifer Neale, Denver Botanic Gardens

Betsy Neely, The Nature Conservancy

Ann Oliver, The Nature Conservancy

Steve Olson, U.S. Forest Service

Susan Spackman Panjabi, Colorado Natural Heritage Program

Jeff Peterson, Colorado Department of Transportation (CDOT)

Josh Pollock, Center for Native Ecosystems (CNE)

Nicola Ripley, Betty Ford Alpine Gardens (BFAG)

Erin Robertson, Center for Native Ecosystems

Renee Rondeau, Colorado Natural Heritage Program

Terri Skadeland, Natural Resources Conservation Service (NRCS)

Carol Till, Rocky Mountain Society of Botanical Artists (RMSBA)

Christina Walters, National Center for Genetic Resources Preservation (NCGRP)

#### **ACKNOWLEDGEMENTS**

Funding and support for this effort were generously provided by The Doris Duke Foundation, NatureServe, and the Colorado Natural Areas Program (CNAP). We especially appreciate the expert guidance and thoughtful review provided by Brian Kurzel (CNAP) and Betsy Neely (The Nature Conservancy - TNC). Peggy Lyon, David Anderson, Renée Rondeau, and Bernadette Kuhn (Colorado Natural Heritage Program - CNHP) and Tim Hogan (University of Colorado Herbarium) provided invaluable input on species habitats, threats, and climate change analysis. Michelle Fink (CNHP) built the Access database used to store information and generate tables. Michelle Fink, Karin Decker, and Amy Lavender (CNHP) and Kei Sochi and Miranda Curzon (TNC) developed maps, figures, and analyses.

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.

Suggested citation: Colorado Natural Heritage Program for Rare Plant Conservation Initiative. 2011. Colorado Wildlife Action Plan: proposed rare plant addendum. Lee Grunau, Jill Handwerk, and Susan Spackman-Panjabi, eds. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO.

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.

# **TABLE OF CONTENTS**

ACKNOWLEDGEMENTS	iii
EXECUTIVE SUMMARY	iv
TABLE OF CONTENTS	1
INTRODUCTION	4
The Rare Plant Conservation Initiative	4
RPCI and the Development of this Addendum	5
The Addendum Development Process	5
Element 1: Information on the distribution and abundance of species	6
Element 2: Locations and relative condition of key habitats	6
Element 3: Issues that may adversely affect PGCN or their habitats, and priority research and survey efforts needed	
Element 4: Conservation actions necessary to conserve the PGCN and their habitats, and priorities for implementing	
Element 5: Strategies for monitoring PGCN, their habitats, and the effectiveness of conservation actions	8
Element 6: Procedures to review the Comprehensive Wildlife Conservation Strategy (referred to hereafter as "SWAP")	8
Element 7: Coordination with federal, state, and local agencies and Native American Tri	
Element 8: Public participation	8
Part 1: PLANTS OF GREATEST CONSERVATION NEED	10
Part 2: KEY HABITATS	16
Relationship Between Key Habitats for Wildlife and Plants	17
Condition of Key Habitats	19
Part 3: PROBLEMS AFFECTING THE SPECIES	20
Energy Development	20
Motorized Recreational Activities	21
Residential Development	21
Pond Construction and Maintenance	22

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Other Factors	22
Climate Change	22
Part 4: PRIORITIES FOR CONSERVATION ACTION	25
Statewide Conservation Objectives	25
Recommended Conservation Actions for Short-term (1-5 years)	26
Long-term Recommendations (5-10 years)	26
Important Plant Areas	27
Priority Research and Survey Efforts Needed	28
Research	28
Survey	29
Part 6: PRIORITIES, THREATS, AND CONSERVATION ACTIONS FOR PGCN A HABITATS	
Part 7: STRATEGIES FOR MONITORING SPECIES, HABITATS, AND SUCCESS CONSERVATION ACTIONS	
Species and Habitats	126
Success of Conservation Actions	128
Viability Status	128
Threat Status	128
Protection/Conservation Status	129
Part 8: COORDINATION, REVIEW, AND REVISION	130
REFERENCES	131
APPENDIX A: TAXONOMIES OF THREATS AND CONSERVATION ACTIONS SPECIES AND HABITATS	
APPENDIX B: CLIMATE CHANGE VULNERABILITY INDEX (CCVI)	
LIST OF FIGURES	
Figure 1. Distribution of Colorado's Plants of Greatest Conservation Need	11
Figure 2. Key habitats as percentage of Colorado and number of PGCN	
Figure 3. Distribution of major rare plant habitat types in Colorado	
FIVILE 4 THEOLISH FISH ATERS OF PUTUN	

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

#### **LIST OF TABLES**

Table 1.	Plants of Greatest Conservation Need	12
Table 2.	Relative priorities for key rare plant habitats.	18
Table 3.	Plants of Greatest Conservation Need - Priorities, Threats, and Conservation Actions	31
Table 4.	Key Plant Habitats - Priorities, Threats, and Conservation Actions	07

## 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 (<a href="http://www.fs.fed.us/r2/projects/scp/assessments/index.shtml">http://www.fs.fed.us/r2/projects/scp/assessments/index.shtml</a>);
- 4) the Colorado Rare Plant Field Guide (<a href="http://www.cnhp.colostate.edu/">http://www.cnhp.colostate.edu/</a>);
- 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

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

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 (Source: Colorado Natural Heritage Program).

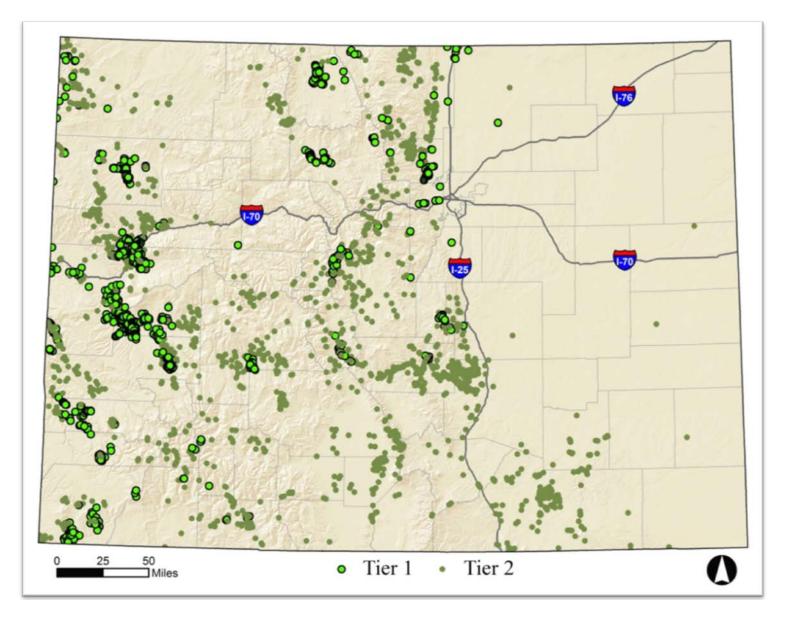


Figure 1. Distribution of Colorado's Plants of Greatest Conservation Need.

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	С	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	С	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	С	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).

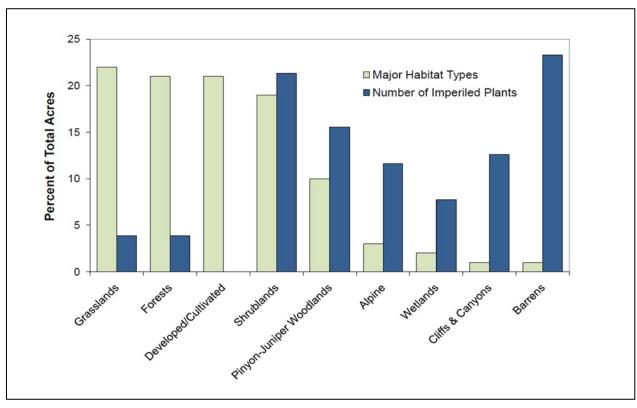


Figure 2. Key habitats as percentage of Colorado and number of PGCN.

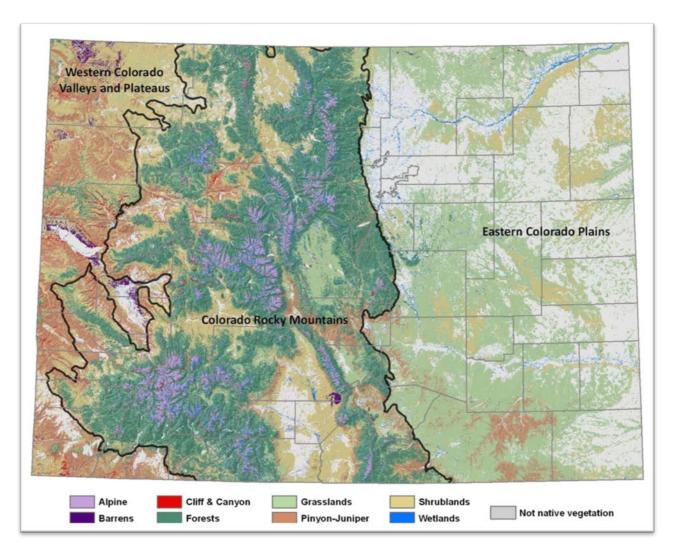


Figure 3. Distribution of major rare plant habitat types in Colorado.

# 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		
		Exposed Rock (alpine)		
	Alpine	Meadow Tundra		
Very High		Shrub Tundra		
	Barrens	Barrens		
		Exposed Rock		
	Cliff and Canyon	Cliff and Canyon		
	Pinyon-Juniper Woodlands and Savannas	Pinyon-Juniper		
		Deciduous Oak		
		Desert Shrub		
	Shrublands	Sagebrush		
		Saltbrush Fans and Flats		
High		Sand Dunes Complex (Shrubland)		
		Upland Shrub		
		Eastern Plains Streams		
		Grass/Forb Dominated Wetlands		
	Wetlands	Mountain Streams		
		Shrub-dominated Wetlands		
		Playas		
		Seeps and Springs		
		Aspen Forest		
Malanta		Douglas Fir		
	Forests	Mixed Conifer		
Moderate		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 lifecycle 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. weberi, 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

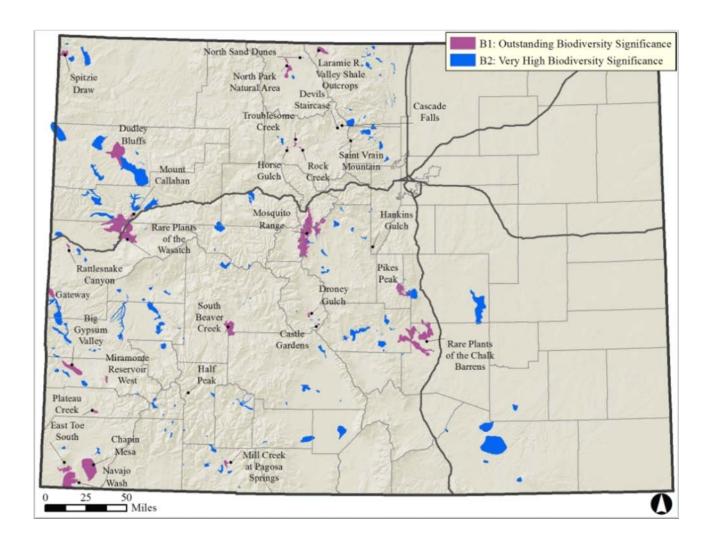


Figure 4. Important Plant Areas for PGCN. To improve map readability, only the B1 Important Plant Areas are labeled.

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 (<a href="https://www.cnhp.colostate.edu">www.cnhp.colostate.edu</a>).

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

Aletes humilis	Population S	Status	Populatio	n Trend	Distribution	Type	Habitat	Primary
	High	D	Stable	D	Southern Rocky Mountains	P	Cliff and Canyon	
Larimer aletes							Ponderosa Pine	
Tier 2 Plants								
General Threat	Specific Thre	eat			General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability poor dispersa restriction to	ıl capac	ity, and/or		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifti climate chang	_	alteration d	ue to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological of species its species unknown	elf and			Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Climate	Climate varia alteration of a e.g., droughts	normal	weather pat		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Natural Factors	Habitat is lim				Research and Monitoring		search critical life history/habitat inponents	M
Natural Factors	Habitat is lim	nited			Research and Monitoring	Mo of p	M	
Non-consumptive Disturbance	Recreation				Education and Communication		olish educational material/sponsor	L
							cational programs to raise public areness	
Aletes latilohus	Population S	Status	Populatio	on Trend	Distribution		1 0 1	Primary
Aletes latilobus	Population S	Status D	Populatio Unknown		Distribution Colorado Plateau	awa	Habitat Cliff and Canyon	Primary 🗸
Canyonlands aletes	*		*			Type	Habitat	
Canyonlands aletes Tier 1 Plants	Medium	D	*		Colorado Plateau	Type P	Habitat Cliff and Canyon Desert Shrub	
Canyonlands aletes	Medium  Specific Thre  Vulnerability poor dispersa	D eat due to	Unknown movement ity, and/or	barriers,		Type P Spe	Habitat Cliff and Canyon	
Canyonlands aletes Tier 1 Plants General Threat	Medium  Specific Three  Vulnerability	D eat due to al capace rare hang and	movement ity, and/or bitat feature	barriers,	Colorado Plateau  General Conservation Action	Type P Spe Coll	Habitat Cliff and Canyon Desert Shrub ccific Conservation Action d banking (incl. protocols,	Priority H
Canyonlands aletes Tier 1 Plants General Threat Climate	Medium  Specific Thre  Vulnerability poor dispersa restriction to  Habitat shifti climate change	eat due to al capacerare ha ng and ge respone	movement ity, and/or bitat feature alteration d	barriers, es ue to e change	Colorado Plateau  General Conservation Action  Ex-situ Conservation	Type P Special Moresy and situ	Habitat Cliff and Canyon Desert Shrub  ccific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Canyonlands aletes Tier 1 Plants General Threat Climate Climate	Medium  Specific Thre Vulnerability poor dispersa restriction to Habitat shifti climate chang	due to due to due to due to due to due to due to and ang and ge respon elf and own ability (normal	movement ity, and/or bitat feature alteration deserted inter-depting intensificati weather pat	barriers, es ue to e change bendent	Colorado Plateau  General Conservation Action  Ex-situ Conservation  Planning and Zoning	Type P Special Moresy and situ Corand cliric (distension of the control of the co	Habitat Cliff and Canyon Desert Shrub  crific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Priority H
Canyonlands aletes Tier 1 Plants General Threat Climate Climate Climate	Medium  Specific Thre Vulnerability poor dispersa restriction to Habitat shifti climate chang  Phenological of species its species unknown  Climate varia alteration of	due to due to due to due to due capace rare ha ng and ge respon elf and/ own ability ( normal s, tornae	movement ity, and/or bitat feature alteration dise to climate for inter-deptintensificati weather pat dos, etc.)	barriers, es ue to e change bendent	Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and	Type P Spectoll Moorest and situ Correst and clim (disternation of the correst and clim) Representation of the correst and clim (disternation of the correst and clim) Moorest and clim (disternation of the correst and clim)	Habitat Cliff and Canyon Desert Shrub  crific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms) gage in collaborative, proactive	Priority H H M

Aletes m	acdougalii	Population	Status	Population Trend	Distribution	Type	Habitat	Primary
ssp. brev	riradiatus	Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	
Mesa Verde	aletes						Sandy Areas	
Tier 2	Plants							
General Thr	eat	Specific Thi	eat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate		poor dispers	al capa	o movement barriers, city, and/or abitat features	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shift climate char	_	l alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			self and	nse to climate change d/or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kno	wledge	Complete di unknown	stributi	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Climate		alteration of	norma	l weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
	mate Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.) ck of knowledge Population status unknown n-consumptive Disturbance Non-motorized recreation				Research and Monitoring Education and Communication	Mo Pub edu awa	M M	
Aliciella	sedifolia	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary
Stonecrop g	ū	Low	D	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine) Meadow Tundra	<b>✓</b>
Tier 1	Plants							
General Thr	eat	Specific Thi	eat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate		poor dispers	al capa		Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shift climate char		l alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			self and	nse to climate change d/or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Indirect Cor (Mortality)	nsumptive Use	Grazing by	domest	ic sheep	Compatible Resource Use		olement compatible grazing nagement	Н
Lack of kno	owledge	Response to poorly unde	_	ement/disturbance	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
		1 ,	rstood					Н
Natural Fac	tors	Small popul		ze	Research and Monitoring	Mo	nitor population status	11
	nptive Disturbance		ation si		Research and Monitoring Education and Communication	Pub edu	nitor population status dish educational material/sponsor cational programs to raise public ureness	Н
Non-consur		Small popul	ation si zed rec	reation		Pub edu awa Wri	olish educational material/sponsor cational programs to raise public	
Non-consur	mptive Disturbance	Small popul Non-motoria Motor-powe	ation sized recred recred recred iability	reation reation (intensification or I weather patterns,	Education and Communication	Pub edu awa Wri mar Eng	olish educational material/sponsor cational programs to raise public areness te and implement travel	Н

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

Anticlea vaginatus	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
J	Medium	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon	<b>✓</b>
Alcove death camas							
Tier 2 Plants							
General Threat	Specific Thre			General Conservation Action		ecific Conservation Action	Priority
Climate	Vulnerability poor dispersal restriction to	l capac	•	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shiftii climate chang	_	alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		elf and	se to climate change for inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete dist unknown	tributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Climate		ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Population sta	atus un	known	Research and Monitoring	Mo	nitor population status	M
Habitat Degradation	Altered hydro aquifer)	logica	l regime (surface or	Maintain or Restore Natural Processes	Res	store natural hydrologic regime	L
Aquilegia chrysantha	Population S	tatus	Population Trend	Distribution	Туре	Habitat	Primary
var. rydbergii	Low	D	Declining D	Southern Rocky Mountains	P	Mountain Streams	<b>✓</b>
•			J			Seeps and Springs	<b>✓</b>
Golden columbine						Douglas Fir	
Tier 2 Plants General Threat	Specific Thre	at		General Conservation Action	Sne	ecific Conservation Action	Priority
Climate	*	due to		Ex-situ Conservation	See	bd banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting climate change	-	alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		elf and	se to climate change for inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Taxonomic st	atus is	unclear	Research and Monitoring	Tax	konomic work is needed	Н
Natural Factors	-	re sma	ll and declining	Research and Monitoring		nitor population status	Н
Non-consumptive Disturbance	Recreation			Voluntary Standards	for	plement Best Management Practices recreation management	Н
Climate		ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, urba development	an, and	ex-urban	Land Protection (Public, Private Easements, and Resource Rights		quire conservation easement for itality protection	M
Habitat Degradation	Fragmentation	n		Land Protection (Public, Private Easements, and Resource Rights	s hab Nat	ablish legal designation to protect bitat (e.g., wilderness, Research tural Area, Special Interest Area)	M
Invasive or Exotic Species	Invasive plan varieties that		ds and garden nybridize)	Invasive Species Control and Prevention	Coı	ntrol non-natives	M
Lack of knowledge			pollination biology parameters unknown	Research and Monitoring		search critical life history/habitat nponents	M

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

Asclepias	uncialis ssp.	Population S	tatus	Population	Trend	Distribution	Type	Habitat	Primary
uncialis	-	Medium	D	Declining	D	Central Shortgrass Prairie	P	Shortgrass Prairie	<b>✓</b>
Dwarf milkw	eed					Southern Rocky Mountains	О	Pinyon-Juniper	
Tier 2	Plants								
General Threa	at	Specific Thre	at			General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		Vulnerability poor dispersa restriction to	l capac	city, and/or	arriers,	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifting climate change	_	alteration du	e to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	H
Climate		Phenological of species itse species unkno	elf and			Research and Monitoring	anc clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conv	ersion	Conversion to	cropl	and		Land Protection (Public, Private Easements, and Resource Rights		quire conservation easement for pitat protection	Н
Natural Facto	ors	Population lin				Research and Monitoring		search critical life history/habitat mponents	Н
Climate		Climate varia alteration of r e.g., droughts	normal	weather patte		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Indirect Cons (Mortality)	sumptive Use	Incompatible	Grazii	ng		Voluntary Standards		plement Best Management Practices livestock grazing	M
Non-consump	ptive Disturbance	Off-road vehi	cular t	ravel		Compatible Resource Use		nage use to be compatible with diversity	M
Habitat Conv	ersion	Energy Devel	opmei	nt		Voluntary Standards		plement Best Management Practices energy development and mining	L
Invasive or E	xotic Species	Invasive plan	ts			Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	L

A atua a alua a mia ua	Population S	Status	Population	Trend	Distribution	Type	Habitat	Primary	
Astragalus anisus	Medium	D	Stable	D	Southern Rocky Mountains	Р	Sagebrush	<b>✓</b>	
C : 211 4.1	Wediam	2	Stubie	D	·		C		
Gunnison milkvetch									
Tier 2 Plants General Threat	Specific Thre	aat			General Conservation Action	Sne	ecific Conservation Action	Priority	
Climate	•		movement ba	arriers.			ed banking (incl. protocols,	H	
	poor dispersa	al capac			2.1 std const. talon		lection, and cultivation)		
Climate	Habitat shifti climate chang	_	alteration due	; to	Planning and Zoning	Mo resp and situ	Н		
Climate		elf and/	nse to climate /or inter-deper		Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Habitat Degradation	Roads				Voluntary Standards		plement Best Management Practices transportation projects	Н	
Non-consumptive Disturbance	Motor-power	red recr	eation		Voluntary Standards		plement Best Management Practices recreation management	Н	
Climate		normal	intensification weather patte dos, etc.)		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Lack of knowledge	Response to unknown	fire and	d other disturb	ances	Research and Monitoring		Research species/habitat response to management or disturbance		
Lack of knowledge	Basic life cyc	cle unkı	nown		Research and Monitoring	Res	M		
Habitat Degradation			(potential for t due to cheatg	grass)	Invasive Species Control and Prevention	_	plement integrated weed/pest nagement plan	L	
Indirect Consumptive Use (Mortality)	Grazing				Voluntary Standards		plement Best Management Practices livestock grazing	L	
Invasive or Exotic Species	Invasive plan	ıts (espe	ecially cheatg	rass)	Invasive Species Control and Prevention	Imp ma:	L		
	D 1.1 (	G	D 14	T 1	D: ( '1 .'	T.	TT 1.5.	D :	
Astragalus cronquistii	Population S Low	D	Population Unknown	D	Distribution Colorado Plateau	Type P	Habitat Desert Shrub	Primary <a>✓</a>	
Cronquist milkvetch									
Tier 2 Plants									
General Threat	Specific Thre				General Conservation Action		ecific Conservation Action	Priority	
Climate	poor dispersa	al capac		ırriers,	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shifti climate chang	-	alteration due	; to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate		elf and/	nse to climate of or inter-dependent		Research and Monitoring	Cor and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of knowledge	Complete dis unknown	tributio	on in Colorado	)	Research and Monitoring		nduct field inventory to refine known tribution	Н	
Climate		normal	intensification weather patte dos, etc.)		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Habitat Degradation	Roads				Voluntary Standards	-	plement Best Management Practices transportation projects	M	
							r J		

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

Astragalus debequaeus	Population S	tatus	Population	n Trend	Distribution	Type	Habitat	Primary
0 1	Medium	D	Stable	D	Southern Rocky Mountains	P	Barrens	<b>✓</b>
D-D					Utah High Plateau	P	Pinyon-Juniper	<b>✓</b>
DeBeque milkvetch					Colorado Plateau	O	Desert Shrub	
Tier 2 Plants							Sagebrush	
General Threat	Specific Thre	at			General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability poor dispersa restriction to	l capac	ity, and/or	•	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shiftin climate chang	_	alteration du	ie to	Planning and Zoning	res and	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate	Phenological of species itse species unkno	lf and/		_	Research and Monitoring	and clin	nduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Resource Extraction	Oil and gas di	rilling			Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate	Climate varia alteration of r e.g., droughts	ormal	weather patt		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Roads				Voluntary Standards		plement Best Management Practices transportation projects	M
Lack of knowledge	Complete dist unknown	ributio	on in Colorac	lo	Research and Monitoring		nduct field inventory to refine known tribution	n M
Lack of knowledge	Biology and e	cology	y poorly kno	wn	Research and Monitoring		search critical life history/habitat mponents	M

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Astragalus deterior	Population	n Status	Population Trend	Distribution	Type	Habitat	Primary	
J	Low	D	Unknown	Colorado Plateau	P	Cliff and Canyon	✓	
Cliff-palace milkvetch	All know	n occurrer	nces are historical.					
Tier 1 Plants								
General Threat	Specific Tl	hreat		General Conservation Action	Spe	ecific Conservation Action	Priority	
				Protected Area Management	Ma wit	Н		
Climate	poor dispe	rsal capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shi climate cha	_	alteration due to	Planning and Zoning	res	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs		
Climate		itself and/	se to climate change or inter-dependent	Research and Monitoring	Cor and clir (dis	Н		
Lack of knowledge	Population	status un	known	Research and Monitoring	Mo	onitor population status	Н	
Lack of knowledge	Complete o	distributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n H	
				Education and Communication	edu	blish educational material/sponsor acational programs to raise public areness	M	
Climate		of normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Lack of knowledge	Response t	o disturba	nnce unknown	Research and Monitoring		search species/habitat response to nagement or disturbance	M	
Non-consumptive Disturbance	Non-motor	rized recre	eation	Voluntary Standards		plement Best Management Practices recreation management	L	

Astragalus equisolensis	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary	
	Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	✓	
Horseshoe milkvetch								
Tier 2 Plants								
General Threat	Specific Th	reat		General Conservation Action	Spe	ecific Conservation Action	Priority	
				Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	Н	
Climate	poor disper	sal capa		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shi	_	alteration due to	Planning and Zoning	res <sub>l</sub>	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs		
Climate	_	tself and	nse to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Habitat Degradation				Land Protection (Public, Private) Easements, and Resource Rights	, Exp	pand existing Palisade ACEC	Н	
Non-consumptive Disturbance	Recreation			Voluntary Standards		Implement Best Management Practices for recreation management		
Climate		f normal	(intensification or weather patterns, ados, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Lack of knowledge	Population			Research and Monitoring	Mo	nitor population status	M	
Astragalus humillimus	Population Low	n Status D	Population Trend Unknown	Distribution Colorado Plateau	Type P	Habitat Cliff and Canyon	Primary <a> ✓</a>	
Mancos milkvetch								
Tier 1 Plants								
General Threat	Specific Th	reat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	Vulnerabili poor disper	ty due to	o movement barriers, city, and/or abitat features	Ex-situ Conservation	See	d banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shi climate cha	-	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate		tself and	nse to climate change /or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of knowledge	Population	status ui	ıknown	Research and Monitoring	Mo	nitor population status	Н	
Lack of knowledge	Complete d	listributi	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н	
Lack of knowledge	Threats are	poorly u	ınderstood	Research and Monitoring	Mo	nitor population status	Н	
Climate			(intensification or weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive	M	

Astragal	us iodopetalus	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary	
		Medium	D	Unknown	Colorado Plateau	P	Sagebrush	<b>✓</b>	
Violet milky	vetch				Southern Rocky Mountains	P	Mixed Forest		
Tier 2	Plants								
General Thr		Specific Thre	eat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate		Vulnerability poor dispersa restriction to	al capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate		Habitat shifti climate chan	_	alteration due to	Planning and Zoning	res <sub>l</sub> and	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate			elf and	se to climate change or inter-dependent	Research and Monitoring	and clin	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Lack of kno	wledge	Complete dis	stributio	on in Colorado	Research and Monitoring	Cor dist	n H		
					Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	M	
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		Engage in collaborative, proactive planning and conservation programs		
Lack of kno	wledge	Population st			Research and Monitoring	Mo	Monitor population status		
Non-consun	nptive Disturbance	Non-motoriz	ed recr	eation	Voluntary Standards	Imp for	M		
Astragal	us	Population S	Status	Population Trend	Distribution	Туре	Habitat	Primary	
lonchoco		Low	D	Unknown	Utah-Wyoming Rocky	P	Pinyon-Juniper	<b>✓</b>	
var. ham	=				Mountains		Desert Shrub		
Hamilton m									
Tier 1	Plants								
General Thr		Specific Thre	eat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate		Vulnerability poor dispersa restriction to	al capac		Ex-situ Conservation	See	ed banking (incl. protocols, lection, and cultivation)	Н	
Climate			ing and	alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate			elf and	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of kno	wledge	unknown		n in Colorado	Research and Monitoring	dist	nduct field inventory to refine known tribution		
Lack of kno	wledge	Population st			Research and Monitoring		nitor population status	H	
Climate				intensification or weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
		e.g., drought	s, torna	dos, etc.)					
Non-consun	nptive Disturbance	e.g., droughts			Voluntary Standards		blement Best Management Practices recreation management	M	

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

Astragalus	Population Sta	atus	Population 7	Γrend	Distribution T	Гуре	Habitat	Primary
microcymbus	Medium	D	Declining	D	Southern Rocky Mountains	P	Sagebrush Pinyon-Juniper	
Skiff milkvetch							1 myon vamper	
Tier 1 Plants								
General Threat	Specific Threat	t			General Conservation Action	Spe	cific Conservation Action	Priority
					Land Protection (Public, Private), Easements, and Resource Rights	hab	ablish legal designation to protect itat (e.g., Area of Critical vironmental Concern)	Н
					Research and Monitoring	Mo	nitor population status	Н
Climate	Vulnerability d poor dispersal or restriction to ra	capaci	ity, and/or	rriers,	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting climate change	-	alteration due	to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological re of species itself species unknow	f and/o		_	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Natural Factors	Herbivory (e.g.	,rabbi	its)		Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)				Capacity Building and Cooperation	Eng plar	M	
Non-consumptive Disturbance	Motor-powered				Education and Communication	edu	olish educational material/sponsor cational programs to raise public ureness	M
Non-consumptive Disturbance	Motor-powered	l recre	eation		Voluntary Standards		element Best Management Practices recreation management	M
Astragalus	Population Sta	atus	Population 7	Γrend	Distribution T	Гуре	Habitat	Primary
missouriensis var. humistratus Missouri milkvetch	Medium	D	Unknown		Southern Rocky Mountains	P	Deciduous Oak Ponderosa Pine Foothill/Mountain Grassland	<b>Y Y</b>
Tier 2 Plants	C C TEI					C	······································	D: '/
General Threat  Climate	Specific Threat Vulnerability d poor dispersal o restriction to ra	ue to	ity, and/or	rriers,	General Conservation Action Ex-situ Conservation	See	d banking (incl. protocols, ection, and cultivation)	Priority H
Climate	Habitat shifting	and a	alteration due	to	Planning and Zoning		del potential habitat/range shifts in conse to projected climate changes	Н
	climate change	-				and	prepare adaptation plan to define in and ex situ conservation needs	
Climate	climate change	espons			Research and Monitoring	and situ Cor and clin	prepare adaptation plan to define in	Н
	Phenological re of species itself species unknow Housing, urban development	espons f and/o vn	or inter-depen	dent	Research and Monitoring  Land Protection (Public, Private), Easements, and Resource Rights	and situ Cor and clin (dis	prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Н
Climate	Phenological re of species itself species unknow Housing, urban	espons f and/o vn i, and ility (i	ex-urban  ntensification weather patter	dent	Land Protection (Public, Private),	and situ Cor and clim (dis Acc hab	prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) quire conservation easement for	

**Table 3. - Continued.** 

Astragalus naturitensis	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
o .	Low	D	Unknown	Colorado Plateau	P	Cliff and Canyon	<b>✓</b>
<b>37</b>				Southern Rocky Mountains	P	Pinyon-Juniper	<b>✓</b>
Naturita milkvetch				Utah High Plateau	O	Sagebrush	
Tier 2 Plants							
General Threat	Specific Three	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability poor dispersa restriction to	ıl capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifti climate chan	0	alteration due to	Planning and Zoning	resp	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate	_	elf and	nse to climate change /or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Resource Extraction	Oil and gas d pipelines, du	_	(including roads,	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Population st	atus un	known	Research and Monitoring	Mo	onitor population status	M
Non-consumptive Disturbance	Motor-power	red recr	reation	Voluntary Standards		plement Best Management Practices recreation management	M

Astragalus osterho	outii	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
3		Low	D	Unknown	Southern Rocky Mountains	P	Sagebrush	<b>✓</b>
Kremmling milkvetch								
Tier 1 Plants								
General Threat	5	Specific Three	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
					Land Protection (Public, Private) Easements, and Resource Rights	hab Nat	ablish legal designation to protect itat (e.g., wilderness, Research ural Area, Acrea of Critical vironmental Concern))	Н
					Planning and Zoning	issu	mote consideration of biodiversity les in transportation and land use nning processes	Н
Climate	1	oor dispersa	ıl capac		Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shifti climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	(		elf and	se to climate change for inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion		Housing, urb development		ex-urban	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for itat protection	Н
Habitat Degradation	]	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н
Lack of knowledge	]	Population st	atus un	known	Research and Monitoring	Mo	nitor population status	Н
Non-consumptive Disturb	ance I	Motor-power	ed recr	eation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public ureness	Н
Non-consumptive Disturb	ance 1	Motor-power	ed recr	eation	Voluntary Standards		plement Best Management Practices recreation management	Н
Resource Extraction	(	Oil and gas d	rilling		Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate	á		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M

Astragalus piscator	Population S	tatus	Population Trend	Distribution	Туре	Habitat	Primary
	Medium	D	Unknown	Colorado Plateau	P	Sandy Areas	<b>V</b>
Fisher Towers milkvetch						Desert Shrub	
Tier 2 Plants						Pinyon-Juniper	
General Threat	Specific Threa	at		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		due to		Ex-situ Conservation	See	d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shiftin climate change	-	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		lf and/	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Housing, urba	ın, and	ex-urban	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for itat protection	Н
Habitat Degradation				Land Protection (Public, Private) Easements, and Resource Rights	, Exp	pand existing Palisade ACEC	Н
Habitat Degradation	Roads or Rails	roads		Voluntary Standards		plement Best Management Practices transportation projects	Н
Climate	alteration of n	ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Climate  Lack of knowledge		ormal , tornac	weather patterns, dos, etc.)	1 ,	plai	7.1	M
Lack of knowledge	alteration of n e.g., droughts,	ormal tornac	weather patterns, dos, etc.)	Cooperation  Research and Monitoring	plai	nning and conservation programs	
Lack of knowledge	alteration of n e.g., droughts, Population sta	ormal tornac	weather patterns, los, etc.) known	Cooperation  Research and Monitoring	plai	nning and conservation programs nitor population status	M
Lack of knowledge  Astragalus rafaelensis	alteration of n e.g., droughts, Population sta	ormal , tornac atus un tatus	weather patterns, dos, etc.) known	Cooperation  Research and Monitoring  Distribution	plan Mo Type	nning and conservation programs nitor population status  Habitat	M Primary
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch	alteration of n e.g., droughts, Population sta	ormal , tornac atus un tatus	weather patterns, dos, etc.) known	Cooperation  Research and Monitoring  Distribution	plan Mo Type	nning and conservation programs nitor population status  Habitat	M Primary
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch  Tier 2 Plants	alteration of n e.g., droughts, Population sta Population St Low	ormal , tornac atus unl tatus	weather patterns, dos, etc.) known	Cooperation  Research and Monitoring  Distribution  Colorado Plateau	Mo Type P	nitor population status  Habitat Pinyon-Juniper	M Primary
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch  Tier 2 Plants  General Threat	alteration of n e.g., droughts, Population sta  Population Sta  Low  Specific Threa  Vulnerability poor dispersal	tatus D  at due to capaci	weather patterns, dos, etc.) known  Population Trend Unknown  movement barriers, ity, and/or	Cooperation  Research and Monitoring  Distribution	Mo Type P Spe	nning and conservation programs nitor population status  Habitat	M Primary
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch  Tier 2 Plants  General Threat  Climate	Population Sta  Population Sta  Low  Specific Threa  Vulnerability poor dispersal restriction to r	tatus  D  at due to capac are hal	weather patterns, dos, etc.) known  Population Trend Unknown  movement barriers, ity, and/or	Cooperation  Research and Monitoring  Distribution  Colorado Plateau  General Conservation Action	Mo Type P Spe coll Mo resp and	nning and conservation programs nitor population status  Habitat Pinyon-Juniper  ccific Conservation Action d banking (incl. protocols,	M Primary  Priority
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch  Tier 2 Plants  General Threat  Climate  Climate	alteration of n e.g., droughts, Population sta  Population Sta  Low  Specific Threa  Vulnerability poor dispersal restriction to r  Habitat shiftin climate change	tatus  D  at due to capacare haling and a e	weather patterns, dos, etc.) known  Population Trend Unknown  movement barriers, ity, and/or bitat features alteration due to	Cooperation  Research and Monitoring  Distribution Colorado Plateau  General Conservation Action Ex-situ Conservation	Mo Type P Spe See coll Mo respand situ Cor and clin	Habitat Pinyon-Juniper  ceific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes aprepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors	M Primary Priority H
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch Tier 2 Plants General Threat Climate  Climate	alteration of n e.g., droughts, Population sta  Population Sta  Low  Specific Three Vulnerability poor dispersal restriction to r  Habitat shiftin climate change	tatus  D  at due to capacare hal ag and se	weather patterns, dos, etc.) known  Population Trend Unknown  movement barriers, ity, and/or bitat features alteration due to  see to climate change or inter-dependent	Cooperation  Research and Monitoring  Distribution Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning	Mo Type P Spee coll Mo respand situ Cor and clin (dis	Habitat Pinyon-Juniper  ceific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing	M Primary Priority H
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch	alteration of n e.g., droughts, Population sta  Population Sta  Low  Specific Threa  Vulnerability poor dispersal restriction to r  Habitat shiftin climate change  Phenological of species itse species unkno  No threats doc  Climate varial	tatus  D  at due to capaciare haling and de e  responsition of the company of the	weather patterns, dos, etc.) known  Population Trend Unknown  movement barriers, ity, and/or bitat features alteration due to  see to climate change or inter-dependent  red intensification or weather patterns,	Cooperation  Research and Monitoring  Distribution Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Mo Type P Spee coll Mo respand situ Cor and clin (dis) Det Eng	Habitat Pinyon-Juniper  ceific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	M Primary Priority H H
Lack of knowledge  Astragalus rafaelensis  San Rafael milkvetch Tier 2 Plants General Threat Climate  Climate  Lack of knowledge	alteration of n e.g., droughts, Population state Populati	tatus  D  at due to capac are hal ng and e  respons of and own  cument bility (i	movement barriers, ity, and/or bitat features alteration due to see to climate change or inter-dependent ed intensification or weather patterns, dos, etc.)	Cooperation  Research and Monitoring  Distribution Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and	Mo Type P Spee coll Mo resp and situ Cor and clin (diss Det Eng plan	Habitat Pinyon-Juniper  ceific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs induct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors in proper spersal mechanisms, mutualisms) in threat status gage in collaborative, proactive	M Primary Priority H H

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Astragalus schmolliae	Population Status Population Tren	d Distribution	Type Habitat	Primary
o .	Medium D Declining D	Colorado Plateau	P Pinyon-Juniper	<b>✓</b>
Schmoll milkvetch	Rapidly declining			
Tier 1 Plants				
General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement barrier poor dispersal capacity, and/or restriction to rare habitat features	s, Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
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	Н
Climate	Phenological response to climate chang of species itself and/or inter-dependent species unknown		Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	Н
Invasive or Exotic Species	Invasive plants	Research and Monitoring	Examine impact of post-fire management strategies	Н
Lack of knowledge	Population status in areas outside National Park is poorly understood	Research and Monitoring	Monitor population status	Н
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 thistl and cheatgrass moving into burned are		Implement integrated weed/pest management plan	M
Lack of knowledge	Current threats are poorly understood of lands outside of the National Park	on 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

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Astragalu	is tortipes	Population Status Population Trend			Distribution	Type	Habitat	Primary	
J	-	Medium	D	Stable	D	Colorado Plateau	P	Desert Shrub	
Sleeping Ute	milkvetch								
Tier 1	Plants								
General Thre	at	Specific Thre	at			General Conservation Action	Spe	ecific Conservation Action	Priority
						Research and Monitoring	Mo	nitor population status	Н
Climate		Vulnerability poor dispersa restriction to	l capac	ity, and/or	ŕ	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifti climate chang	_	alteration d	ue to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		Phenological of species itse species unkno	elf and			Research and Monitoring	and clin	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of know	vledge	Complete dis unknown	tributio	on in Colora	ıdo	Research and Monitoring		nduct field inventory to refine known tribution	n H
Non-consump	ptive Disturbance	Motor-power	ed recr	eation		Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н
Non-consump	ptive Disturbance	Motor-power	ed recr	eation		Voluntary Standards		plement Best Management Practices recreation management	Н
Climate		Climate varia alteration of r e.g., droughts	normal	weather pat		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Conv	rersion	Conversion to	o cropl	and?		Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for oitat protection	M
Lack of know	vledge	Response to o	listurb	ance		Research and Monitoring		search species/habitat response to nagement or disturbance	M

Boechera crandallii	Population Status	Population Trend	Distribution	Type	Habitat	Primary	
	Unknown	Unknown	Southern Rocky Mountains	P	Sagebrush		
Crandall's rock-cress					Sandy Areas		
Tier 2 Plants							
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н	
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	resp and	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs		
Climate	Phenological respon of species itself and/ species unknown		Research and Monitoring	and clin	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Habitat Degradation	Roads		Voluntary Standards		plement Best Management Practices transportation projects	Н	
Lack of knowledge	Population status un	known	Research and Monitoring		nitor population status	Н	
Lack of knowledge	Complete distributio unknown	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н	
			Land Protection (Public, Private) Easements, and Resource Rights		ablish legal designation to protect itat (e.g., Special Interestl Area)	M	
Climate	Climate variability (i alteration of normal e.g., droughts, tornac	weather patterns,	Capacity Building and Cooperation	_	gage in collaborative, proactive nning and conservation programs	M	
Boechera glareosa	Population Status	Population Trend			Habitat	Primary	
3	Unknown	Unknown			Barrens	✓	
NA							
Tier 1 Plants							
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н	
Climate	Habitat shifting and climate change		Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate	Phenological respon of species itself and/ species unknown		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of knowledge	Threats and response poorly understood	e to change are	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н	
Lack of knowledge	Biology, ecology, an are poorly known	d detailed habitat	Research and Monitoring		earch critical life history/habitat	Н	
			Passarah and Manitorina	Cor	nduct field inventory to refine known	Н	
	Complete distributio unknown	n in Colorado	Research and Monitoring		ribution		
Lack of knowledge  Lack of knowledge	Complete distributio		Research and Monitoring	dist	ribution nitor population status	Н	

Botrychium lineare	Population	Status	Population 7	Trend	Distribution	Type	Habitat	Primary
	Low	D	Declining	D	Southern Rocky Mountains	P	Aspen Forest	<b>✓</b>
Narrowleaf grape fern							Foothill/Mountain Grassland Mixed Conifer	
Tier 2 Plants							Wixed Collifer	
General Threat	Specific Thr	eat			General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability poor dispers restriction to	al capac	•	riers,	Ex-situ Conservation	See coll	Н	
Climate	Habitat shift climate chan	_	alteration due	to	Planning and Zoning	Mo resp and situ	Н	
Climate		self and/	se to climate c or inter-depen		Research and Monitoring	Cor and clin (dis	Н	
Lack of knowledge	Complete di unknown	stributio	n in Colorado		Research and Monitoring		nduct field inventory to refine known ribution	Н
					Research and Monitoring		nitor population status	M
Climate		normal	ntensification weather patter los, etc.)		Capacity Building and Cooperation	_	gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Roads or Ra	ilroads			Voluntary Standards		plement Best Management Practices transportation projects	M
Lack of knowledge	Details of ha	abitat un	known		Research and Monitoring	Det	ermine habitat requirements	M
D - 4 1	Population	Statue	Domulation 7	Frand	Distribution	Туре	Habitat	D.:
KATTUCHIUM TAY HAV	1 Opulation	Status	Population .	Henu	Distribution		Habitat	Primary
Botrychium tax. nov. "furcatum"	*		Population 7	rena		P	Meadow Tundra	Primary <a></a>
"furcatum"	Low	X	Unknown	rend	Southern Rocky Mountains			
•	*		•	rend			Meadow Tundra	
"furcatum"  Fork-leaved moonwort  Tier 1 Plants	Low	X	•	riend	Southern Rocky Mountains	P	Meadow Tundra Spruce-Fir	
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat	Low Specific Thr	X	Unknown		Southern Rocky Mountains  General Conservation Action	P Spe	Meadow Tundra Spruce-Fir cific Conservation Action	Priority
"furcatum"  Fork-leaved moonwort  Tier 1 Plants	Low Specific Thr	X eat y due to al capac	Unknown  movement basity, and/or		Southern Rocky Mountains	P Spe See	Meadow Tundra Spruce-Fir	
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat	Low  Specific Thr  Vulnerability poor dispers restriction to	X  reat  y due to al capaci o rare hal	Unknown  movement basity, and/or	riers,	Southern Rocky Mountains  General Conservation Action	Spe See coll Mo resp and	Meadow Tundra Spruce-Fir cific Conservation Action d banking (incl. protocols,	Priority
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate	Low  Specific Thr  Vulnerability poor dispers restriction to  Habitat shift climate chan	x y due to al capaco rare halting and age	Unknown  movement basity, and/or bitat features alteration due	riers, to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation	P Spe See coll Mo resp and situ Cor and clin	Meadow Tundra Spruce-Fir  ceific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate  Climate	Low  Specific Thr  Vulnerability poor dispers restriction to  Habitat shift climate chan  Phenologica of species its	x y due to al capaco rare halting and age	Unknown  movement basity, and/or bitat features alteration due	riers, to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning	P Spe See coll Mo resp and situ Cor and clin (dis Imp	Meadow Tundra Spruce-Fir  cific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors	Priority H
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate  Climate	Low  Specific Thr  Vulnerability poor dispers restriction to  Habitat shift climate chan  Phenologica of species its species unkr	y due to al capace o rare hal- ting and age	Unknown  movement basity, and/or bitat features alteration due	tto  hange dent	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	P Spe See coll Mo resp and situ Cor and clin (dis Imp for Res	Meadow Tundra Spruce-Fir  cific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors persal mechanisms, mutualisms) element Best Management Practices	Priority H H
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate  Climate  Climate  Habitat Degradation	Low  Specific Thr  Vulnerability poor dispers restriction to  Habitat shift climate chan  Phenologica of species its species unkr  Roads  Biology, ecc are poorly ki  Complete di unknown	y due to al capace o rare hal- ting and age  I responself and/nown	movement barity, and/or bitat features alteration due se to climate cor inter-depend detailed hab	tto  hange dent	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Voluntary Standards	P Spe See coll Mo resp and situ Cor and clin (dis Imp for Ress con Cor	Meadow Tundra Spruce-Fir  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors appears al mechanisms, mutualisms) element Best Management Practices transportation projects earch critical life history/habitat	Priority H H H
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate  Climate  Climate  Habitat Degradation  Lack of knowledge	Low  Specific Thr Vulnerability poor dispers restriction to Habitat shift climate chan  Phenologica of species its species unkr  Roads  Biology, ecc are poorly ki Complete di unknown  Climate vari	y due to al capaco rare haling and age  I responsel fand/nown  blogy, annown stributio ability (i	movement barity, and/or pitat features alteration due se to climate cor inter-depend d detailed habit in Colorado entensification weather patter	tto hange dent	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Voluntary Standards  Research and Monitoring	P Spe See coll Mo resp and situ Cor and clin (dis Imp for Res con Cor dist Eng	Meadow Tundra Spruce-Fir  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors appears al mechanisms, mutualisms) element Best Management Practices transportation projects	Priority H H H
"furcatum"  Fork-leaved moonwort  Tier 1 Plants  General Threat  Climate  Climate  Climate  Habitat Degradation  Lack of knowledge  Lack of knowledge	Low  Specific Thr Vulnerability poor dispers restriction to Habitat shift climate chan  Phenologica of species its species unkr  Roads  Biology, ecc are poorly ki Complete di unknown  Climate vari alteration of e.g., drought	y due to al capacio rare haling and age  I responsel fand/nown  blogy, annown stributio ability (in normal as, tornace responsel	movement barity, and/or pitat features alteration due se to climate cor inter-depend d detailed habit in Colorado entensification weather patter	to hange dent or ns,	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Voluntary Standards  Research and Monitoring  Research and Monitoring  Capacity Building and	P Spe See coll Mo resp and situ Cor and clin (dis Imp for Res con Cor dist Eng plan Res	Meadow Tundra Spruce-Fir  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors appears almechanisms, mutualisms) element Best Management Practices transportation projects transportation projects transportation projects transportation projects the action of the protocol projects the protocol projects the protocol protocol projects the protocol protocol projects the protocol protocol projects the protocol protocol protocol projects the protocol	Priority H H H

Caesalpinia repens	Population Status	Population Trend		Habitat	Primary
T	Unknown	Unknown		Sandy Areas	<b>✓</b>
Cucanina much maa				Desert Shrub	
Creeping rush-pea					
Tier 2 Plants General Threat	Smooifia Throat		General Conservation Action	Specific Consequention Action	Duionity
Climate	Specific Threat  Vulnerability due to r	novement barriers	Ex-situ Conservation	Specific Conservation Action	Priority H
Cililate	poor dispersal capacit restriction to rare hab	ty, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	п
Climate	Habitat shifting and a climate change	lteration due to	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	Н
Climate	Phenological respons of species itself and/o species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete distribution unknown	n in Colorado	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Climate	Climate variability (in alteration of normal ve.g., droughts, tornado	veather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Camissonia	Population Status	Population Trend	Distribution	Type Habitat	Primary
eastwoodiae	Low	Unknown	Colorado Plateau	P Saltbrush Fans and Flats	<b>✓</b>
Eastwood evening primrose Tier 2 Plants				Pinyon-Juniper	
General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to r poor dispersal capacit restriction to rare hab	ty, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and a climate change	lteration due to	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes	Н
				and prepare adaptation plan to define in situ and ex situ conservation needs	
Climate	Phenological respons of species itself and/o species unknown		Research and Monitoring		Н
Climate  Lack of knowledge	of species itself and/o	or inter-dependent	Research and Monitoring  Research and Monitoring	situ and ex situ conservation needs  Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors	
	of species itself and/o species unknown	n in Colorado  ntensification or veather patterns,		situ and ex situ conservation needs  Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Conduct field inventory to refine known	
Lack of knowledge	of species itself and/o species unknown  Complete distribution unknown  Climate variability (in alteration of normal v	n in Colorado  ntensification or veather patterns,	Research and Monitoring Capacity Building and	situ and ex situ conservation needs  Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Conduct field inventory to refine known distribution  Engage in collaborative, proactive	Н
Lack of knowledge  Climate  Habitat Degradation	of species itself and/o species unknown  Complete distribution unknown  Climate variability (in alteration of normal v e.g., droughts, tornado	n in Colorado  Intensification or weather patterns, os, etc.)	Research and Monitoring  Capacity Building and Cooperation	situ and ex situ conservation needs  Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Conduct field inventory to refine known distribution  Engage in collaborative, proactive planning and conservation programs  Implement Best Management Practices	H M
Lack of knowledge  Climate	of species itself and/o species unknown  Complete distribution unknown  Climate variability (in alteration of normal v e.g., droughts, tornado Roads	n in Colorado  Intensification or weather patterns, oos, etc.)	Research and Monitoring  Capacity Building and Cooperation  Voluntary Standards	situ and ex situ conservation needs  Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Conduct field inventory to refine known distribution  Engage in collaborative, proactive planning and conservation programs  Implement Best Management Practices for transportation projects	H M

Carex stenoptila	Population Status	Population Trend	Distribution	Type	Habitat	Primary
Small-winged sedge Tier 2 Plants	Medium D	Unknown	Southern Rocky Mountains	P	Mountain Streams Shrub-dominated Wetlands Spruce-Fir Aspen Forest Exposed Rock Rocky Mtn Bristlecone Pine	<b>y y y y y y y y y y</b>
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Lack of knowledge	Threats unknown		Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Lack of knowledge	Complete distributio unknown	n in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Climate	Climate variability (i alteration of normal e.g., droughts, tornac	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Climate	Vulnerability due to poor dispersal capaci restriction to rare hal	ity, and/or	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	M
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define ir situ and ex situ conservation needs		M
Climate	Phenological respons of species itself and/ species unknown		Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	M
Lack of knowledge	Population status unl	known	Research and Monitoring	Mo	nitor population status	M
Non-consumptive Disturbance	Recreation?		Voluntary Standards		plement Best Management Practices recreation management	M

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Castilleja puberula	Population Status	Population Trend	Distribution	Type	Habitat	Primary
v <u>-</u>	Medium D	Unknown	Southern Rocky Mountains	P	Shrub Tundra	<b>✓</b>
Downy Indian-paintbrush						
Tier 2 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
			Species Management		intain/update comprehensive species abase	Н
Climate	Vulnerability due t poor dispersal capa restriction to rare h		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	d alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		onse to climate change d/or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete distribut	ion in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Climate	Climate variability alteration of norma e.g., droughts, torn	l weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Population status u	nknown	Research and Monitoring	Mo	onitor population status	M
Non-consumptive Disturbance	Recreation		Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	L
Non-consumptive Disturbance	Recreation		Voluntary Standards		plement Best Management Practices recreation management	L

Cirsium	perplexans	Population	Status	Population	on Trend	Distribution	Type	Habitat	Primary
		Low	D	Stable	D	Colorado Plateau	P	Sagebrush	<b>✓</b>
Adobe this	ilo.					Southern Rocky Mountains	P	Saltbrush Fans and Flats	
						Utah High Plateau	P		
Tier 2	Plants						-		
General Th	reat	Specific Thr				General Conservation Action		ecific Conservation Action	Priority
Climate		Habitat shift climate chan		alteration d	lue to	Planning and Zoning	res and	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		Phenologica of species its species unkr	self and/			Research and Monitoring	and clin	nduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of kno	owledge	Most occurre very few in a unknown				Research and Monitoring		search species/habitat response to nagement or disturbance	Н
						Education and Communication	Pul edu aw	M	
						Education and Communication	tho	ucate land owners, managers, and ose engaged in weed control about oiding impacts to native thistles	M
Climate		Climate vari alteration of e.g., drought	normal	weather pa		Capacity Building and Cooperation		gage in collaborative, proactive inning and conservation programs	M
Invasive or	Exotic Species	Bio-control species			um	Invasive Species Control and Prevention	nat mit	sign weed control activites to avoid tive thistles and develop methods for tigating impacts from bio-control ents such as introduced weevils	М
Lack of kno	owledge	Complete di unknown	stributio	n in Colora	ıdo	Research and Monitoring		nduct field inventory to refine know tribution of natural occurrences	n M
Lack of kno	owledge	Biology and	ecology	are poorly	known	Research and Monitoring		search critical life history/habitat mponents	M
Habitat Deg	gradation	Roads				Voluntary Standards		plement Best Management Practices transportation projects	L
Indirect Co (Mortality)	nsumptive Use	Grazing				Compatible Resource Use		plement compatible grazing nagement	L
Resource E	xtraction	Oil and gas	drilling			Voluntary Standards		plement Best Management Practices energy development and mining	L

Cirsium scapanolepis	Population Status Population Population Status	oulation Trend	I	Habitat	Primary
Cirsium scapanoiepis		known		Mixed Conifer	<b>✓</b>
	Chanown	KIIO WII		Foothill/Mountain Grassland	
Mountain-slope thistle				Mixed Forest	
Tier 1 Plants	G 'C' TT				D 1 1.
General Threat  Climate	Specific Threat  Habitat shifting and altera climate change	ation due to	General Conservation Action Planning and Zoning	Specific Conservation Action  Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs	Priority H
Climate	Phenological response to of species itself and/or int species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Invasive or Exotic Species	Bio-control of non-native species	Cirsium	Invasive Species Control and Prevention	Educate land owners, managers, and those engaged in weed control about avoiding impacts to native thistles	Н
Invasive or Exotic Species	Bio-control of non-native species	Cirsium	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	Н
Lack of knowledge	Taxonomy		Research and Monitoring	Taxonomic work	Н
Lack of knowledge	Complete distribution in Cunknown	Colorado	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Climate	Climate variability (intensalteration of normal weath e.g., droughts, tornados, e	ner patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or Exotic Species	Bio-control of non-native species		Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Cleome multicaulis	Population Status Population	oulation Trend	Distribution T	'ype Habitat	Primary
Cicone manieauis		clining D	Southern Rocky Mountains	P Grass/Forb Dominated Wetlands Playas	<b>V</b>
Slender spiderflower				1 layus	
Tier 2 Plants General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
General Fineat	Specific Tiffeat		Land Protection (Public, Private), Easements, and Resource Rights	Establish legal designation to protect habitat (e.g., Area of Critical Environmental Concern)	Н
			Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	Н
Climate	Vulnerability due to move poor dispersal capacity, ar restriction to rare habitat f	nd/or		Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and altera climate change	tion due to	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	Н
Climate	Phenological response to of species itself and/or int species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
					M
			Research and Monitoring	Monitor population status	
Climate	Climate variability (intensalteration of normal weath	ner patterns,	Research and Monitoring Capacity Building and Cooperation	Monitor population status  Engage in collaborative, proactive planning and conservation programs	M
Climate  Habitat Degradation	alteration of normal weath	ner patterns, tc.)	Capacity Building and	Engage in collaborative, proactive	

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

Corispermum navicula	Population Sta	tus Population Trend	Distribution	Type	Habitat	Primary
•		D Unknown	Southern Rocky Mountains	P	Barrens Sandy Areas	
Boat-shaped bugseed					y	
Tier 1 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	poor dispersal c	ue to movement barriers, apacity, and/or re habitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting climate change	and alteration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate	_	and/or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Taxonomic wor	k is needed	Research and Monitoring	Tax	konomy	Н
Lack of knowledge	Complete distri	bution in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n H
Non-consumptive Disturbance	Motor-powered	recreation	Education and Communication	edu	blish educational material/sponsor acational programs to raise public areness	Н
Non-consumptive Disturbance	Motor-powered	recreation	Voluntary Standards		plement Best Management Practices recreation management	Н
Climate		lity (intensification or rmal weather patterns, ornados, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Population statu	ıs unknown	Research and Monitoring	Mo	onitor population status	M

C								
Crypiani	tha gypsophila	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
		Medium	D	Unknown	Colorado Plateau	P	Barrens	<b>✓</b>
Gypsum Va	alley cat's- eye				Southern Rocky Mountains	О	Pinyon-Juniper	<b>✓</b>
Tier 1	Plants							
General Th	reat	Specific Thre	at		General Conservation Action	Spe	cific Conservation Action	Priority
					Land Protection (Public, Private) Easements, and Resource Rights	habi	blish legal designation to protect itat (e.g., Area of Critical ironmental Concern)	Н
Climate		Vulnerability poor dispersa restriction to	l capac	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shiftin climate chang	-	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			elf and/	se to climate change for inter-dependent	Research and Monitoring	and clim	duct primary research on rare plant pollinator responses to changing late, and other vulnerability factors persal mechanisms, mutualisms)	Н
Habitat Deg	gradation	Oil and gas pi	ipelines	s, roads, dust, etc.	Voluntary Standards		lement Best Management Practices energy development and mining	Н
Non-consur	mptive Disturbance	Motor-power	ed recre	eation	Compatible Resource Use		port off-road travel restrictions on lic land	Н
Resource E	xtraction	Oil and gas da	rilling a	and uranium mining	Voluntary Standards		lement Best Management Practices energy development and mining	Н
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		age in collaborative, proactive uning and conservation programs	M
Lack of kno	owledge	Population sta			Research and Monitoring	Moı	nitor population status	M
Delphin	•	Population S	totus		B: . 3 . 4			
	ium ramosum	1 opulation 5	iaius	Population Trend	Distribution	Type	Habitat	Primary
-	ium ramosum estre	Medium	D	Population Trend Unknown	Southern Rocky Mountains	Type P	Habitat Meadow Tundra	Primary <a> ✓</a>
var. alpe	estre	*		*		* *		
var. alpe	estre	*		*		* *		
var. alpe Colorado la	es <b>tre</b> urkspur Plants	*	D	*		P		
var. alpe Colorado la Tier 2	es <b>tre</b> urkspur Plants	Medium  Specific Thre	D at due to l capac	Unknown  movement barriers, ity, and/or	Southern Rocky Mountains	P Spec	Meadow Tundra	<b>✓</b>
var. alpe Colorado la Tier 2 General Thi Climate	es <b>tre</b> urkspur Plants	Medium  Specific Thre  Vulnerability poor dispersa restriction to	at due to l capac rare hal	Unknown  movement barriers, ity, and/or	Southern Rocky Mountains  General Conservation Action	Spec Seec collo	Meadow Tundra  cific Conservation Action d banking (incl. protocols,	Priority
var. alpe Colorado la Tier 2 General Th	es <b>tre</b> urkspur Plants	Medium  Specific Thre  Vulnerability poor dispersa restriction to a  Habitat shifting climate change	at due to l capac rare hal ng and ge respon	movement barriers, ity, and/or bitat features alteration due to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation	P Spec Seec colle Mooresp and situ Con and clim	Meadow Tundra  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in	Priority H
var. alpe Colorado la Tier 2 General Thi Climate Climate	estre urkspur Plants reat	Medium  Specific Thre  Vulnerability poor dispersa restriction to a  Habitat shiftin climate chang  Phenological of species itse species unknown	at due to l capac rare hal ng and ge respon	movement barriers, ity, and/or bitat features alteration due to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning	Special Seed collection of the seed collectio	Meadow Tundra  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Priority H H
var. alpe Colorado la Tier 2 General Thi Climate Climate Climate	estre urkspur Plants reat	Medium  Specific Thre  Vulnerability poor dispersa restriction to  Habitat shiftir climate chang  Phenological of species itse species unknown  Complete dist unknown	at due to l capac rare hal ng and ge respon elf and/ own tributio bility (inormal	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent in Colorado intensification or weather patterns,	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	P Special Moorespand situ Con and clim (distance) Eng	Meadow Tundra  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) duct field inventory to refine known	Priority H H
var. alpe Colorado la Tier 2 General Thr Climate  Climate  Lack of kno	estre urkspur Plants reat	Medium  Specific Thre  Vulnerability poor dispersa restriction to  Habitat shiftir climate chang  Phenological of species itse species unknown  Complete dist unknown  Climate varia alteration of r	at due to l capac rare hal ng and ge respon bility (inormal n, tornac	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent in in Colorado intensification or weather patterns, dos, etc.)	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and	P Special Moorespand situ Con and clim (distinguished) Eng plan	Meadow Tundra  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) duct field inventory to refine known ribution age in collaborative, proactive	Priority H H
var. alpe Colorado la Tier 2 General Th Climate	estre urkspur Plants reat	Medium  Specific Thre  Vulnerability poor dispersa restriction to a  Habitat shiftin climate chang  Phenological of species itse species unknown  Complete dist unknown  Climate varia alteration of ree.g., droughts	at due to l capac rare hal ng and ge respon bility (inormal n, tornac	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent in in Colorado intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and Cooperation	P Special Security Se	Meadow Tundra  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) duct field inventory to refine known ibution age in collaborative, proactive uning and conservation programs	Priority H H H M

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

Delphinium robustum	Population Status Popular	tion Trend		Habitat	Primary
1	Unknown Unknow	wn		Cliff and Canyon	<b>✓</b>
Wahatoya Creek larkspur				Aspen Forest	
Tier 2 Plants					
General Threat	Specific Threat	(	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement poor dispersal capacity, and/or restriction to rare habitat feature	or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and alteration climate change	due to I	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	Н
Climate	Phenological response to clim of species itself and/or inter-d species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete distribution in Colo unknown	orado I	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Climate	Climate variability (intensific alteration of normal weather p e.g., droughts, tornados, etc.)		Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Lack of knowledge	Population status unknown	I	Research and Monitoring	Monitor population status	M
Lack of knowledge	Biology, ecology, and detailed are poorly known	d habitats I	Research and Monitoring	Research critical life history/habitat components	M
Lack of knowledge	Threats unknown	I	Research and Monitoring	Research species/habitat response to management or disturbance	M
Descurainia kenheilii	Population Status Popula	tion Trend	Distribution	Type Habitat	Primary
	Low X Unknow	wn	Southern Rocky Mountains	P Meadow Tundra	<b>✓</b>
Heil's tansy mustard					
Tier 1 Plants					
General Threat	Specific Threat	(	General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to movement poor dispersal capacity, and/orestriction to rare habitat featu	or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and alteration climate change	n due to I	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	Н
Climate	Phenological response to clim of species itself and/or inter-d species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of knowledge	Threats and response to chang poorly understood	ge are I	Research and Monitoring	Research species/habitat response to management or disturbance	Н
Lack of knowledge	Biology, ecology, and detailed are poorly known	d habitat I	Research and Monitoring	Research critical life history/habitat components	Н
			Research and Monitoring	Conduct field inventory to refine known	Н
Lack of knowledge	Complete distribution in Colo unknown	orado I		distribution	
Lack of knowledge  Lack of knowledge  Climate	•	I	Research and Monitoring Capacity Building and	distribution  Monitor population status  Engage in collaborative, proactive	H M

Dicoria wetheril	lii	Population State Unknown	us	Population Unknown	Trend			Habitat Unknown	Primary
Wetherill's dicoria									
Tier 2 Plants									
General Threat		Specific Threat				General Conservation Action		ecific Conservation Action	Priority
Climate		Phenological res of species itself a species unknown	and/c		_	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge		Distribution, stat biology/ecology, are all unknown			threats	Research and Monitoring		sic research on all aspects of this cies' conservation are needed	Н
Draba exunguic	ulata	Population Statu	us	Population	Trend	Distribution	Type	Habitat	Primary
Clawless draba		Low I	)	Stable	D	Southern Rocky Mountains	P	Exposed Rock (alpine) Meadow Tundra	
Tier 2 Plants									
General Threat		Specific Threat				General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		Vulnerability due poor dispersal ca restriction to rare	paci	ty, and/or		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifting a climate change	and a	lteration du	e to	Planning and Zoning	res <sub>i</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		Phenological res of species itself a species unknown	and/c		_	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge		Numbers and dis known	tribu	tion are poo	orly	Research and Monitoring		nduct field inventory to refine known tribution and abundance	н Н
Climate		Climate variabili alteration of norr e.g., droughts, to	nal v	veather patte		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Non-consumptive Dist	urbance	Non-motorized r	ecrea	ntion		Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	M
Non-consumptive Dist	urbance	Non-motorized r	ecrea	ntion		Voluntary Standards		plement Best Management Practices recreation management	M
Lack of knowledge		Biology, ecology known	, and	l habitat are	poorly	Research and Monitoring		search critical life history/habitat nponents	L
Natural Factors		Trampling by mo	ounta	in goats		Research and Monitoring		search species/habitat response to nagement or disturbance	L

Draba g	gramınea	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
		Medium	D	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	
San Juan w	hitlow-grass						Shrub Tundra	Ш
Tier 2	Plants							
General Th	reat	Specific Thre	at		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		Vulnerability poor dispersa restriction to	l capac		Ex-situ Conservation	See coll	Н	
Climate		Habitat shiftii climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			elf and/	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Climate			ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of kno	owledge	Complete dist unknown	ributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	M
Lack of kno	owledge	Population sta	atus un	known	Research and Monitoring	Mo	nitor population status	L
Draba g	rayana	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
Ŭ	•			** 1	C d D 1 M	D	F 1D 1 / 1 ' )	
Gray's Peak	k whitlow-grass	Unknown		Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	
Gray's Peak Tier 2 General Th	Plants	Unknown  Specific Thre	at	Unknown	General Conservation Action		exposed Rock (alpine)	Priority
Tier 2	Plants		at	Unknown	·	Spe Ma	ecific Conservation Action intain/update comprehensive species	Priority H
Tier 2	Plants	Specific Thre	due to	movement barriers, ity, and/or	General Conservation Action	Spe Ma data See	ecific Conservation Action	•
Tier 2 General Th	Plants	Specific Thre  Vulnerability poor dispersa restriction to	due to l capac rare hal	movement barriers, ity, and/or	General Conservation Action Species Management	Spe Ma data See coll Mo resp and	ecific Conservation Action intain/update comprehensive species abase d banking (incl. protocols,	Н
Tier 2 General Th Climate	Plants	Vulnerability poor dispersa restriction to a Habitat shiftin climate change	due to l capac rare hal ng and ge	movement barriers, ity, and/or bitat features alteration due to	General Conservation Action Species Management Ex-situ Conservation	Spee Ma data See coll Mo resp and situ Con and clin	ecific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation) del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Н
Tier 2 General Th Climate Climate Climate	Plants	Vulnerability poor dispersa restriction to a Habitat shiftin climate chang  Phenological of species itse species unknown	due to l capac rare hal ng and te respon elf and/ own	movement barriers, ity, and/or bitat features alteration due to se to climate change	General Conservation Action Species Management Ex-situ Conservation Planning and Zoning	Spee Ma data See coll Mo resp and situ Con and clin (dis Con	cific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Н
Tier 2 General Th Climate Climate Climate	Plants	Vulnerability poor dispersa restriction to a Habitat shiftin climate chang  Phenological of species itse species unknown  Numbers and known  Climate varia	due to I capac rare hal ng and respon elf and/ own distrib	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent ution are poorly intensification or weather patterns,	General Conservation Action Species Management Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Spee Ma data See coll Mo resp and situ Con and clin (dis Con dist	cific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs induct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms) induct field inventory to refine known	Н
Tier 2 General Th Climate Climate Climate Lack of known	Plants	Vulnerability poor dispersa restriction to a Habitat shiftin climate change Phenological of species itse species unknown Climate varia alteration of results.	due to I capac rare haling and ge respondif and/own distribution bility (acrmal, tornad, torna	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent ution are poorly intensification or weather patterns, dos, etc.)	General Conservation Action Species Management Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and	Spe Ma data See coll  Mo resq and situ Con and clin (dist Eng plan	cific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs induct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms) induct field inventory to refine known ribution and abundance gage in collaborative, proactive	н н н
Tier 2 General Th  Climate  Climate  Climate  Lack of known consumments of the consumments of the consuments of the cons	Plants  areat  owledge	Vulnerability poor dispersa restriction to a Habitat shiftin climate chang  Phenological of species itse species unknown  Numbers and known  Climate varia alteration of r e.g., droughts	due to I capac rare hal ng and ge respon elf and/ own distrib bility (sormal , tornac ed recre	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent ution are poorly intensification or weather patterns, dos, etc.)	General Conservation Action Species Management  Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and Cooperation	Spe Ma data See coll Mo resp and situ Cor and clin (dis Cor dist Eng plan Pub edu awa Imp	ecific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs induct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors repersal mechanisms, mutualisms) induct field inventory to refine known ribution and abundance gage in collaborative, proactive ming and conservation programs  olish educational material/sponsor icational programs to raise public	H H H M
Tier 2 General Th  Climate  Climate  Climate  Lack of known consumments of the consumments of the consuments of the cons	Plants  preat  owledge  mptive Disturbance  mptive Disturbance	Vulnerability poor dispersa restriction to a Habitat shiftin climate change Phenological of species itse species unknown Climate varia alteration of re.g., droughts Non-motorize Non-motorize	due to I capac rare hal ng and ge respon elf and/ own distrib bility (second) tormal tormal tormae defected	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent ution are poorly intensification or weather patterns, dos, etc.) eation	General Conservation Action Species Management  Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and Cooperation  Education and Communication	Spee Ma data See coll Mo resp and situ Cor and clim (dist Eng plan Pub edu awa Imp for Res	ecific Conservation Action intain/update comprehensive species abase d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in onse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs induct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors repersal mechanisms, mutualisms) induct field inventory to refine known ribution and abundance gage in collaborative, proactive maing and conservation programs  olish educational material/sponsor cational programs to raise public areness blement Best Management Practices	H H H M

Draba malpighiacea	Population Status	Population Trend	Distribution	Type	Habitat	Primary
1 0	Unknown	Unknown	Southern Rocky Mountains		Aspen Forest Spruce-Fir	
Whitlow-grass					Spruce-rii	
Tier 1 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological respon of species itself and/ species unknown		Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Threats and response poorly understood	e to change are	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
Lack of knowledge	Biology, ecology, an are poorly known	d detailed habitat	Research and Monitoring		earch critical life history/habitat	Н
Lack of knowledge	Complete distributio unknown	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of knowledge	Population status un	known	Research and Monitoring	Mo	nitor population status	Н
Lack of knowledge	Taxonomic status is	uncertain	Research and Monitoring	Tax	conomic work is needed	Н
Climate	Climate variability (i alteration of normal e.g., droughts, tornad	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M

Draba si	mithii	Population Sta	atus F	Population Trend	Distribution	Type	Habitat	Primary
Smith white	ow-grass	Medium	D U	Unknown	Southern Rocky Mountains	P	Cliff and Canyon Aspen Forest Mixed Forest	
Tier 2	Plants						Upland Shrub	
General Thr	reat	Specific Threat	t		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		Vulnerability d poor dispersal or restriction to ra	capacity.		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifting climate change	_	eration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		_	f and/or	to climate change inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Non-consur	nptive Disturbance	Non-motorized	l recreati	on	Voluntary Standards		plement Best Management Practices recreation management	Н
					Education and Communication	edı	blish educational material/sponsor acational programs to raise public areness	M
Climate		Climate variabi alteration of no e.g., droughts, t	ormal we	ather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Deg	gradation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	M
Lack of kno	owledge	Numbers and d known	listributi	on are poorly	Research and Monitoring		nduct field inventory to refine known tribution and abundance	M
Lack of kno	owledge	Biology, ecolog known	gy, and l	nabitat are poorly	Research and Monitoring		search critical life history/habitat mponents	M

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 Th	reat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	poor disper	sal capa	movement barriers, city, and/or bitat features	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shi climate cha	_	alteration due to	Planning and Zoning	res <sub>I</sub>	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		tself and	nse to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Population	status ur	ıknown	Research and Monitoring	Mo	nitor population status	Н
Lack of knowledge	Complete of unknown	listributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Climate		f normal	(intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Natural sys (hydrologic		ification n construction	Education and Communication		cate dam operator about avoiding //or mitigating impacts	M
Lack of knowledge	Biology, ed known	cology, a	nd habitat are poorly	Research and Monitoring		search critical life history/habitat	M
Non-consumptive Disturbance	Non-motor	ized recr	eation	Education and Communication		rk with land manager to post No spassing signage	M
						TT 1 '	Primary
Erigeron kachinensis	Population	Status	Population Trend	Distribution	Type	Habitat	Filliary
Erigeron kachinensis	Population High	n Status D	Population Trend Unknown	Distribution Colorado Plateau	Type P	Cliff and Canyon	✓ ✓
Erigeron kachinensis  Kachina daisy	*				* *		
Kachina daisy	*				* *		
_	*	D			P	Cliff and Canyon	✓
Kachina daisy Tier 2 Plants General Threat	High  Specific The Vulnerability poor dispersion of the poor dispers	D areat ity due to	Unknown	Colorado Plateau	P Spe		
Kachina daisy Tier 2 Plants	High  Specific Th  Vulnerabili poor disper	D areat ity due to rsal capac to rare ha fting and	Unknown  movement barriers, city, and/or	Colorado Plateau  General Conservation Action	Spee See coll Mo resp	Cliff and Canyon  ccific Conservation Action d banking (incl. protocols,	Priority
Kachina daisy Tier 2 Plants General Threat Climate Climate	High  Specific Tr  Vulnerability poor disperse restriction  Habitat shist climate characteristics  Phenologic	D  areat  ty due to sal capacato rare hat fiting and ange  al respontself and	Unknown  movement barriers, eity, and/or abitat features alteration due to	Colorado Plateau  General Conservation Action  Ex-situ Conservation	P Spe See coll Mo resp and situ Cor and clin	Cliff and Canyon  ccific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Kachina daisy Tier 2 Plants General Threat Climate	High  Specific Tr  Vulnerability poor dispersestriction  Habitat shist climate characteristic characteristic consistency of species in species unless the species of species of species of species unless the species of speci	D  areat  ty due to sal capacio rare ha fiting and inge  al respontiself and cnown	Unknown  movement barriers, city, and/or abitat features alteration due to	Colorado Plateau  General Conservation Action  Ex-situ Conservation  Planning and Zoning	P Spe See coll Mo resp and situ Con and clin (dis	Cliff and Canyon  ccific Conservation Action d banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Priority H
Kachina daisy Tier 2 Plants General Threat Climate Climate	High  Specific Tr  Vulnerability poor disperse restriction  Habitat shist climate characteristic characteristic consideration of species in species unless additional consideration of the species of species unless additional consideration of the species consideration of the spe	D  areat  ty due to sal capacio rare hater the sal capacio rare hater the sal capacio rare hater the sal capacio rate hater the sal capacio rater the sal	Unknown  o movement barriers, city, and/or abitat features alteration due to  ase to climate change for inter-dependent  al regime (surface or cintensification or weather patterns,	Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Maintain or Restore Natural	P Spe See coll Mo resp and situ Con and clin (dis Ma	Cliff and Canyon  ccific Conservation Action d banking (incl. protocols, dection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Priority H H

Erigero	n wilkenii	Population	Status	Population Trend	Distribution	Type	Habitat	Primary
Wilken flea		Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon Pinyon-Juniper	
Tier 1	Plants							
General Th		Specific Th	reat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate		Vulnerabili poor disper	ty due to sal capac	movement barriers, ity, and/or bitat features	Ex-situ Conservation	See	d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shif climate char	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			tself and/	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kn	owledge	Population	status un	known	Research and Monitoring	Mo	nitor population status	Н
Lack of kn	owledge	Complete d unknown	istributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of kn	owledge	Threats poo	orly know	vn	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
Climate		alteration of	f normal	intensification or weather patterns,	Capacity Building and Cooperation	_	gage in collaborative, proactive nning and conservation programs	M
			its. tornac	ios, etc.)				
		e.g., drough	nts, torna	ios, etc.)				
Friogon	num hrandegeei			Population Trend	Distribution	Туре	Habitat	Primary
Eriogon	um brandegeei	Population	Status	Population Trend		Type P	Habitat Barrens	
Eriogon	num brandegeei			-	Distribution Southern Rocky Mountains	* *	Barrens	Primary  ✓
	num brandegeei	Population	Status	Population Trend		* *		
	, and the second	Population	Status	Population Trend		* *	Barrens	Primary  V
Brandegee	wild buckwheat Plants	Population	Status D	Population Trend		P	Barrens	
Brandegee Tier 1	wild buckwheat Plants	Population Low  Specific Th Vulnerabilit poor dispers	D reat ty due to sal capac	Population Trend Stable D movement barriers,	Southern Rocky Mountains	P Spe See	Barrens Sagebrush	
Brandegee Tier 1 General Th	wild buckwheat Plants	Population Low  Specific Th Vulnerabilit poor disperse restriction to	D reat ty due to sal capaco o rare hal	Population Trend Stable D  movement barriers, ity, and/or	Southern Rocky Mountains  General Conservation Action	P Spe See coll Mo resp and	Barrens Sagebrush cific Conservation Action d banking (incl. protocols,	Priority
Brandegee Tier 1 General Th Climate Climate	wild buckwheat Plants	Population Low  Specific Th Vulnerabilit poor dispersestriction to Habitat shift climate chain	reat ty due to sal capaco o rare halfting and nge	Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation	P Spee See coll Mo resp and situ Cor and clin	Barrens Sagebrush  ceific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Brandegee Tier 1 General Th Climate Climate	wild buckwheat Plants	Specific Th Vulnerabili poor dispersestriction to Habitat shift climate chain	reat ty due to sal capaco o rare halfting and nge al respontself and/nown	Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to  se to climate change for inter-dependent	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning	P Spee See coll Mo resp and situ Cor and clin (dis	Barrens Sagebrush  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors	Priority H
Brandegee Tier 1 General Th Climate Climate Climate	wild buckwheat Plants  areat	Specific Th Vulnerabilit poor dispersestriction to Habitat shift climate chain Phenologica of species it species unk	reat  ty due to sal capaco o rare halfting and nge  all respontself and/nown	Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent eation	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	P Spee See coll Mo resp and situ Cor and clin (dis Mar	Barrens Sagebrush  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors persal mechanisms, mutualisms)	Priorit; H H
Brandegee Tier 1 General Th Climate Climate Climate Non-consu	wild buckwheat Plants  rreat  mptive Disturbance	Specific Th Vulnerability poor dispersestriction to Habitat shift climate characteristic of species it species unk Motor-power Motor-power Climate var	reat ty due to sal capaco rare haliting and nge all respontself and/nown ered recreied recreiability (if normal	Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to  se to climate change or inter-dependent eation eation intensification or weather patterns,	Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement	P Spee See coll Mo resp and situ Cor and clin (dis Mai	Barrens Sagebrush  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors persal mechanisms, mutualisms) nage off-road travel	Priorit; H H
Brandegee Tier 1 General Th Climate Climate Climate	wild buckwheat Plants  reat  mptive Disturbance mptive Disturbance	Specific Th Vulnerabili poor disper restriction te Habitat shif climate chain Phenologica of species it species unk Motor-powe Climate var alteration of	reat ty due to sal capaco rare haliting and nge all respontself and/nown ered recreiability (if normal ats, tornaciban, and	Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to  se to climate change or inter-dependent eation intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement Education and Communication Capacity Building and	P Spe See coll Mo resp and situ Cor and clin (dis Mai Infe Eng plai	Barrens Sagebrush  ceific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors persal mechanisms, mutualisms) mage off-road travel  orm BLM travel management plan. gage in collaborative, proactive	Priority H H H

Eriogonum clavellatu	m Populat	ion Status	Population Trend	Distribution	Type	Habitat	Primary
3	Low	D	Unknown	Colorado Plateau	P	Desert Shrub Saltbrush Fans and Flats	<b>✓</b>
Comb Wash buckwheat						Sandrush Fans and Flats	
Tier 2 Plants							
General Threat	Specific	Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	poor disp	persal capac	movement barriers, ity, and/or bitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat s climate c	_	alteration due to	Planning and Zoning	resp	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		s itself and/	se to climate change for inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete unknowr		on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n H
Lack of knowledge	Population	on status un	known	Research and Monitoring	Mo	onitor population status	Н
Resource Extraction	Oil and g	gas drilling		Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate	alteration	• .	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation	,	gage in collaborative, proactive nning and conservation programs	M

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Eriogonum	Population Status	Population Trend	Distribution	Type	Habitat	Primary
coloradense Colorado wild buckwheat	Medium D	Unknown	Southern Rocky Mountains	P	Foothill/Mountain Grassland Shrub Tundra Meadow Tundra	<b>V V</b>
Tier 2 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
			Education and Communication	edu	blish educational material/sponsor acational programs to raise public areness	Н
Climate	Vulnerability due t poor dispersal capa restriction to rare h	acity, and/or	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	d alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		onse to climate change d/or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Biology and ecolog	gy are poorly known	Research and Monitoring		search critical life history/habitat nponents	Н
Lack of knowledge	Complete distribut unknown	ion in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Lack of knowledge	Population status u	ınknown	Research and Monitoring	Mo	nitor population status	Н
Non-consumptive Disturbance	Non-motorized rec	reation	Voluntary Standards		plement Best Management Practices recreation management	Н
Climate	Climate variability alteration of norma e.g., droughts, torn	al weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Roads		Voluntary Standards		plement Best Management Practices transportation projects	M
Indirect Consumptive Use (Mortality)	Incompatible grazi	ng?	Compatible Resource Use		plement compatible grazing nagement	M

# Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Eriogonum	Population Status	Population '	Trend	Distribution	Гуре	Habitat	Primary
pelinophilum	Low D Rapidly declining	Declining	D	Colorado Plateau	P	Desert Shrub	<b>✓</b>
Clay-loving wild buckwheat  Tier 1 Plants							
General Threat	Specific Threat			General Conservation Action	Spe	ecific Conservation Action	Priority
				Land Protection (Public, Private) Easements, and Resource Rights	*	ablish legal designation to protect vitat (extend existing ACEC)	Н
Climate	Vulnerability due to poor dispersal capaci restriction to rare hab	ty, and/or	rriers,	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	alteration due	to	Planning and Zoning	resp and	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological respons of species itself and/ species unknown			Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Conversion to cropla	nd		Land Protection (Public, Private) Easements, and Resource Rights	,	quire conservation easement for pitat protection	Н
Habitat Conversion	Housing, urban, and development	ex-urban		Land Protection (Public, Private) Easements, and Resource Rights	,	quire conservation easement for pitat protection	Н
Habitat Degradation	Roads			Planning and Zoning	issu	mote consideration of biodiversity ues in transportation and land use nning processes	Н
Climate	Climate variability (i alteration of normal e.g., droughts, tornac	weather patter		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Biology and ecology	poorly know	n	Research and Monitoring	req bet	termine minimum viable population uirements; transition probabilities ween different plant stages; and ble seed production	M
Lack of knowledge	Complete distribution unknown	n in Colorado		Research and Monitoring		nduct field inventory to refine known tribution	L

Eutrema edwardsii ssp	Population S	tatus	Populatio	n Trend	Distribution	Type	Habitat	Primary
penlandii	Medium	D	Stable	D	Southern Rocky Mountains	P	Meadow Tundra	✓
Penland alpine fen mustard								
Tier 1 Plants								
General Threat	Specific Thre	at			General Conservation Action	Spe	cific Conservation Action	Priority
					Land Protection (Public, Private Easements, and Resource Rights	hab	ablish legal designation to protect itat (e.g., state Natural Area)	Н
					Research and Monitoring		nitor population status	Н
Climate	Vulnerability poor dispersa restriction to	l capac	city, and/or	Í	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifti climate chang	_	alteration d	ue to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological of species itse species unkno	elf and			Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Climate	Climate varia alteration of r e.g., droughts	normal	weather pat		Capacity Building and Cooperation		age in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Altered hydro aquifer)	ologica	l regime (su	rface or	Maintain or Restore Natural Processes	Res	tore natural hydrologic regime	M
D	3.41					-	1 (D (M (D (	M
Resource Extraction	Mining				Voluntary Standards		element Best Management Practices mining	IVI
Gaura neomexicana	Population S	Status	Populatio	n Trend	· ·		ĕ	Primary
Gaura neomexicana		status D	Population Declining		· ·	for	mining	Primary 🗸
	Population S		•		Distribution	for	mining Habitat	Primary
Gaura neomexicana ssp. coloradensis	Population S		•		Distribution Central Shortgrass Prairie	for	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands	Primary 🗸
Gaura neomexicana ssp. coloradensis Colorado butterfly plant	Population S	D	•		Distribution Central Shortgrass Prairie	Type P	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs	Primary 🗸
Gaura neomexicana ssp. coloradensis Colorado butterfly plant Tier 1 Plants	Population S Low	D at due to l capac	Declining  movement bity, and/or	g D barriers,	Distribution Central Shortgrass Prairie Front Range	Type P Spe	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs Shrub-dominated Wetlands	Primary  ✓
Gaura neomexicana ssp. coloradensis Colorado butterfly plant Tier 1 Plants General Threat	Population S Low  Specific Thre Vulnerability poor dispersa	at due to l capac rare ha	Declining movement city, and/or bitat feature	barriers,	Distribution Central Shortgrass Prairie Front Range General Conservation Action	Type P Spe See coll Moorespand	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs Shrub-dominated Wetlands cific Conservation Action d banking (incl. protocols,	Primary  ✓  ✓  Priority
Gaura neomexicana ssp. coloradensis  Colorado butterfly plant Tier 1 Plants  General Threat Climate	Population S Low  Specific Thre Vulnerability poor dispersa restriction to Habitat shifti climate chang	at due to l capac rare ha ng and ge	Declining  movement city, and/or bitat feature alteration d	barriers, us to	Distribution Central Shortgrass Prairie Front Range General Conservation Action Ex-situ Conservation	Type P Spe See coll Moorespand situ Cor and clim	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs Shrub-dominated Wetlands cific Conservation Action d banking (incl. protocols, ection, and cultivation) del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Primary  V Priority H
Gaura neomexicana ssp. coloradensis  Colorado butterfly plant  Tier 1 Plants  General Threat  Climate  Climate	Population S Low  Specific Thre Vulnerability poor dispersa restriction to Habitat shifti climate change  Phenological of species itse	at due to l capac rare ha ng and ge respon	Declining  movement bity, and/or bitat feature alteration d  ase to climat /or inter-dep	barriers, es ue to e change	Distribution Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation Planning and Zoning	Type P Spe See coll Moorespand situ Cor and clin (dis	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs Shrub-dominated Wetlands cific Conservation Action d banking (incl. protocols, ection, and cultivation) del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Primary  V Priority H
Gaura neomexicana ssp. coloradensis  Colorado butterfly plant  Tier 1 Plants  General Threat  Climate  Climate	Population S Low  Specific Thre Vulnerability poor dispersa restriction to Habitat shiftic climate chang  Phenological of species itse species unknown Altered hydro	at due to l capacing and ge responent and own	Declining  movement bity, and/or bitat feature alteration d  ase to climat /or inter-dep	barriers, es ue to e change	Distribution Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Maintain or Restore Natural	Type P Spe See coll Mooresp and situ Cor and clin (dis Res	Habitat Eastern Plains Streams Grass/Forb Dominated Wetlands Seeps and Springs Shrub-dominated Wetlands cific Conservation Action d banking (incl. protocols, ection, and cultivation) del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Primary  V Priority H H

Gutierr	ezia elegans	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
		Low	D	Unknown	Colorado Plateau	P	Barrens	
Lone Mesa	a snakeweed						Sagebrush	
Tier 1	Plants							
General Tl	hreat	Specific Threa	at		General Conservation Action	Spe	cific Conservation Action	Priority
Climate		Vulnerability poor dispersal restriction to r	capac	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shiftin climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			lf and/	se to climate change or inter-dependent	Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kn	owledge	Complete dist unknown	ributio	on in Colorado	Research and Monitoring		duct field inventory to refine known ribution	Н
Non-consu	imptive Disturbance	Infrastructure visitor use	develo	opment for Park	Protected Area Management		ign public improvements to be apatible with biodiversity	Н
Resource I	Extraction	Oil and gas dr	illing	and seismic testing	Voluntary Standards		energy development and mining	Н
Climate			ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		age in collaborative, proactive ning and conservation programs	M
Habitat Co	onversion	Water storage			Protected Area Management		nage public use to be compatible n biodiversity	M
Lack of kn	owledge	Population sta	itus un	known	Research and Monitoring	Mo	nitor population status	M
Non-consu	imptive Disturbance	Motor-powere	ed recr	eation	Compliance and Enforcement	Mai	nage off-road travel	L
Hackeli	ia besseyi	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
	•	Unknown		Unknown	Southern Rocky Mountains	P	Mixed Conifer	✓
Bessey's st								
Tier 2	Plants							
General Tl	nreat	Specific Threa			General Conservation Action	-	cific Conservation Action	Priority
Climate		Vulnerability poor dispersal restriction to r	capac	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shiftin climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			lf and/	se to climate change or inter-dependent	Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kn	owledge	Biology, ecolo known	ogy, ar	nd habitat poorly	Research and Monitoring		earch critical life history/habitat aponents	Н
	owledge	Complete dist	ributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of kn		unknown						
Lack of kn		unknown Population sta	ıtus un	known	Research and Monitoring		nitor population status	Н

Hackelia gracilenta	Population	n Status	Populatio	n Trend	Distribution	Type	Habitat	Primary
Ü	Low	D	Stable	D	Colorado Plateau	P	Pinyon-Juniper Mixed Forest	
Mesa Verde stickseed								
Tier 1 Plants								
General Threat	Specific Th				General Conservation Action	-	cific Conservation Action	Priorit
Climate	poor disper	rsal capac	movement l ity, and/or bitat feature		Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shi climate cha	_	alteration d	ue to	Planning and Zoning	Moo resp and situ	Н	
Climate		itself and/	se to climate or inter-dep		Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of knowledge	Complete o	listributio	n in Colora	do	Research and Monitoring	Cor	iduct field inventory to refine known	Н
Climate		of normal	intensification weather patedos, etc.)		Capacity Building and Cooperation		age in collaborative, proactive nning and conservation programs	M
Non-consumptive Disturbance	Non-motor	ized recre	eation		Voluntary Standards		element Best Management Practices recreation management	M
Non-consumptive Disturbance	Non-motor	ized recre	eation		Education and Communication	edu	lish educational material/sponsor cational programs to raise public reness	L
Herrickia horrida	Population	n Status	Populatio	n Trend	Distribution	m	Habitat	ъ.
					Distribution	Type	Habitat	Primary
Canadian Divar aniny actor	Low	D	Unknown		Southern Rocky Mountains	P	Pinyon-Juniper Cliff and Canyon	Primary  —
• •	Low	D	-				Pinyon-Juniper	
Tier 2 Plants			-		Southern Rocky Mountains	P	Pinyon-Juniper Cliff and Canyon	
Tier 2 Plants General Threat	Specific Th	nreat	Unknown		Southern Rocky Mountains  General Conservation Action	P Spe	Pinyon-Juniper Cliff and Canyon cific Conservation Action	Priority
Tier 2 Plants General Threat	Specific The Vulnerability poor dispersional value of the Vulnerability	nreat ity due to rsal capac	Unknown	barriers,	Southern Rocky Mountains	P Spe See	Pinyon-Juniper Cliff and Canyon	
Tier 2 Plants General Threat Climate	Specific The Vulnerability poor dispersestriction	nreat ity due to rsal capac to rare ha fting and	Unknown  movement lity, and/or	barriers,	Southern Rocky Mountains  General Conservation Action	Spe See coll Moresp	Pinyon-Juniper Cliff and Canyon  cific Conservation Action d banking (incl. protocols,	Priority
Tier 2 Plants  General Threat  Climate  Climate	Specific TI Vulnerabili poor disper restriction Habitat shi climate cha	nreat ity due to real capac to rare ha fting and unge	Unknown movement l ity, and/or bitat feature alteration du	barriers, s ue to	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation	P Spe See coll Moorespand situ Cor and clim	Pinyon-Juniper Cliff and Canyon  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Tier 2 Plants  General Threat  Climate  Climate	Specific TI Vulnerabil poor disper restriction Habitat shi climate cha Phenologic of species is	nreat ity due to rsal capac to rare ha fting and unge al respon itself and/ known	movement lity, and/or bitat feature alteration du	barriers, s ue to e change endent	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning	P Spe See coll Moorespand situ Cor and clim (dis	Pinyon-Juniper Cliff and Canyon  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Priority H H
Tier 2 Plants  General Threat  Climate  Climate  Climate  Lack of knowledge	Specific TI Vulnerabilipoor disperestriction Habitat shi climate cha Phenologic of species is species unl Complete of	nreat ity due to rsal capac to rare ha fting and unge cal respon ttself and/ known	movement lity, and/or bitat feature alteration du se to climate or inter-dep	barriers, s ue to e change endent	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning  Research and Monitoring	P Spe See coll Mooresp and situ Cor and clin (dis Cor dist	Pinyon-Juniper Cliff and Canyon  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) aduct field inventory to refine known	Priority H H
Canadian River spiny aster Tier 2 Plants General Threat Climate  Climate  Climate  Lack of knowledge  Lack of knowledge  Lack of knowledge	Specific TI Vulnerabil poor disper restriction Habitat shi climate cha  Phenologic of species i species unl  Complete c unknown Population Threats poor	nreat ity due to rsal capace to rare ha fting and inge cal respon itself and/ known distribution status un orly known	movement lity, and/or bitat feature alteration du se to climate or inter-depon in Colorae known	barriers, s ue to e change endent	Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Spe See coll Moorespand situ Corrand clin (dis Corrdist Moorespand	Pinyon-Juniper Cliff and Canyon  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) aduct field inventory to refine known ribution	Priority H H

Ipomopsis aggregata	Population S	tatus	Population Trend	Distribution	Туре	Habitat	Primary
ssp. weberi	Low	D	Unknown	Southern Rocky Mountains	P	Mixed Conifer	<b>✓</b>
Rabbit Ears gilia							
Tier 2 Plants							
General Threat	Specific Thre	at		General Conservation Action	Spe	ecific Conservation Action	Priority
Lack of knowledge	Genetics of is understood	olated	populations poorly	Research and Monitoring	isol	netic studies to determine the ation and genetic diversity of parate occurrences	Н
Non-consumptive Disturbance	Non-motorize	ed recre	eation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public ureness	Н
Non-consumptive Disturbance	Recreation			Land Protection (Public, Private). Easements, and Resource Rights	hab	ablish legal designation to protect itat (e.g., wilderness, Research ural Area)	Н
Non-consumptive Disturbance	Motor-power	ed recr	eation	Voluntary Standards		plement Best Management Practices recreation management	Н
Indirect Consumptive Use (Mortality)	Grazing and t non-native un		ng by native and	Compatible Resource Use		Implement compatible grazing management	
Lack of knowledge	Population sta	atus un	known	Research and Monitoring	Mo	nitor population status	M
Climate		ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		Engage in collaborative, proactive planning and conservation programs	
Climate	Vulnerability poor dispersa restriction to	l capac	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	L
Climate	Habitat shiftin climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	L
Climate		elf and/	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	L
Invasive or Exotic Species	Invasive plan	ts		Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	L
Lack of knowledge	Reproductive unknown	and/or	pollination biology	Research and Monitoring		Research critical life history/habitat components	
Lack of knowledge	Complete dist	tributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	L

<b>Ipomopsis</b>	globularis	Population S	tatus	Population Trend	Distribution	Type	Habitat	Primary
1 1 .	0	Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra Exposed Rock (alpine)	<b>✓</b>
Globe gilia							Exposed Rock (alphie)	
	Plants					-		
General Threat		Specific Thre			General Conservation Action		ecific Conservation Action	Priority
Climate		Vulnerability poor dispersa restriction to	l capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shiftin climate chang		alteration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate			elf and/	se to climate change for inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowle	edge	Complete dissunknown	tributio	on in Colorado	Research and Monitoring		nduct field inventory to refine knowr tribution	ı H
Non-consumpti	ive Disturbance	Non-motorize	ed recre	eation	Education and Communication	edu	blish educational material/sponsor acational programs to raise public areness	Н
Non-consumpti	ive Disturbance	Motor-power	ed recr	eation	Voluntary Standards		plement Best Management Practices recreation management	Н
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Invasive or Exc	otic Species	Invasive plan	ts		Invasive Species Control and Prevention		onitor occurrences for weed invasion d control promptly	M
Lack of knowle	edge	Population sta	atus un	known	Research and Monitoring	Mo	onitor population status	M
Lack of knowle	edge	Response to c	hange	is poorly understood	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowle	edge	Biology, ecol are poorly kn		and specific habitat	Research and Monitoring		search critical life history/habitat nponents	M
Resource Extra	ection	Mining						M

Ipomopsis polyantha	Population Status Po	pulation Trend	Distribution	Туре	Habitat	Primary
Pagosa skyrocket	Medium D Do	eclining D	Southern Rocky Mountains	P	Barrens Ponderosa Pine	
Tier 1 Plants General Threat	Specific Threat		General Conservation Action	Sne	ecific Conservation Action	Priority
Climate	Vulnerability due to mov poor dispersal capacity, restriction to rare habitat	and/or		See	ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and alter climate change	ration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological response to of species itself and/or ir species unknown		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Commerical and industri	al development	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for oitat protection	Н
Habitat Conversion	Housing, urban, and ex-u development	ırban	Land Protection (Public, Private) Easements, and Resource Rights	*	quire conservation easement for sitat protection	Н
Habitat Degradation	Roads and Utilities		Voluntary Standards	for	plement Best Management Practices transportation and utility astruction and maintenance	Н
Invasive or Exotic Species	Invasive plants		Invasive Species Control and Prevention		p weed infestations and sensitive no ay/no mow zones	Н
			Education and Communication		plement landowner reach/education program	M
			Planning and Zoning	issu	mote consideration of biodiversity ues in transportation and land use nning processes	M
Climate	Climate variability (inter alteration of normal wea e.g., droughts, tornados,	ther patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Indirect Consumptive Use (Mortality)	Grazing		Compatible Resource Use		plement compatible grazing nagement	M
Lack of knowledge	Biology, ecology, and sp poorly known	ecific habitat is	Research and Monitoring		search critical life history/habitat nponents	M
Lack of knowledge	Complete distribution in unknown	Colorado	Research and Monitoring		nduct field inventory to refine known	n M
Lack of knowledge			Species Management	See	ed banking for future restoration worl	k M

Lepidium crenatum	Population Status	Population Trend	Distribution	Type	Habitat	Primary
1	Medium D	Unknown	Colorado Plateau	P	Desert Shrub	<b>✓</b>
A 111:			Southern Rocky Mountains	P	Sagebrush	
Alkaline pepperwort			Utah-Wyoming Rocky	P		
Tier 2 Plants			Mountains			
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability due t poor dispersal capa restriction to rare h		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	d alteration due to	Planning and Zoning	resp	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		nse to climate change d/or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete distributi unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n H
Lack of knowledge	Population status u	nknown	Research and Monitoring	Mo	onitor population status	Н
Lack of knowledge	Threats poorly kno	wn	Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Climate	Climate variability alteration of norma e.g., droughts, torn	l weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M

Lesquere	lla calcicola	Population	Status	Population Trend	Distribution	Type	Habitat	Primary
•		Low	D	Unknown	Central Shortgrass Prairie	P	Barrens	<b>~</b>
Rocky Moun	ntain bladderpod				Southern Rocky Mountains	0	Ponderosa Pine	
Tier 2	Plants							
General Thre	eat	Specific Th	reat		General Conservation Action		ecific Conservation Action	Priority
Climate		poor disper	sal capac	movement barriers, ity, and/or bitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shift climate cha		alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate			tself and/	se to climate change for inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conv	version	Housing, undevelopment		ex-urban	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for oitat protection	Н
Non-consum	ptive Disturbance	Motor-pow	ered recr	eation	Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н
Resource Ex	traction	Mining (co	al, sand/g	gravel, etc.)	Education and Communication	avo	ucate development industries about biding and/or mitigating impacts to e or sensitive species	Н
Climate			f normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degr	radation	Overhead u	itility line	es and towers	Voluntary Standards		plement Best Management Practices urban development, landscaping, etc	. M
Habitat Degr	radation	Roads or R	ailroads		Voluntary Standards		plement Best Management Practices transportation projects	M
Indirect Cons (Mortality)	sumptive Use	Grazing			Compatible Resource Use		plement compatible grazing nagement	L
Invasive or E	Exotic Species	Invasive pl	ants		Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	L

Lesquerella congesta	Population St	tatus	Population Trend	Distribution	Type	Habitat	Primary
	Medium	D	Unknown	Utah High Plateau	P	Barrens	✓
Dudley Bluffs bladderpod							
Tier 1 Plants							
General Threat	Specific Threa	ıt		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability poor dispersal restriction to r	capac		Ex-situ Conservation	See	Н	
Climate	Habitat shiftin climate change	_	alteration due to	Planning and Zoning	Mo resp and situ	Н	
Climate		lf and/	se to climate change for inter-dependent	Research and Monitoring	Con and clir (dis	Н	
Habitat Degradation	Utility and pip	eline	construction	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Habitat Degradation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н
Lack of knowledge	Population sta	tus un	known	Research and Monitoring	Mo	onitor population status	Н
Lack of knowledge	Response to cl	hange		Research and Monitoring	of o	estigate how plants respond to layers dust deposited during resource raction	Н
D F	0:1 1 1-	illing	and oil shale mining	Voluntary Standards	Imp	Н	
Resource Extraction	On and gas dr				for	energy development and mining	
Resource Extraction  Climate	Climate variab	oility (	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation	Eng	energy development and mining gage in collaborative, proactive nning and conservation programs	M
Climate	Climate variab	oility ( ormal torna	weather patterns,		Eng	gage in collaborative, proactive	M Primary
	Climate variable alteration of ne.g., droughts,	oility ( ormal torna	weather patterns, dos, etc.)	Cooperation  Distribution  Utah High Plateau	Eng pla Type P	gage in collaborative, proactive nning and conservation programs  Habitat  Barrens	
Climate	Climate variate alteration of ne.g., droughts,	oility ( ormal tornac	weather patterns, dos, etc.)  Population Trend	Cooperation	Eng plan	gage in collaborative, proactive nning and conservation programs Habitat	Primary
Climate  Lesquerella parviflora	Climate variate alteration of ne.g., droughts,	oility ( ormal tornac	weather patterns, dos, etc.)  Population Trend	Cooperation  Distribution  Utah High Plateau	Enş pla Type P O	gage in collaborative, proactive nning and conservation programs  Habitat  Barrens  Cliff and Canyon	Primary  V
Climate  Lesquerella parviflora  Piceance bladderpod	Climate variatalteration of ne.g., droughts,  Population St Medium  Specific Threa	pility (ormal tornactatus D	weather patterns, dos, etc.)  Population Trend Stable D	Distribution Utah High Plateau Southern Rocky Mountains General Conservation Action	Eng pla	gage in collaborative, proactive nning and conservation programs  Habitat  Barrens  Cliff and Canyon  ecific Conservation Action	Primary  Priority
Climate  Lesquerella parviflora  Piceance bladderpod Tier 2 Plants	Climate variatalteration of ne.g., droughts,  Population St Medium  Specific Threa	bility (ormal tornactatus  D  at due to capac	weather patterns, dos, etc.)  Population Trend Stable D  movement barriers, ity, and/or	Cooperation  Distribution  Utah High Plateau  Southern Rocky Mountains	Eng pla	gage in collaborative, proactive nning and conservation programs  Habitat  Barrens  Cliff and Canyon	Primary  V
Climate  Lesquerella parviflora  Piceance bladderpod Tier 2 Plants General Threat	Climate variate alteration of ne.g., droughts,  Population St.  Medium  Specific Threate Vulnerability poor dispersal restriction to restriction to restrict the second second second second second second second second sec	bility (ormal tornactatus D at due to capacare hairs and	weather patterns, dos, etc.)  Population Trend Stable D  movement barriers, ity, and/or	Distribution Utah High Plateau Southern Rocky Mountains General Conservation Action	Type P O Spe col Mo res and	Habitat Barrens Cliff and Canyon ecific Conservation Action ed banking (incl. protocols,	Primary  Priority
Climate  Lesquerella parviflora  Piceance bladderpod  Tier 2 Plants  General Threat  Climate	Climate variate alteration of ne.g., droughts,  Population St Medium  Specific Threat Vulnerability poor dispersal restriction to restriction to restriction to restriction to restrict climate change	bility (ormal tornard	weather patterns, dos, etc.)  Population Trend Stable D  movement barriers, ity, and/or bitat features alteration due to	Cooperation  Distribution  Utah High Plateau  Southern Rocky Mountains  General Conservation Action  Ex-situ Conservation	Type P O Spe col Mo resi and situ	Habitat Barrens Cliff and Canyon  ceific Conservation Action ed banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes a prepare adaptation plan to define in	Primary  Priority  H
Climate  Lesquerella parviflora  Piceance bladderpod Tier 2 Plants General Threat Climate  Climate	Climate variate alteration of ne.g., droughts, e.g., droughts, Population St Medium  Specific Threate Vulnerability poor dispersal restriction to restriction to restriction to restriction to restrict the climate change of species itse species unknown alternative variation of species itse species unknown alternative variation of species itse species unknown alternative variation varia	bility (cormal tornaction) tornaction to the tatus and to capacare have a capa	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent	Cooperation  Distribution Utah High Plateau Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning	Type P O Special Mores; and situ Con and clir (dis	Habitat Barrens Cliff and Canyon  ccific Conservation Action ed banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes a prepare adaptation plan to define in and ex situ conservation needs and cultivation responses to changing mate, and other vulnerability factors	Primary  Priority  H
Climate  Lesquerella parviflora  Piceance bladderpod Tier 2 Plants General Threat Climate  Climate	Climate variate alteration of ne.g., droughts, e.g., droughts,	bility ( formal tornar totatus  D  totat  due to capacare ha ag and e  respon lf and/ wn  illing,	movement barriers, ity, and/or bitat features alteration due to se to climate change for inter-dependent and oil shale mining intensification or weather patterns,	Cooperation  Distribution Utah High Plateau Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Type P O Special Moresiand situ Corand clirr (dis Imp	Habitat Barrens Cliff and Canyon  ceific Conservation Action ed banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes a prepare adaptation plan to define in and ex situ conservation needs and cultivation protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes a prepare adaptation plan to define in and ex situ conservation needs and cultivation proposes to changing mate, and other vulnerability factors spersal mechanisms, mutualisms) plement Best Management Practices	Primary Priority H H
Climate  Lesquerella parviflora  Piceance bladderpod Tier 2 Plants General Threat Climate  Climate  Climate  Resource Extraction	Climate variate alteration of ne.g., droughts,  Population St Medium  Specific Threate Vulnerability poor dispersal restriction to restrictio	bility ( cormal tornar  tatus  D  tatus  Tatus  D  tatus  T	movement barriers, ity, and/or bitat features alteration due to se to climate change for inter-dependent and oil shale mining intensification or weather patterns,	Distribution Utah High Plateau Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Voluntary Standards  Capacity Building and	Type P O Special Mores; and situ Con and clir (dis Imp for Eng pla	Habitat Barrens Cliff and Canyon  ceific Conservation Action ed banking (incl. protocols, lection, and cultivation)  del potential habitat/range shifts in ponse to projected climate changes a prepare adaptation plan to define in and ex situ conservation needs anduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms) plement Best Management Practices energy development and mining gage in collaborative, proactive	Primary  Priority  H  H

Lesquerella pruinosa	Population Status	Population Trend	Distribution	Туре	Habitat	Primary
	Medium D	Unknown	Southern Rocky Mountains	P	Barrens Foothill/Mountain Grassland	
Pagosa bladderpod					1 ootimi/ Wountain Grassiana	
Tier 2 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capac restriction to rare ha		Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting and climate change	l alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological responder of species itself and species unknown		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Climate	Climate variability ( alteration of normal e.g., droughts, torna	weather patterns,	Capacity Building and Cooperation	_	gage in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, urban, and development	d ex-urban	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for itat protection	M
Habitat Degradation	Roads		Voluntary Standards		element Best Management Practices transportation projects	M
Invasive or Exotic Species	Invasive plants		Invasive Species Control and Prevention		plement integrated weed/pest magement plan	M
Invasive or Exotic Species	Invasive plants		Invasive Species Control and Prevention		p weed infestations and sensitive no ny/no mow zones	M
Lack of knowledge	Complete distribution	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	M
Lack of knowledge	Population status ur	nknown	Research and Monitoring	Mo	nitor population status	M
Non-consumptive Disturbance	Motor-powered reco	reation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public ureness	M
Resource Extraction	Oil and gas drilling		Voluntary Standards		plement Best Management Practices energy development and mining	M

Lesquerella vicina	Population	Status	Population Trend	Distribution	Type	Habitat	Primary	
•	Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	<b>~</b>	
Good-neighbor bladderpod				Southern Rocky Mountains	P	Desert Shrub		
Tier 2 Plants								
General Threat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	Vulnerability poor dispers	y due to al capac	movement barriers, city, and/or bitat features	Ex-situ Conservation	See	Seed banking (incl. protocols, collection, and cultivation)		
Climate	Habitat shift climate chan	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate		self and	nse to climate change /or inter-dependent	Research and Monitoring	Cor and clin (dis	Н		
Habitat Degradation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н	
Non-consumptive Disturbance	Recreation			Education and Communication	edu	plish educational material/sponsor acational programs to raise public areness	Н	
Non-consumptive Disturbance	Recreation			Land Protection (Public, Private) Easements, and Resource Rights	hab	ablish legal designation to protect bitat (e.g., Area of Critical vironmental Concern)	Н	
Climate		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation	-	gage in collaborative, proactive nning and conservation programs	M	
Lack of knowledge	Population s			Research and Monitoring	Mo	onitor population status	M	
Lack of knowledge	Complete di unknown	stributio	on in Colorado	Research and Monitoring		nduct field inventory to refine knowr tribution	n M	
Limnorchis zothecina	Population		Population Trend		Туре	Habitat	Primary	
	Low	D	Unknown	Utah-Wyoming Rocky Mountains	P	Cliff and Canyon Seeps and Springs		
Alcove bog orchid						seeps and springs		
Tier 2 Plants								
General Threat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	poor dispers	al capac	movement barriers, city, and/or bitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shift climate chan		alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate		self and	se to climate change /or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of knowledge	Complete di unknown	stributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n H	
Lack of knowledge	Population s	tatus un	known	Research and Monitoring	Mo	onitor population status	Н	
Climate		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
			l regime (surface or	Maintain or Restore Natural		store natural hydrologic regime	L	

Lomatiu	m concinnum	Population S	tatus	Population '	Trend	Distribution	Type	Habitat	Primary
		Medium	D	Declining	D	Colorado Plateau	P	Sagebrush	<b>✓</b>
Colorado de	esert-parsley					Southern Rocky Mountains	O	Barrens	
Tier 2	Plants								
General Thr		Specific Thre	at			General Conservation Action	Spe	cific Conservation Action	Priority
Climate		•		movement ba	rriers.		-	d banking (incl. protocols,	Н
		poor dispersa restriction to	l capac	ity, and/or	,			ection, and cultivation)	
Climate		Habitat shiftii climate chang	_	alteration due	to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		Phenological of species itse species unkno	elf and/			Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Non-consun	nptive Disturbance	Recreation				Voluntary Standards		lement Best Management Practices recreation management	Н
Climate			normal	intensification weather patter dos, etc.)		Capacity Building and Cooperation		age in collaborative, proactive uning and conservation programs	M
						Research and Monitoring	Cor	duct field inventory to refine known	L
Lack of kno	owledge	Complete dist unknown	tributio	on in Colorado		Research and Monitoring		ribution	
Lack of kno  Lupinus				Population 7		Distribution			Primary
		unknown					dist	ribution	
	crassus	unknown Population S	status	Population '		Distribution	Type	ribution Habitat	Primary
Lupinus	crassus	unknown Population S	status	Population '		Distribution Colorado Plateau	Type P	Habitat Pinyon-Juniper	Primary
Lupinus  Payson lupir	crassus ne Plants	unknown Population S	Status D	Population '		Distribution Colorado Plateau	Type P P	Habitat Pinyon-Juniper	Primary
Lupinus Payson lupin	crassus ne Plants	Population S	Etatus D at due to l capac	Population Tunknown  Unknown  movement ba ity, and/or	Trend	Distribution Colorado Plateau Southern Rocky Mountains	Type P P Spe	Habitat Pinyon-Juniper Barrens	Primary 🗸
Lupinus Payson lupin Tier 2 General Thr	crassus ne Plants	Population S Low  Specific Thre Vulnerability poor dispersa	at due to l capac rare ha	Population of Unknown  Movement basity, and/or bitat features	Trend	Distribution Colorado Plateau Southern Rocky Mountains General Conservation Action	Type P P Spe See coll	Habitat Pinyon-Juniper Barrens  cific Conservation Action d banking (incl. protocols,	Primary  Priority
Lupinus  Payson lupin Tier 2 General Thr Climate	crassus ne Plants	Population S Low  Specific Thre Vulnerability poor dispersa restriction to the state of the stat	at due to l capac rare haling and ge	Population ' Unknown  movement ba ity, and/or bitat features alteration due	Trend rriers, to	Distribution Colorado Plateau Southern Rocky Mountains General Conservation Action Ex-situ Conservation	Type P P Spe See coll Moorespand situ Cor and clin	Habitat Pinyon-Juniper Barrens  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Primary  Priority  H
Lupinus  Payson lupin Tier 2 General Thr Climate  Climate	crassus ne Plants reat	Population S Low  Specific Thre Vulnerability poor dispersa restriction to Habitat shiftin climate change	at due to l capac rare haling and ge	Population 'Unknown  movement bacity, and/or bitat features alteration due	Trend rriers, to	Distribution Colorado Plateau Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning	Type P P Spe See coll Mooresp and situ Cor and clin (dis	Habitat Pinyon-Juniper Barrens  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in sonse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Primary  Priority  H
Lupinus Payson lupir Tier 2 General Thr Climate Climate	crassus ne Plants reat	Phenological of species unknown  Population S  Low  Specific Thre  Vulnerability poor dispersa restriction to a Habitat shifting climate change  Phenological of species itse species unknown.  Population state Climate varia	at due to l capac rare haling and ge responent atus un bility (normal	movement bacity, and/or bitat features alteration due see to climate co/or inter-dependent when the control of	Trend  Triers,  to  change dent  or	Distribution Colorado Plateau Southern Rocky Mountains  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Type P P Spe See coll Mooresp and situ Cor and clin (dis Mooresp Eng	Habitat Pinyon-Juniper Barrens  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Primary  Priority  H  H

Lygodesmia		Population	n Status	Population Trend	Distribution	Type	Habitat	Primary
doloresensis		Low	D	Unknown	Colorado Plateau	P	Pinyon-Juniper	<b>✓</b>
Dolores River skel	letonplant						Desert Shrub	
Tier 1 Plan	its							
General Threat		Specific Tl	hreat		General Conservation Action	Spe	ecific Conservation Action	Priority
					Land Protection (Public, Private) Easements, and Resource Rights		oand existing Palisade ACEC	Н
Climate		poor disper	rsal capac	movement barriers, city, and/or bitat features	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shi climate cha	-	alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			itself and	se to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degradation	on	Roads			Voluntary Standards	Imp	blement Best Management Practices transportation projects	Н
Lack of knowledge	e	Complete o	distributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known cribution	Н
Lack of knowledge	e	Population	status un	known	Research and Monitoring	Mo	nitor population status	Н
Climate			of normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Machaeranth	hera	Population	n Status	Population Trend	Distribution	Туре	Habitat	Primary
coloradoensi	S	Medium	D	Unknown	Southern Rocky Mountains	P	Foothill/Mountain Grassland Exposed Rock	
Colorado tansy-asi	ter						Meadow Tundra	
Tier 2 Plan	its							
General Threat		Specific Tl			General Conservation Action	•	ecific Conservation Action	Priority
Climate		poor disper	rsal capac	movement barriers, eity, and/or bitat features	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shi climate cha		alteration due to	Planning and Zoning	res <sub>l</sub> and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			itself and	se to climate change for inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	e	Additional needed	informat	ion on habitat is	Research and Monitoring	Res	search critical habitat components	Н
Lack of knowledge	e	Population	status un	known	Research and Monitoring	Mo	nitor population status	Н
Climate			of normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	e	Threats and poorly und		e to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowledge	e	Complete o	distributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	M
Non-consumptive	Disturbance	Non-motor	rized recr	eation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	M

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

Mentzelia rhizomata	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
	Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	<b>✓</b>
Roan Cliffs blazing star				Utah High Plateau	P		
Tier 2 Plants							
General Threat	Specific Three	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
				Land Protection (Public, Private) Easements, and Resource Rights		Н	
Climate	poor dispersa	ıl capac		Ex-situ Conservation	See	Н	
Climate	Habitat shifti climate chan	-	alteration due to	Planning and Zoning	Mo resp and situ	Н	
Climate	_	elf and	se to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Resource Extraction	Oil and gas d	lrilling,	and oil shale mining	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge			on in Colorado	Research and Monitoring		nduct field inventory to refine known	n M
Lack of knowledge	Population st	atus un	known	Research and Monitoring	Mo	nitor population status	M
Mertensia humilis	Population S	Status	Population Trend	Distribution	Туре	Habitat	Primary
	Low	D	Unknown	Southern Rocky Mountains	P	Sagebrush	✓
Rocky Mountain bluebells							
Tier 2 Plants							
General Threat	Specific Thre	eat		General Conservation Action	Sne	ecific Conservation Action	Priority
Climate	Vulnerability poor dispersa	due to			See	d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifti climate chan	-	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		elf and	se to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
			e to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Lack of knowledge	Threats and a		e to change are		Research critical life history/habitat components		
	poorly under	stood logy, a	nd detailed habitat	Research and Monitoring		•	Н
Lack of knowledge	poorly under Biology, eco are poorly kr	stood logy, ar rown		Research and Monitoring Research and Monitoring	Con	•	
Lack of knowledge  Lack of knowledge  Lack of knowledge  Lack of knowledge	poorly under Biology, eco are poorly kr Complete dis	stood logy, ar nown stributio	nd detailed habitat		Con dist Mo	nponents nduct field inventory to refine known	

Mimulus gemmiparus	Population Status	Population Trend	Distribution	Type	Habitat	Primary
9 1	Medium D	Unknown	Southern Rocky Mountains	P	Cliff and Canyon Seeps and Springs	<b>✓</b>
Budding monkey flower					Grass/Forb Dominated Wetlands	
Tier 1 Plants					Grass/1 oro Bommacca Westalias	_
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capa restriction to rare ha		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	l alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		nse to climate change d/or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Population status un	nknown	Research and Monitoring	Mo	nitor population status	Н
Non-consumptive Disturbance	Non-motorized reci	reation	Voluntary Standards		plement Best Management Practices recreation management	Н
Climate	Climate variability alteration of norma e.g., droughts, torna	l weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Complete distributi unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known cribution	M
Non-consumptive Disturbance	Non-motorized recr	reation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	M
Lack of knowledge	Restoration techniq understood	ues are poorly	Research and Monitoring		storation techniques (e.g., storage of pagules and reintroduction of plants)	L
Lack of knowledge	Threats and respons	se to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	L

Nuttallia	chrysantha	Population	Status	Population	Trend	Distribution	Type	Habitat	Primary	
	·	Low	D	Declining	D	Central Shortgrass Prairie	P	Barrens	✓	
Golden blaz	ing star					Southern Rocky Mountains	O	Pinyon-Juniper		
	Ü									
Tier 2 General Thr	Plants	C:CTI-				General Conservation Action	C	: <i>C</i> C	Priority	
	eat	Specific Th		. 1				ecific Conservation Action	H	
Climate		poor dispers	sal capac	movement ba city, and/or bitat features	rriers,	Ex-situ Conservation		Seed banking (incl. protocols, collection, and cultivation)		
Climate		Habitat shifting and alteration due to climate change				Planning and Zoning	res	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate		Phenological response to climate change of species itself and/or inter-dependent species unknown				Research and Monitoring	and clir	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Habitat Con	version	Housing, urban, and ex-urban development			Land Protection (Public, Private Easements, and Resource Rights		Acquire conservation easement for habitat protection			
Lack of kno	wledge	Taxonomy i	s poorly	understood		Research and Monitoring	Tax	konomic work	Н	
Non-consun	nptive Disturbance	Motor-powe	ered recr	eation		Compliance and Enforcement	Ma	nage off-road travel	Н	
Non-consun	nptive Disturbance	Motor-powe	ered reci	reation		Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н	
Resource Ex	traction	Mining (coa	ıl, sand/ş	gravel, etc.)		Education and Communication	avo	ucate development industries about oiding and/or mitigating impacts to e or sensitive species	Н	
Climate			normal	intensification weather patter dos, etc.)		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Habitat Deg	radation			es and towers		Voluntary Standards		plement Best Management Practices urban development, landscaping, etc	M	
Habitat Deg	radation	Roads or Ra	ilroads			Voluntary Standards		plement Best Management Practices transportation projects	M	
Indirect Con (Mortality)	sumptive Use	Grazing				Compatible Resource Use		plement compatible grazing nagement	L	
Invasive or l	Exotic Species	Invasive pla	ints			Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	L	

Nuttallia densa	Population Sta	tatus Po	opulation Trend	Distribution	Туре	Habitat	Primary
Arkansas Canyon stickleaf Tier 2 Plants	Low	D U	nknown	Southern Rocky Mountains	P	Pinyon-Juniper Upland Shrub	
General Threat	Specific Threat	ıt		General Conservation Action	Spe	ecific Conservation Action	Priority
	1			Land Protection (Public, Private). Easements, and Resource Rights	, Esta	ablish legal designation to protect itat (e.g., Area of Critical vironmental Concern)	Н
Climate	Vulnerability d poor dispersal restriction to ra	capacity,		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting climate change	_	ration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological re of species itsel species unknow	lf and/or ii		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Housing, urbar development	n, and ex-	urban	Land Protection (Public, Private). Easements, and Resource Rights		quire conservation easement for itat protection	Н
Lack of knowledge	Population stat	tus unkno	wn	Research and Monitoring	Mo	nitor population status	Н
Non-consumptive Disturbance	Recreation			Voluntary Standards		plement Best Management Practices recreation management	Н
				Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	M
Climate	Climate variable alteration of no e.g., droughts,	ormal wea	ther patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, urbar development			Education and Communication		olement landowner reach/education program	M
Lack of knowledge	Complete distrunknown	ribution in	Colorado	Research and Monitoring		nduct field inventory to refine known ribution	M
Lack of knowledge	Threats and res poorly underste		change are	Research and Monitoring		search species/habitat response to nagement or disturbance	M

Oenothera acutissima	Population Status	Population Trend	Distribution	Type	Habitat	Primary
Narrow-leaf evening primrose Tier 2 Plants	Low D	Unknown	Utah-Wyoming Rocky Mountains Wyoming Basin	P O	Grass/Forb Dominated Wetlands Sagebrush	
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capac restriction to rare ha		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	res	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological respon of species itself and species unknown		Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degradation	Altered hydrologica aquifer)	l regime (surface or	Maintain or Restore Natural Processes		intain and restore natural hydrologic ime	Н
Lack of knowledge	Complete distribution unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Lack of knowledge	Population status un	known	Research and Monitoring	Mo	onitor population status	Н
Climate	Climate variability ( alteration of normal e.g., droughts, torna	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M

Oenothera harringtonii	Population Sta	atus	Population Trend	Distribution	Туре	Habitat	Primary
Arkansas Valley evening primrose Tier 2 Plants	Medium	D	Unknown	Central Shortgrass Prairie	P	Barrens Shortgrass Prairie	<b>✓</b>
General Threat	Specific Threat	t		General Conservation Action	Spe	cific Conservation Action	Priority
Climate	Vulnerability d poor dispersal restriction to ra	capaci	ty, and/or	Ex-situ Conservation	See	Н	
Climate	Habitat shifting and alteration due to climate change  Phenological response to climate change			Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		f and/o	e to climate change or inter-dependent	Research and Monitoring	and clin	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Habitat Conversion	Housing, urbar development	n, and	ex-urban	Land Protection (Public, Private) Easements, and Resource Rights	*	quire conservation easement for itat protection	Н
Non-consumptive Disturbance	Motor-powered	d recre	ation	Compliance and Enforcement	Ma	nage off-road travel	Н
Climate		ormal v	ntensification or veather patterns, os, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, urbar development	n, and	ex-urban	Education and Communication		olement landowner reach/education program	M
Habitat Conversion	Housing, urbar development	n, and	ex-urban	Education and Communication	edu	lish educational material/sponsor cational programs to raise public ureness	M
Habitat Degradation	Roads or Railre	oads		Voluntary Standards		plement Best Management Practices transportation projects	M
Indirect Consumptive Use (Mortality)	Grazing			Compatible Resource Use		olement compatible grazing nagement	M
Non-consumptive Disturbance	Motor-powered road vehicular		ation or other off-	Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for itat protection	M
Resource Extraction	Mining (coal, s	sand/gi	ravel, etc.)	Voluntary Standards		energy development and mining	M
Invasive or Exotic Species	Invasive plants	3		Invasive Species Control and Prevention		olement integrated weed/pest nagement plan	L

Oonopsis foliosa var.	Population Status	Population Trend	Distribution	Type	Habitat	Primary	
monocephala	Medium D	Unknown	Central Shortgrass Prairie	P	Shortgrass Prairie	✓	
Rayless goldenweed			Southern Rocky Mountains	О			
Tier 2 Plants							
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	Vulnerability due to poor dispersal capac restriction to rare ha		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	resp	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate	Phenological respor of species itself and species unknown		Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Lack of knowledge	Population status ur	nknown	Research and Monitoring	Mo	Monitor population status		
Lack of knowledge	Complete distribution unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н	
Climate	Climate variability ( alteration of normal e.g., droughts, torna	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Habitat Degradation	Roads		Voluntary Standards		plement Best Management Practices transportation projects	M	
Non-consumptive Disturbance	Motor-powered recr road vehicular trave		Compliance and Enforcement	Ma	nage off-road travel	M	

Oonopsis	puebloensis	Population S	Status	Population	Trend	Distribution	Type	Habitat	Primary	
-	•	Medium	D	Declining	D	Central Shortgrass Prairie	P	Barrens	<b>V</b>	
Pueblo golde	nweed							Shortgrass Prairie	✓	
Tier 2	Plants									
General Thre		Specific Thre	eat			General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate		Vulnerability poor dispersa	due to		rriers,	Ex-situ Conservation	See	d banking (incl. protocols, lection, and cultivation)	Н	
Climate		Habitat shifti climate chan		alteration due	to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate		Phenological response to climate change of species itself and/or inter-dependent species unknown  Housing, urban, and ex-urban				Research and Monitoring	and clin	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Habitat Conv	rersion	Housing, urban, and ex-urban development				Education and Communication		olement landowner reach/education program	Н	
Habitat Conv	version	Housing, urban, and ex-urban development			Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	Н		
Habitat Conv	rersion	Housing, urb		l ex-urban		Land Protection (Public, Private Easements, and Resource Rights		quire conservation easement for itat protection	Н	
Non-consum	ptive Disturbance	Motor-power	red recr	eation		Compliance and Enforcement	Ma	Manage off-road travel		
Non-consum	ptive Disturbance	Motor-power road vehicula		eation or othe	r off-	Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	Н	
Resource Ext	traction	Mining (lime	estone)			Education and Communication	avo	icate development industries about iding and/or mitigating impacts to e or sensitive species	Н	
Climate			normal	intensification weather patte dos, etc.)		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Habitat Degr	adation			es and towers		Voluntary Standards		olement Best Management Practices urban development, landscaping, etc	. M	
Habitat Degr	adation	Roads or Rai	lroads			Voluntary Standards		blement Best Management Practices transportation projects	M	
Indirect Cons (Mortality)	sumptive Use	Grazing				Compatible Resource Use		blement compatible grazing nagement	L	
Invasive or E	Exotic Species	Invasive plan	nts			Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	L	

Opuntia heacockiae	Population Status	Population Trend		Habitat	Primary
	Unknown	Unknown		Pinyon-Juniper	<b>✓</b>
Heacock's prickly-pear					
Tier 2 Plants					
General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capaci restriction to rare hab	ty, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and a climate change	alteration due to	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	Н
Climate	Phenological respons of species itself and/o species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of knowledge	Taxonomy is poorly	understood	Research and Monitoring	Taxonomic work is needed	Н
Lack of knowledge	Threats and response poorly understood	to change are	Research and Monitoring	Research species/habitat response to management or disturbance	Н
Lack of knowledge	Complete distribution unknown	n in Colorado	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Lack of knowledge	Population status unk	known	Research and Monitoring	Monitor population status	Н
Climate	Climate variability (i alteration of normal v e.g., droughts, tornad	weather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	М
Oreocarya osterhoutii	Population Status	Population Trend	Distribution	Type Habitat	Primary
•	Low D	Stable D	Colorado Plateau	P Barrens	<b>✓</b>
Osterhout cat's-eye				Desert Shrub	
Tier 2 Plants					
General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capaci restriction to rare hab	ty, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and a climate change	alteration due to	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	Н
Climate	Phanological respons		D 1 135 1 1	Conduct primary research on rare plant	Н
Cimiace	of species itself and/o species unknown	se to climate change or inter-dependent	Research and Monitoring	and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	
	of species itself and/o	or inter-dependent	Research and Monitoring  Research and Monitoring	and pollinator responses to changing climate, and other vulnerability factors	Н
Lack of knowledge  Climate	of species itself and/o species unknown	or inter-dependent in in Colorado intensification or weather patterns,		and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms) Conduct field inventory to refine known	H M
Lack of knowledge	of species itself and/o species unknown  Complete distribution unknown  Climate variability (i alteration of normal v	n in Colorado  Intensification or weather patterns, los, etc.)	Research and Monitoring  Capacity Building and	and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Conduct field inventory to refine known distribution  Engage in collaborative, proactive	

Oreoxis humilis	Population	Status	Populatio	on 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							Meddow Fundia		
General Threat	Specific Th	reat			General Conservation Action	Spe	ecific Conservation Action	Priority	
					Research and Monitoring		onitor population status	Н	
Climate	Vulnerabili poor disper restriction t	sal capac	city, and/or		Ex-situ Conservation		Seed banking (incl. protocols, collection, and cultivation)		
Climate	Habitat shifting and alteration due to climate change				Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н	
Climate	Phenologica of species in species unk	tself and			Research and Monitoring	and clin	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
Habitat Degradation	Roads or R	ailroads			Voluntary Standards		plement Best Management Practices transportation projects	Н	
Lack of knowledge	Threats and poorly unde		e to change	are	Research and Monitoring		search species/habitat response to nagement or disturbance	Н	
					Education and Communication	edu	plish educational material/sponsor acational programs to raise public areness	M	
Climate	Climate var alteration of e.g., drough	f normal	weather pat		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Lack of knowledge	Taxonomy	is poorly	understood	l	Research and Monitoring		sess taxonomic status and ationship to Oreoxis alpina	M	
Lack of knowledge	Biology, ec are poorly k	05	nd detailed l	nabitat	Research and Monitoring		search critical life history/habitat nponents	M	
Lack of knowledge	Complete d unknown	istributio	on in Colora	do	Research and Monitoring		nduct field inventory to refine known tribution	M	
Non-consumptive Disturbance	Non-motori	zed recre	eation		Voluntary Standards		plement Best Management Practices recreation management	M	

Oxybaphus	Population Status Population Trend	Distribution T	Type Habitat	Primary
rotundifolius	Medium D Declining D	Central Shortgrass Prairie	P Barrens	<b>✓</b>
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)	Н
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	Н
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)	Н
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Implement landowner outreach/education program	Н
Habitat Conversion	Housing, urban, and ex-urban development	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	Н
Habitat Conversion	Housing, urban, and ex-urban development	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	Н
Non-consumptive Disturbance	Motor-powered recreation	Compliance and Enforcement	Manage off-road travel	Н
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	Н
Resource Extraction	Mining (limestone)	Education and Communication	Educate development industries about avoiding and/or mitigating impacts to rare or sensitive species	Н
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

Oxytropis besseyi va	Population Statu	s Population Trend	Distribution	Type	Habitat	Primary
obnapiformis	Low D	Unknown	Wyoming Basin Utah High Plateau	P	Sagebrush Pinyon-Juniper	
Bessey locoweed						
Tier 2 Plants				-		
General Threat	Specific Threat		General Conservation Action	-	cific Conservation Action	Priority
Climate	poor dispersal cap restriction to rare	•	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting a climate change	nd alteration due to	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		Н
Climate		onse to climate change nd/or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of knowledge	Population status	unknown	Research and Monitoring	Mo	nitor population status	Н
Lack of knowledge	Complete distribu unknown		Research and Monitoring		nduct field inventory to refine known ribution	Н
Climate		y (intensification or nal weather patterns, nados, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive aning and conservation programs	M
Resource Extraction	Oil and gas drillin		Voluntary Standards		element Best Management Practices energy development and mining	M
Pediocactus knowlto	onii Population Statu	s Population Trend	Distribution	Type	Habitat	Primary
Pediocactus knowlto	Population Statu Unknown	Population Trend Unknown	Distribution Colorado Plateau	Type P	Habitat Pinyon-Juniper	Primary
Pediocactus knowlto	-			• •		
Knowlton cactus	-			• •		
Knowlton cactus Tier 1 Plants	Unknown		Colorado Plateau	P	Pinyon-Juniper	✓
Knowlton cactus	Unknown  Specific Threat	Unknown  to movement barriers, pacity, and/or	Colorado Plateau  General Conservation Action	P Spe		✓
Knowlton cactus Tier 1 Plants General Threat	Unknown  Specific Threat  Vulnerability due poor dispersal cap restriction to rare	Unknown  to movement barriers, pacity, and/or	Colorado Plateau  General Conservation Action	P Spe See coll Mo resp and	Pinyon-Juniper  cific Conservation Action d banking (incl. protocols,	Priority
Knowlton cactus Tier 1 Plants General Threat Climate	Unknown  Specific Threat  Vulnerability due poor dispersal car restriction to rare  Habitat shifting ar climate change	Unknown  to movement barriers, pacity, and/or habitat features alteration due to	Colorado Plateau  General Conservation Action  Ex-situ Conservation	P Spe See coll Mo resp and situ Cor and clin	Pinyon-Juniper  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Knowlton cactus Tier 1 Plants General Threat Climate Climate	Unknown  Specific Threat  Vulnerability due poor dispersal car restriction to rare  Habitat shifting ar climate change  Phenological resp of species itself ar	Unknown  to movement barriers, pacity, and/or habitat features and alteration due to bonse to climate change and/or inter-dependent	Colorado Plateau  General Conservation Action  Ex-situ Conservation  Planning and Zoning	P Spe See coll Mo resp and situ Cor and clin (dis	Pinyon-Juniper  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in ionse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors	Priority H
Knowlton cactus Tier 1 Plants General Threat Climate Climate Climate Direct Consumptive Use	Unknown  Specific Threat  Vulnerability due poor dispersal car restriction to rare  Habitat shifting a climate change  Phenological resp of species itself as species unknown	Unknown  to movement barriers, pacity, and/or habitat features and alteration due to honse to climate change and/or inter-dependent	Colorado Plateau  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	P Spe See coll Mo resp and situ Con and clin (dis Enf	Pinyon-Juniper  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Priority H H

Penstem	on crandallii	Population Status	Population Trend	Distribution	Type	
ssp. prod	cumbens	Unknown	Unknown	Southern Rocky Mountains	P	
Crandall's l	beardtongue					
Tier 2	Plants					
General Th		Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate		Phenological respons of species itself and/o species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of kno	owledge	Taxonomy is poorly	understood	Research and Monitoring	Taxonomic work is needed	Н
Lack of kno	owledge	Threats and response poorly understood	to change are	Research and Monitoring	Research species/habitat response to management or disturbance	Н
Lack of kno	owledge	Biology, ecology, an are poorly known	d detailed habitat	Research and Monitoring	Research critical life history/habitat components	Н
Lack of kno	owledge	Complete distribution unknown	n in Colorado	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Lack of kno	owledge	Population status unl		Research and Monitoring	Monitor population status	Н
Climate		Climate variability (i alteration of normal e.g., droughts, tornac	weather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Penstem	on debilis	Population Status	Population Trend	Distribution	Type Habitat	Primary
1 011510111		Medium D	Declining D	Southern Rocky Mountains	P Barrens	<b>✓</b>
Parachute p	penstemon		C	Utah High Plateau	P	
Tier 1	Plants					
General Th	reat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
				Research and Monitoring	Monitor population status	Н
Climate		Vulnerability due to poor dispersal capaci restriction to rare hab	ty, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate		Habitat shifting and climate change	alteration due to	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	Н
Climate		Phenological respons of species itself and/ species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
	extraction	Oil and gas drilling		Voluntary Standards	Implement Best Management Practices for energy development and mining	Н
Resource E						M
Resource E Climate		Climate variability (i alteration of normal e.g., droughts, tornac	weather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	IVI
	owledge	alteration of normal	weather patterns, los, etc.)	1 2		

Penstemon degeneri	Population St	tatus	Population Trend	Distribution	Type	Habitat	Primary
C	Medium	D	Unknown	Southern Rocky Mountains	P	Pinyon-Juniper Foothill/Mountain Grassland	
Degener beardtongue							
Tier 2 Plants							
General Threat	Specific Threa	ıt		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability of poor dispersal restriction to ra	capac		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting climate change	_	alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		lf and/	se to climate change or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Non-consumptive Disturbance	Non-motorized	d recre	eation	Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н
Non-consumptive Disturbance	Motor-powere	ed recre	eation	Voluntary Standards		plement Best Management Practices recreation management	Н
Climate		ormal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Invasive or Exotic Species	Invasive plants	s		Invasive Species Control and Prevention		p weed infestations and sensitive no ay/no mow zones	M
Invasive or Exotic Species	Invasive plants	s		Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	M
Lack of knowledge	Complete distr	ributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known	n M
Lack of knowledge	Threats and re-		e to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowledge	Biology, ecolo are poorly kno		d detailed habitat	Research and Monitoring	Res	search critical life history/habitat	M
Lack of knowledge	Population stat		known	Research and Monitoring		nitor population status	M

Penstemon fremontii	Population	Status	Population Trend	Distribution	Type	Habitat	Primary
var. glabrescens Fremont's beardtongue	Low	D	Unknown	Utah High Plateau Wyoming Basin	P O	Sagebrush	✓
Tier 2 Plants							
General Threat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerabilit poor dispers restriction to	al capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shift climate char	_	alteration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		self and/	se to climate change or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Complete di unknown	stributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Lack of knowledge	Population s	tatus un	known	Research and Monitoring	Mo	onitor population status	H
Resource Extraction	Oil and gas	drilling		Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate		normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	M
Non-consumptive Disturbance	Motor-powe	red recr	eation	Voluntary Standards		plement Best Management Practices recreation management	M

Donstom	on gibbensii	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary
1 ensiem	on giovensii	Medium	D	Unknown	Wyoming Basin	P	Barrens	<b>✓</b>
Gibben's be	eardtongue	1710010111	2	Cinno Wi	Utah-Wyoming Rocky Mountains	О	Pinyon-Juniper	
Tier 1	Plants							
General Thr	reat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
					Land Protection (Public, Private) Easements, and Resource Rights	hal	tablish legal designation to protect bitat (e.g., Area of Critical vironmental Concern)	Н
Climate		poor dispers	al capac		Ex-situ Conservation		ed banking (incl. protocols, llection, and cultivation)	Н
Climate		Habitat shift climate char	_	alteration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes d prepare adaptation plan to define in u and ex situ conservation needs	Н
Climate			self and	se to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of kno	wledge	Complete di unknown	stributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Non-consur	nptive Disturbance	Motor-powe road vehicul			Voluntary Standards		plement Best Management Practices travel management	Н
					Education and Communication	edu	blish educational material/sponsor ucational programs to raise public tareness	M
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive unning and conservation programs	M
Lack of kno	wledge	Population s	tatus un	known	Research and Monitoring	Mo	onitor population status	M
Penstem	on grahamii	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary
		Low	D	Unknown	Wyoming Basin	P	Barrens Binaran Janinan	<b>✓</b>
Graham bea	ırdtongue						Pinyon-Juniper	
Tier 2	Plants							
General Thr	eat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		poor dispers	al capac	movement barriers, city, and/or bitat features	Ex-situ Conservation		ed banking (incl. protocols, llection, and cultivation)	Н
Climate		Habitat shift climate char		alteration due to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes d prepare adaptation plan to define in u and ex situ conservation needs	Н
Climate		_	self and	se to climate change /or inter-dependent	Research and Monitoring	and clin	anduct primary research on rare plant d pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Deg	radation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н
Lack of kno	wledge	Complete di unknown	stributio	on in Colorado	Research and Monitoring	Co	onduct field inventory to refine known stribution	Н
Lack of kno	wledge	Population s	tatus un	known	Research and Monitoring	Mo	onitor population status	Н
Resource Ex	xtraction	Oil and gas exploration	drilling	and seismic	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate		Climate vari	normal	intensification or weather patterns,	Capacity Building and Cooperation	En	gage in collaborative, proactive unning and conservation programs	M

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

Penstemon penlandii	Population S	Status	Populatio	n Trend	Distribution	Гуре	Habitat	Primary
-	Medium	D	Stable	D	Southern Rocky Mountains	P	Sagebrush Upland Shrub	
Penland penstemon							1	
Tier 1 Plants								
General Threat	Specific Thre	at			General Conservation Action	Spe	ecific Conservation Action	Priority
					Land Protection (Public, Private). Easements, and Resource Rights	hat Na	ablish legal designation to protect bitat (e.g., wilderness, Research tural Area, Acrea of Critical vironmental Concern))	Н
					Planning and Zoning	issı	omote consideration of biodiversity ues in transportation and land use nning processes	Н
					Research and Monitoring	Mo	nitor population status	Н
Climate	Vulnerability poor dispersa restriction to	l capac	ity, and/or		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifti climate chang	_	alteration d	ie to	Planning and Zoning	res	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate	Phenological of species itse species unkno	elf and			Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Housing, urba	an, and	ex-urban		Land Protection (Public, Private). Easements, and Resource Rights		quire conservation easement for pitat protection	Н
Habitat Degradation	Roads				Voluntary Standards		plement Best Management Practices transportation projects	Н
Non-consumptive Disturbance	Motor-power	ed recr	eation		Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н
Non-consumptive Disturbance	Motor-power	ed recr	eation		Voluntary Standards		plement Best Management Practices recreation management	Н
Climate	Climate varia alteration of r e.g., droughts	normal	weather pat		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Resource Extraction	Oil and gas d	rilling			Voluntary Standards		plement Best Management Practices energy development and mining	M

Penstemon scariosus	Population Statu	us Po <sub>l</sub>	pulation Trend	Distribution	Type	Habitat	Primary
var. albifluvis	Low	O Un	known	Wyoming Basin	P	Barrens	<b>~</b>
White River penstemon				Utah High Plateau	О	Desert Shrub	
Γier 1 Plants							
General Threat	Specific Threat			General Conservation Action	Spe	cific Conservation Action	Priorit
Climate	Vulnerability due poor dispersal ca restriction to rare	pacity, a	nd/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting a climate change	and altera	ation due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological responsible of species itself a species unknown	and/or int		Research and Monitoring	and clin	aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Habitat Degradation	Roads			Voluntary Standards		lement Best Management Practices transportation projects	Н
Lack of knowledge	Population status	unknow	'n	Research and Monitoring	Mo	nitor population status	Н
Resource Extraction	Oil and gas drilli	ng		Voluntary Standards		energy development and mining	Н
Climate	Climate variabilit alteration of norm e.g., droughts, to	nal weatl	ner patterns,	Capacity Building and Cooperation		age in collaborative, proactive nning and conservation programs	M
Penstemon scariosus	Population Statu	us Poj	pulation Trend	Distribution	Type	Habitat	Primary
var. cyanomontanus	Medium Γ	) Sta	ble D	Utah-Wyoming Rocky Mountains	P	Pinyon-Juniper Desert Shrub	<b>✓</b>
Plateau penstemon						2 coot Sinus	_
Tier 2 Plants General Threat	Specific Threat			General Conservation Action	Sno	aifia Consamiation Action	Driorit
Climate	Specific Threat  Vulnerability due				SDE	cific Conservation Action	Priorit
	poor dispersal ca restriction to rare	pacity, a	nd/or		See	d banking (incl. protocols, ection, and cultivation)	Н
Climate		pacity, a habitat	nd/or features		See coll  Mo resp and		Н
Climate	restriction to rare Habitat shifting a climate change	ponse to	nd/or features ation due to	Ex-situ Conservation	Mo resp and situ Cor and clin	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Н
Climate	restriction to rare Habitat shifting a climate change  Phenological responsible species itself a	pacity, a e habitat is and altera ponse to and/or int	nd/or features ation due to climate change er-dependent	Ex-situ Conservation Planning and Zoning	See coll  Mo resp and situ  Cor and clin (dis	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Н
Climate	Phenological responses unknown  Complete distribution	pacity, a e habitat is and altera ponse to and/or int	nd/or features ation due to climate change er-dependent	Ex-situ Conservation  Planning and Zoning  Research and Monitoring	See coll  Mo resp and situ  Cor and clin (dis  Cor dist	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) aduct field inventory to refine known	Н
	Phenological responses unknown  Complete distribution	pacity, a chabitat is and alteration and alteration in the chapter of the chapter	nd/or features ation due to  climate change er-dependent  Colorado  sification or ner patterns,	Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Research and Monitoring	See coll  Mo resp and situ  Cor and clin (dist  Cor dist  Mo  Eng	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) aduct field inventory to refine known ribution	Н

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	Spe	ecific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capaci restriction to rare hab	ty, and/or	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and a climate change	alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological respons of species itself and/o species unknown	_	Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Taxonomy is poorly	understood	Research and Monitoring	Tax	konomic work is needed	Н
Lack of knowledge	Threats and response poorly understood	to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Lack of knowledge	Biology, ecology, and are poorly known	d detailed habitat	Research and Monitoring		search critical life history/habitat nponents	Н
Lack of knowledge	Complete distribution unknown	n in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н
Lack of knowledge	Population status unl	known	Research and Monitoring	Mo	nitor population status	Н
Climate	Climate variability (i alteration of normal ve.g., droughts, tornad	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M

Phacelia formosula	Population S	Status	Populatio	n Trend	Distribution	Туре	Habitat	Primary
v	Medium	D	Stable	D	Southern Rocky Mountains	P	Barrens	<b>✓</b>
North Park phacelia								
Tier 1 Plants								
General Threat	Specific Thre	eat			General Conservation Action	Spe	ecific Conservation Action	Priority
					Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	Н
					Land Protection (Public, Private) Easements, and Resource Rights		pand existing ACECs and create new EC in Larimer County	Н
					Research and Monitoring		onitor population status	Н
Climate	Vulnerability poor dispersa restriction to	al capac	city, and/or		Ex-situ Conservation	See	ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifti climate chan		alteration d	ue to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate	Phenological of species its species unkn	elf and			Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Conversion	Housing, urb development		l ex-urban		Land Protection (Public, Private) Easements, and Resource Rights		quire conservation easement for pitat protection	Н
Lack of knowledge	Taxonomy of population is				Research and Monitoring		conomic work is needed for Larimer unty population	Н
Non-consumptive Disturbance	Motor-power	red recr	eation		Voluntary Standards		plement Best Management Practices recreation management	Н
					Capacity Building and Cooperation	alig	ordinate with related agencies to gn goals, policies, measures of cess, etc.	M
Climate	Climate varia alteration of e.g., drought	normal	weather pat		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Degradation	Roads and Po				Voluntary Standards	for	plement Best Management Practices transportation and powerline ridors	M
Indirect Consumptive Use (Mortality)	Incompatible	grazin	g?		Research and Monitoring		search species/habitat response to nagement or disturbance	M
Resource Extraction	Oil and gas o	lrilling			Voluntary Standards		plement Best Management Practices energy development and mining	M

Phacelia submutica	Population	n Status	Population Trend	Distribution	Type	Habitat	Primary
	Low	D	Unknown	Utah High Plateau	P O	Barrens	<b>✓</b>
DeBeque phacelia				Southern Rocky Mountains	O		
Tier 1 Plants							
General Threat	Specific Tl	hreat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	poor dispe	rsal capac	movement barriers, city, and/or bitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shi climate cha	_	alteration due to	Planning and Zoning	resp	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		itself and	sse to climate change /or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degradation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н
Non-consumptive Disturbance	Motor-pow	vered recr	reation	Voluntary Standards		plement Best Management Practices recreation management	Н
Resource Extraction	Oil and gas	s drilling		Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate		of normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of knowledge	Complete ounknown	distributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	n M
Lack of knowledge	Population	status un	known	Research and Monitoring	Mo	onitor population status	M
Lack of knowledge	1	-	s and vulnerability oorly known	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowledge	Biology an	id ecology	y are poorly known	Research and Monitoring		nduct studies on demography and roductive biology	L

_ nysun	ia alpina	Population Status	Population Trend	Distribution 7	Гуре	Habitat	Primary
		Unknown	Unknown	Southern Rocky Mountains	P	Exposed Rock (alpine)	
Avery Pea	k twinpod						
Tier 2	Plants						
General Tl	hreat	Specific Threat		General Conservation Action	Spec	cific Conservation Action	Priority
Climate		Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation		banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shifting and climate change	alteration due to	Planning and Zoning	respo	lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		Phenological respon of species itself and/ species unknown		Research and Monitoring	and j	duct primary research on rare plant pollinator responses to changing ate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kn	owledge	Threats and response poorly understood	e to change are	Research and Monitoring		earch species/habitat response to agement or disturbance	Н
Lack of kn	nowledge	Biology, ecology, an are poorly known	nd detailed habitat	Research and Monitoring		earch critical life history/habitat ponents	Н
Lack of kn	nowledge	Complete distributio unknown	n in Colorado	Research and Monitoring		duct field inventory to refine known ibution	Н
Lack of kn	nowledge	Population status un		Research and Monitoring	Mon	itor population status	Н
Climate		Climate variability (i alteration of normal e.g., droughts, tornad	weather patterns,	Capacity Building and Cooperation		age in collaborative, proactive ning and conservation programs	M
Non-consu	amptive Disturbance	Motor-powered recre		Compliance and Enforcement	Man	age off-road travel	M
Physari	ia hellii	Population Status	Population Trend	Distribution 7	Evino.	** 1 ** .	ъ.
	u veiii	1 opulation Status	ropulation Hend	Distribution 7	Гуре	Habitat	Primary
	u veiiii	Medium D	Declining D	Central Shortgrass Prairie	71	Barrens	Primary
Bell's twir		-			71		
		-		Central Shortgrass Prairie	P		
Tier 2	npod Plants	-		Central Shortgrass Prairie	P P		
Tier 2 General Tl	npod Plants	Medium D	Declining D  movement barriers, ity, and/or	Central Shortgrass Prairie Front Range	P P Spec	Barrens	<b>✓</b>
Tier 2 General Tl Climate	npod Plants	Medium D  Specific Threat  Vulnerability due to poor dispersal capac	Declining D  movement barriers, ity, and/or bitat features	Central Shortgrass Prairie Front Range General Conservation Action	P P Spec	Barrens  cific Conservation Action  I banking (incl. protocols,	Priority
Bell's twir Tier 2 General Tl Climate Climate	npod Plants	Medium D  Specific Threat  Vulnerability due to poor dispersal capac restriction to rare hal Habitat shifting and climate change	movement barriers, ity, and/or bitat features alteration due to	Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation	P P P Spec Seed colle Mod respe and j situ a	Barrens  cific Conservation Action  I banking (incl. protocols, ection, and cultivation)  lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority H
Tier 2 General TI Climate Climate Climate	npod Plants hreat	Medium D  Specific Threat  Vulnerability due to poor dispersal capac restriction to rare hal Habitat shifting and climate change  Phenological respon of species itself and/	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent	Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation  Planning and Zoning	P P Spec Seed colle Mod respe and j situ a Cone and j clim (disp	Barrens  cific Conservation Action  I banking (incl. protocols, ection, and cultivation)  lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing ate, and other vulnerability factors	Priority H
Tier 2 General TI Climate Climate Climate Habitat Co	ppod Plants hreat	Medium D  Specific Threat  Vulnerability due to poor dispersal capac restriction to rare hal Habitat shifting and climate change  Phenological respon of species itself and/species unknown  Housing, urban, and	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent	Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Land Protection (Public, Private),	P P Spec Seed colle Mod respe and j situ a Cone and j clim (disp Acqu habit	Barrens  cific Conservation Action  I banking (incl. protocols, ection, and cultivation)  lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing ate, and other vulnerability factors persal mechanisms, mutualisms)  uire conservation easement for	Priority H H
Tier 2 General TI Climate Climate Climate Habitat Co	ppod Plants hreat  onversion egradation	Medium D  Specific Threat  Vulnerability due to poor dispersal capac restriction to rare hal Habitat shifting and climate change  Phenological respon of species itself and/species unknown  Housing, urban, and development	movement barriers, ity, and/or bitat features alteration due to see to climate change or inter-dependent	Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Land Protection (Public, Private), Easements, and Resource Rights	P P Spec Seed colle Mod respe and j situ a Cone and j clim (disp Acqu habit Impl for tr	Barrens  cific Conservation Action  I banking (incl. protocols, ection, and cultivation)  lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing ate, and other vulnerability factors persal mechanisms, mutualisms)  uire conservation easement for tat protection  ement Best Management Practices	Priority H H H
Tier 2 General Tl Climate Climate	ppod Plants hreat  onversion egradation	Medium D  Specific Threat  Vulnerability due to poor dispersal capac restriction to rare hal Habitat shifting and climate change  Phenological respon of species itself and/species unknown  Housing, urban, and development  Roads or Railroads  Complete distributio	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent ex-urban in Colorado intensification or weather patterns,	Central Shortgrass Prairie Front Range  General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Land Protection (Public, Private), Easements, and Resource Rights Voluntary Standards	P P Spec Seed colle Mod respe and j situ a Cone and j clim (disp Acqu habit Impl for tr Cone distr Enga	Barrens  cific Conservation Action  I banking (incl. protocols, ection, and cultivation)  lel potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs duct primary research on rare plant pollinator responses to changing ate, and other vulnerability factors persal mechanisms, mutualisms)  uire conservation easement for tat protection  ement Best Management Practices ransportation projects duct field inventory to refine known	Priority H H H

Physaria	obcordata	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
•		Medium	D	Unknown	Utah High Plateau	P	Barrens	<b>✓</b>
Piceance twii	npod							
Tier 1	Plants							
General Thre	at	Specific Thre	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate		Vulnerability poor dispersa restriction to	ıl capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifti climate chan	_	alteration due to	Planning and Zoning	resp	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate			elf and/	se to climate change or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degra	adation	Utility and p	ipeline	construction	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Habitat Degr	adation	Roads			Voluntary Standards		plement Best Management Practices transportation projects	Н
Lack of know	vledge	Population st	atus un	known	Research and Monitoring	Mo	onitor population status	Н
Lack of knov	vledge	Response to	change		Research and Monitoring	of o	estigate how plants respond to layers dust deposited during resource raction	Н
Resource Ext	traction	Oil and gas o	lrilling,	and oil shale mining	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Lack of know	vledge	Complete dis unknown	tributio	n in Colorado	Research and Monitoring		nduct field inventory to refine known	ı L

Physaria	ı pulvinata	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
1 nysuru	i puivinaia	Medium	D	Unknown	Southern Rocky Mountains	P	Barrens	<b>V</b>
G 11 11		1/10010111	2	Cimilo Wi	·		Deciduous Oak	
Cushion bla	•						Ponderosa Pine	
Tier 1	Plants						Sagebrush	Ш
General Thi	reat	Specific Three			General Conservation Action	•	ecific Conservation Action	Priority
Climate		Vulnerability poor dispersa restriction to	l capac	city, and/or	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifti climate chang	_	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			elf and	se to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of kno	wledge	Complete dis unknown	tributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known cribution on private land	Н
Non-consur	nptive Disturbance	Motor-power	ed recr	reation	Compliance and Enforcement	Mai	nage off-road travel	Н
Non-consur	nptive Disturbance	Infrastructure visitor use at		opment for Park Mesa	Protected Area Management		sign public improvements to be inpatible with biodiversity	Н
Resource Ex	xtraction	Oil and gas d	rilling	and seismic testing	Voluntary Standards		plement Best Management Practices energy development and mining	Н
Climate			normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation	_	gage in collaborative, proactive nning and conservation programs	M
Habitat Cor	version	Water storage		,	Protected Area Management		nage public use to be compatible h biodiversity	M
Lack of kno	wledge	Population st	atus un	known	Research and Monitoring	Mo	nitor population status	M
Physaria	ı rollinsii	Population S	Status	Population Trend	Distribution	Type	Habitat	Primary
.,		Low	D	Unknown	Southern Rocky Mountains	P	Barrens	<b>✓</b>
Rollins twir	npod							
Tier 2	Plants							
General Thi		Specific Three	eat		General Conservation Action	Sne	ecific Conservation Action	Priority
Climate			due to	city, and/or	Ex-situ Conservation	See	d banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shifti climate chang	-	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate			elf and	sse to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of kno	owledge	Threats and r		e to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Lack of kno	owledge	Biology, ecolore are poorly kn		nd detailed habitat	Research and Monitoring		search critical life history/habitat apponents	Н
Lack of kno	wledge	Complete dis	tributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of kno	wledge	Population st	atus un	known	Research and Monitoring	Mo	nitor population status	Н
Climate		Climate varia	1 '1'. /		Capacity Building and	Enc	gage in collaborative, proactive	M

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

r nysari	a scrotiformis	Population Status	Population Trend	Distribution	Type	Habitat	Primary
		Unknown	Unknown	Southern Rocky Mountains	P	Barrens	
West Silve	r bladderpod					Meadow Tundra Spruce-Fir	
Tier 1	Plants					Spruce-11	
General Th	nreat	Specific Threat		General Conservation Action	Spe	cific Conservation Action	Priorit
Climate		Vulnerability due to poor dispersal capac restriction to rare ha	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate		Habitat shifting and climate change	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		Phenological respon of species itself and/ species unknown		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of kn	owledge	Threats and response poorly understood	e to change are	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
Lack of kn	owledge	Biology, ecology, ar are poorly known	nd detailed habitat	Research and Monitoring	con	earch critical life history/habitat aponents	Н
Lack of kn	owledge	Complete distribution unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of kn	owledge	Population status un		Research and Monitoring	Mo	nitor population status	Н
Climate		Climate variability ( alteration of normal e.g., droughts, torna	weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive aning and conservation programs	M
Potentil	lla rupincola	Population Status	Population Trend	Distribution	Type	Habitat	Primary
							. <i> </i>
Rocky Mo	untain cinquefoil	Medium D	Unknown	Southern Rocky Mountains	Р	Cliff and Canyon	
Tier 2	Plants		Unknown	·		·	
Tier 2 General Th	Plants	Specific Threat		General Conservation Action	Spe	cific Conservation Action	Priorit
Rocky Mo Tier 2 General Th Climate	Plants		movement barriers, ity, and/or	·	Spe See	·	
Tier 2 General Th Climate	Plants	Specific Threat  Vulnerability due to poor dispersal capac	movement barriers, ity, and/or bitat features	General Conservation Action	Spe See coll Mo resp and	cific Conservation Action d banking (incl. protocols,	Priorit
Tier 2 General Th Climate Climate	Plants	Specific Threat  Vulnerability due to poor dispersal capac restriction to rare ha Habitat shifting and climate change	movement barriers, ity, and/or bitat features alteration due to se to climate change	General Conservation Action Ex-situ Conservation	Spe See coll Mo resp and situ Cor and clin	cific Conservation Action d banking (incl. protocols, ection, and cultivation) del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priorit H
Tier 2 General Th Climate Climate	Plants  nreat	Specific Threat  Vulnerability due to poor dispersal capac restriction to rare ha Habitat shifting and climate change  Phenological respon of species itself and/	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent	General Conservation Action Ex-situ Conservation Planning and Zoning	Spe See coll Mo resp and situ Cor and clin (dis	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors	Priority H
Tier 2 General The Climate Climate Climate Lack of kn	Plants  nreat	Specific Threat  Vulnerability due to poor dispersal capac restriction to rare ha Habitat shifting and climate change  Phenological respon of species itself and species unknown	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent known intensification or weather patterns,	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Spee See coll  Moorespand situ  Cor and clin (dis  Mo Eng	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Priorit H
Tier 2 General Tr Climate  Climate  Climate  Lack of kn Climate	Plants  nreat  owledge	Specific Threat  Vulnerability due to poor dispersal capace restriction to rare hat Habitat shifting and climate change  Phenological respons of species itself and species unknown  Population status un Climate variability (alteration of normal	movement barriers, ity, and/or bitat features alteration due to se to climate change or inter-dependent known intensification or weather patterns,	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Research and Monitoring Capacity Building and	Spe See coll Mo resp and situ Cor and clin (dis Mo Eng plan	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nitor population status tagge in collaborative, proactive	Priority H H
Tier 2 General The Climate Climate Climate Lack of knew Climate Habitat De	Plants  nreat  owledge  gradation	Specific Threat  Vulnerability due to poor dispersal capace restriction to rare hat Habitat shifting and climate change  Phenological respons of species itself and/species unknown  Population status un Climate variability (alteration of normal e.g., droughts, tornadores)	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent known intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Research and Monitoring Capacity Building and Cooperation	Spe See coll Mo resp and situ Cor and clin (dis Mo Eng plan Imp for Cor dist	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nitor population status tage in collaborative, proactive nning and conservation programs element Best Management Practices transportation projects aduct field inventory to refine known ribution	Priority H H M M M
Tier 2 General Tr Climate  Climate  Climate  Lack of kn Climate  Habitat De	Plants  nreat  owledge  gradation	Specific Threat  Vulnerability due to poor dispersal capace restriction to rare hat Habitat shifting and climate change  Phenological responsof species itself and species unknown  Population status un Climate variability (alteration of normal e.g., droughts, tornat Roads  Complete distribution	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent known intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and Cooperation  Voluntary Standards	Spee See coll Mo resp and situ Cor and clin (dis Mo Eng plan Imp for Cor dist Ma	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nitor population status tage in collaborative, proactive ming and conservation programs element Best Management Practices transportation projects aduct field inventory to refine known	Priority H H M M M
Tier 2 General Tr Climate  Climate  Climate  Lack of kn Climate  Habitat De  Lack of kn	Plants  owledge  gradation  owledge	Specific Threat  Vulnerability due to poor dispersal capace restriction to rare hat Habitat shifting and climate change  Phenological responsof species itself and species unknown  Population status un Climate variability (alteration of normal e.g., droughts, tornar Roads  Complete distribution unknown	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent known intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Capacity Building and Cooperation  Voluntary Standards  Research and Monitoring  Invasive Species Control and	Spee See coll Mo respand situ Corrand clin (dis Mo Eng plan Imp for Corr dist Maj spra Mo	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in sonse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) mitor population status tage in collaborative, proactive nning and conservation programs  element Best Management Practices transportation projects aduct field inventory to refine known ribution p weed infestations and sensitive no	Priority H H M M L

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

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Ptilagrostis porteri	Population S	Status	Population	Trend	Distribution	Гуре	Habitat	Primary
	Medium	D	Declining	D	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	✓
Porter feathergrass								
Tier 2 Plants								
General Threat	Specific Three	eat			General Conservation Action	Spe	ecific Conservation Action	Priority
					Land Protection (Public, Private), Easements, and Resource Rights	hab	ablish legal designation to protect bitat (e.g., Research Natural Area, ecial Interest Area)	Н
Habitat Degradation	Altered hydr aquifer)	ologica	l regime (surf	ace or	Land Protection (Public, Private), Easements, and Resource Rights	, Est	ablish in-stream flow rights	Н
Habitat Degradation	Altered hydr aquifer)	ologica	l regime (surf	ace or	Maintain or Restore Natural Processes	Res	store natural hydrologic regime	Н
Resource Extraction	Mining (peat, placer)				Education and Communication		ucate miners about avoiding and/or igating impacts	Н
Climate	Climate variability (intensification or alteration of normal weather patterns, e.g., droughts, tornados, etc.)				Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Climate	Vulnerability poor dispersa restriction to	al capac		urriers,	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	M
Climate	Habitat shifti climate chan		alteration due	e to	Planning and Zoning	res	odel potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	M
Climate		elf and	se to climate /or inter-depe		Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	M
Lack of knowledge	Response to	change	is poorly und	erstood	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowledge	Complete dis unknown	stributio	on in Colorado	)	Research and Monitoring		nduct field inventory to refine known tribution	M
Lack of knowledge	Restoration r understood	nethods	s are poorly		Research and Monitoring		ed banking and identification of ective restoration methods	L

Puccinellia parishii	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary	
1 исстини ран <i>ы</i> т	Medium	D	Unknown	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	✓	
Parish's alkali grass								
Tier 2 Plants								
General Threat	Specific Thr	eat		General Conservation Action	Spe	ecific Conservation Action	Priority	
Climate	poor dispers	al capa	o movement barriers, city, and/or abitat features	Ex-situ Conservation		Seed banking (incl. protocols, collection, and cultivation)		
Climate	Habitat shift climate chan	-	alteration due to	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		Н	
Climate		self and	nse to climate change /or inter-dependent	Research and Monitoring	and clin	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Habitat Degradation	Altered hydraquifer)	ologica	al regime (surface or	Maintain or Restore Natural Processes		intain natural hydrologic regime	Н	
Climate	Climate vari alteration of e.g., drought	normal	(intensification or weather patterns, ados, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Indirect Consumptive Use (Mortality)	Grazing			Compatible Resource Use	Implement compatible grazing management		M	
Invasive or Exotic Species	Invasive pla	nts		Invasive Species Control and Prevention		plement integrated weed/pest nagement plan	M	
Lack of knowledge	Population s	tatus ur	nknown	Research and Monitoring	Mo	Monitor population status		
Salix arizonica	Population	Status	Population Trend	Distribution	Туре	Habitat	Primary	
Sam ar Lomea	Low	D	Unknown	Southern Rocky Mountains	P	Shrub-dominated Wetlands	<b>✓</b>	
A mirrom o vvillovy								
Arizona willow								
Tier 2 Plants General Threat	Specific Thr	201		General Conservation Action	Cma	ecific Conservation Action	Priority	
Climate	Vulnerability poor dispers	y due to al capa	o movement barriers, city, and/or abitat features	Ex-situ Conservation	See	Н		
Climate	Habitat shift climate chan		alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in ponse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н	
Climate		self and	nse to climate change /or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н	
				Compatible Resource Use	Implement compatible grazing management		Н	
•	Incompatible	e Grazii	ng		mai	nagement		
(Mortality)			on in Colorado	Research and Monitoring	Coı	nagement nduct field inventory to refine known tribution	Н	
Indirect Consumptive Use (Mortality) Lack of knowledge Lack of knowledge	Complete di	stributio	on in Colorado	Research and Monitoring  Research and Monitoring	Cor dist	nduct field inventory to refine known	Н	

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Saussurea weberi	Population Status	Population Trend	Distribution	Type	Habitat	Primary
	Medium D	Unknown	Southern Rocky Mountains	P	Meadow Tundra	<b>✓</b>
Weber saussurea						
Tier 2 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	ecific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capa restriction to rare h		Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shifting and climate change	l alteration due to	Planning and Zoning	res <sub>l</sub>	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate		nse to climate change d/or inter-dependent	Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of knowledge	Threats and respon- poorly understood	se to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	Н
Lack of knowledge	Biology, ecology, a are poorly known	and detailed habitat	Research and Monitoring	spe	search critical life history (e.g., is cies rhizomatous?)/habitat nponents	Н
Lack of knowledge	Complete distributi unknown	on in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Lack of knowledge	Population status u	nknown	Research and Monitoring	Mo	nitor population status	Н
Climate	Climate variability alteration of norma e.g., droughts, torna	l weather patterns,	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Non-consumptive Disturbance	Motor-powered rec	reation	Compliance and Enforcement	Ma	nage off-road travel	M
Resource Extraction	Mining		Voluntary Standards		plement Best Management Practices mining	M
Non-consumptive Disturbance	Non-motorized reco	reation	Education and Communication	edu	olish educational material/sponsor cational programs to raise public areness	L

**Table 3. - Continued.** 

Scleroca	ictus glaucus	Population	Status	Population Trend	Distribution	Type	Habitat	Primary
	J	Low	D	Unknown	Colorado Plateau	P	Desert Shrub	<b>✓</b>
Colorado ho	ookless cactus				Utah High Plateau	P		
					Southern Rocky Mountains	O		
Tier 1	Plants	a .c. m	,		C 10 ' A'	C	·C C · A ·	D: '
General Thr	reat	Specific Th			General Conservation Action		ecific Conservation Action	Priority
Climate		poor disper	sal capaci	movement barriers, ity, and/or pitat features	Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate		Habitat shif climate cha	_	alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate			tself and/	se to climate change or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing mate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Lack of kno	owledge	Complete d unknown	listributio	n in Colorado	Research and Monitoring		nduct field inventory to refine knowr tribution	н Н
Lack of kno	owledge	Population	status unl	known	Research and Monitoring	Mo	onitor population status	Н
Resource Ex	xtraction	Oil and gas	drilling		Voluntary Standards		plement Best Management Practices energy development and mining	Н
					Land Protection (Public, Private Easements, and Resource Rights	hab	ablish legal designation to protect bitat (e.g., Area of Critical vironmental Concern)	M
Climate			f normal	ntensification or weather patterns, los, etc.)	Capacity Building and Cooperation	,	gage in collaborative, proactive nning and conservation programs	M
Habitat Deg	gradation	Roads, pow	verlines, a	nd pipelines	Voluntary Standards	for	plement Best Management Practices energy development and asportation projects	M

#### Colorado Wildlife Action Plan: Proposed Rare Plant Addendum

Scleroca	ctus mesae-	Population	Status	Population Trend	Distribution	Type	Habitat	Primary	
verdae		Low	D	Unknown	Colorado Plateau	P	Barrens Saltbrush Fans and Flats	<b>✓</b>	
Mesa Verde	hookless cactus						Suitorusii I ulis aliu I lats		
Tier 1	Plants								
General Thr	eat	Specific Th	reat		General Conservation Action	Spe	Specific Conservation Action		
Climate	Climate Vulnerability due to movement barrier poor dispersal capacity, and/or restriction to rare habitat features				Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н	
Climate		Habitat shifting and alteration due to climate change			Planning and Zoning	resp	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs		
Climate		Phenological response to climate change of species itself and/or inter-dependent species unknown			Research and Monitoring	and clir	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)		
Direct Cons (Mortality)	umptive Use	Gathering/C	Collectin	g	Compliance and Enforcement	Enf	force collecting regulations	Н	
Lack of kno	wledge	Complete d unknown	istributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	Н	
Climate			f normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M	
Lack of kno	wledge	Population	status un	known	Research and Monitoring	Mo	onitor population status	M	
Natural Fact	tors	Insect herbi	ivory		Research and Monitoring	Mo	onitor population status	M	
Direct Cons (Mortality)	umptive Use	Gathering/C	Collectin	g	Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	L	

Sisyrinchium pallidum	Population 3	Status	Population Trend	Distribution	Гуре	Habitat	Primary
1	Low	D	Unknown	Southern Rocky Mountains	P	Grass/Forb Dominated Wetlands	<b>✓</b>
Pale blue-eyed-grass							
Tier 2 Plants							
General Threat	Specific Thre	eat		General Conservation Action	Spe	ecific Conservation Action	Priority
				Land Protection (Public, Private). Easements, and Resource Rights	hab Res	ablish legal designation to protect bitat (e.g., Special Interest Area, search Natural Area, Area of Critical vironmental Concern, state Natural ea)	Н
Climate	poor dispersa	al capac		Ex-situ Conservation		ed banking (incl. protocols, lection, and cultivation)	Н
Climate	Habitat shift climate chan		alteration due to	Planning and Zoning	res <sub>j</sub>	del potential habitat/range shifts in ponse to projected climate changes I prepare adaptation plan to define in a and ex situ conservation needs	Н
Climate		elf and	nse to climate change /or inter-dependent	Research and Monitoring	and clir	nduct primary research on rare plant I pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degradation	Altered hydr aquifer)	ologica	l regime (surface or	Maintain or Restore Natural Processes	Res	store natural hydrologic regime	Н
Resource Extraction	Peat mining			Land Protection (Public, Private). Easements, and Resource Rights		quire conservation easement for pitat protection	Н
Resource Extraction	Peat mining			Voluntary Standards		plement Best Management Practices mining	Н
Climate		normal	(intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Indirect Consumptive Use (Mortality)	Grazing			Compatible Resource Use		plement compatible grazing nagement	M
Lack of knowledge	Threats and a		e to change are	Research and Monitoring		search species/habitat response to nagement or disturbance	M
Lack of knowledge	Complete dis unknown	stributio	on in Colorado	Research and Monitoring		nduct field inventory to refine known tribution	M
Non-consumptive Disturbance	Recreation			Education and Communication	edu	olish educational material/sponsor acational programs to raise public areness	M

Spiranthes diluvialis	Population	1 Status	Population	Trend	Distribution	Type	Habitat	Primary
1	Low	D	Declining	D	Front Range	P	Grass/Forb Dominated Wetlands	<b>✓</b>
TT4- 1- 4:? 4					Southern Rocky Mountains	P		
Ute ladies'-tresses					Central Shortgrass Prairie	O		
Tier 1 Plants					Utah-Wyoming Rocky Mountains	О		
General Threat	Specific Th	reat			General Conservation Action	Spe	ecific Conservation Action	Priority
				Protected Area Management		nage public use to be compatible h biodiversity	Н	
Climate	Vulnerability due to movement barriers poor dispersal capacity, and/or restriction to rare habitat features  Habitat shifting and alteration due to			rriers,	Ex-situ Conservation		d banking (incl. protocols, lection, and cultivation)	Н
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		Н	
Climate		tself and/	se to climate or inter-deper		Research and Monitoring	and clir	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors spersal mechanisms, mutualisms)	Н
Habitat Degradation	Altered hyd aquifer)	drological	regime (surf	ace or	Compliance and Enforcement	Enf	Force 404 wetlands regulations	Н
Habitat Degradation	Altered hyd aquifer)	drological	regime (surf	ace or	Maintain or Restore Natural Processes	Res	store natural hydrologic regime	Н
					Research and Monitoring	Mo	nitor population status	M
Climate		f normal	ntensification weather patte los, etc.)		Capacity Building and Cooperation		gage in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, u		ex-urban		Land Protection (Public, Private) Easements, and Resource Rights	*	quire conservation easement for itat protection	M
Lack of knowledge	Complete d unknown	listributio	n in Colorado	)	Research and Monitoring		nduct field inventory to refine known ribution	M

Telesonix jamesii	Population Status Popula	ntion Trend	Distribution	Type Habitat I	Primary
1 etesonix juntesti	Medium D Unkno		Southern Rocky Mountains	P Cliff and Canyon	<b>V</b>
T				Meadow Tundra	
James telesonix				Mixed Conifer	
Tier 2 Plants General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate	Vulnerability due to moveme	ent harriers	Ex-situ Conservation	*	H
Cilliate	poor dispersal capacity, and/o restriction to rare habitat feat	or	EA-Situ Conservation	collection, and cultivation)	
Climate	Habitat shifting and alteration climate change	n due to	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	Н
Climate	Phenological response to clin of species itself and/or inter-of species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of knowledge	Threats and response to chan poorly understood	ge are	Research and Monitoring	Research species/habitat response to management or disturbance	Н
Lack of knowledge	Complete distribution in Colounknown	orado	Research and Monitoring	Conduct field inventory to refine known distribution	Н
Lack of knowledge	Population status unknown		Research and Monitoring	1 1	Н
Climate	Climate variability (intensific alteration of normal weather e.g., droughts, tornados, etc.)	patterns,	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	Population Status Popula	ntion Trend	Distribution	Type Habitat I	Primary
heliophilum	Medium D Stable	D	Utah High Plateau	P Barrens	<b>✓</b>
Sun-loving meadow rue			Southern Rocky Mountains	O	
Tier 2 Plants					
General Threat	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
	ar-		Research and Monitoring	*	Н
Climate	Vulnerability due to moveme poor dispersal capacity, and/o restriction to rare habitat feat	or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate	Habitat shifting and alteration climate change	n due to	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	Н
				situ and ex situ conservation needs	
Climate	Phenological response to clin of species itself and/or inter-or species unknown		Research and Monitoring		Н
Invasive or Exotic Species	of species itself and/or inter-o	dependent	Research and Monitoring  Invasive Species Control and Prevention	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
	of species itself and/or inter-or species unknown	dependent	Invasive Species Control and Prevention	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms) Monitor for the presence of noxious weeds and implement weed control immediately if detected	
Invasive or Exotic Species	of species itself and/or inter-orate species unknown  Invasive plants	hale mining cation or patterns,	Invasive Species Control and Prevention	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Monitor for the presence of noxious weeds and implement weed control immediately if detected  Implement Best Management Practices for energy development and mining	Н
Invasive or Exotic Species  Resource Extraction	of species itself and/or inter-or species unknown  Invasive plants  Oil and gas drilling, and oil s  Climate variability (intensific alteration of normal weather	hale mining eation or patterns,	Invasive Species Control and Prevention  Voluntary Standards  Capacity Building and	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)  Monitor for the presence of noxious weeds and implement weed control immediately if detected  Implement Best Management Practices for energy development and mining  Engage in collaborative, proactive planning and conservation programs	н

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

Thelypodiopsis	Population Status	Population Trend	Distribution	Гуре	Habitat	Primary
juniperorum	Unknown	Unknown	Colorado Plateau	P	Pinyon-Juniper	<b>✓</b>
· -			Southern Rocky Mountains	O	Sagebrush	
Juniper tumble mustard			Utah High Plateau	O		
Tier 2 Plants						
General Threat	Specific Threat		General Conservation Action	Spe	cific Conservation Action	Priority
Climate	Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation		d banking (incl. protocols, ection, and cultivation)	Н
Climate	Habitat shifting and climate change	alteration due to	Planning and Zoning	resp and	del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs	Н
Climate	Phenological respon of species itself and/ species unknown		Research and Monitoring	and clin	nduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н
Lack of knowledge	Threats and response poorly understood	e to change are	Research and Monitoring		earch species/habitat response to nagement or disturbance	Н
Lack of knowledge	Biology, ecology, an are poorly known	nd detailed habitat	Research and Monitoring		earch critical life history/habitat	Н
Lack of knowledge	Population status un	known	Research and Monitoring	Mo	nitor population status	Н
Lack of knowledge	Complete distributio unknown	n in Colorado	Research and Monitoring		nduct field inventory to refine known ribution	Н
Climate	Climate variability (i alteration of normal e.g., droughts, tornad	weather patterns,	Capacity Building and Cooperation		age in collaborative, proactive nning and conservation programs	M
Habitat Conversion	Housing, urban, and development	ex-urban	Land Protection (Public, Private). Easements, and Resource Rights	*	quire conservation easement for itat protection	M
Indirect Consumptive Use (Mortality)	Grazing		Compatible Resource Use		olement compatible grazing nagement	M
Non-consumptive Disturbance	Motor-powered recre	eation	Compliance and Enforcement	Ma	nage off-road travel	M
Invasive or Exotic Species	Invasive plants		Invasive Species Control and Prevention		plement integrated weed/pest magement plan	L
Resource Extraction	Oil and gas drilling		Voluntary Standards		energy development and mining	L

Thelypodi	ium	Population Status	Population Trend	1	Habitat	Primary
paniculat	um	Unknown	Unknown		Grass/Forb Dominated Wetlands	<b>✓</b>
Northwestern	thelypody					
Tier 2	Plants					
General Threa	at	Specific Threat		General Conservation Action	Specific Conservation Action	Priority
Climate		Vulnerability due to poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation	Seed banking (incl. protocols, collection, and cultivation)	Н
Climate		Habitat shifting and climate change	alteration due to	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	Н
Climate		Phenological respon of species itself and/ species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Lack of know	ledge	Threats and response poorly understood	e to change are	Research and Monitoring	Research species/habitat response to management or disturbance	Н
Lack of know	ledge	Biology, ecology, an are poorly known		Research and Monitoring	Research critical life history/habitat components	Н
Lack of know	ledge	Complete distributio unknown		Research and Monitoring	Conduct field inventory to refine known distribution	Н
Lack of know	ledge	Population status un	known	Research and Monitoring	Monitor population status	Н
Climate		Climate variability (i alteration of normal e.g., droughts, tornac	weather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Townsend	dia fendleri	Population Status	Population Trend	Distribution T	'ype Habitat	Primary
Fendler's tow	uncand-daisy	Low D	Unknown	Central Shortgrass Prairie Southern Rocky Mountains	P Barrens P	<b>✓</b>
	•					
Tier 2 General Threa	Plants	Specific Threat		General Conservation Action	Specific Consequation Action	Deioeity
Climate	at	Specific Threat  Vulnerability due to	movement harriers	Ex-situ Conservation	Specific Conservation Action Seed banking (incl. protocols,	Priority H
Cilliate		poor dispersal capac restriction to rare hal	ity, and/or	Ex-situ Conservation	collection, and cultivation)	п
Climate		Habitat shifting and climate change	alteration due to	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	Н
Climate		Phenological respon of species itself and/ species unknown		Research and Monitoring	Conduct primary research on rare plant and pollinator responses to changing climate, and other vulnerability factors (dispersal mechanisms, mutualisms)	Н
Habitat Conv	ersion	Housing, urban, and development	ex-urban	Land Protection (Public, Private), Easements, and Resource Rights	Acquire conservation easement for habitat protection	Н
Lack of know	ledge	Population status un	known	Research and Monitoring	Monitor population status	Н
Climate		Climate variability (in alteration of normal e.g., droughts, tornace	weather patterns,	Capacity Building and Cooperation	Engage in collaborative, proactive planning and conservation programs	M
Invasive or E	xotic Species	Invasive plants		Invasive Species Control and Prevention	Map weed infestations and sensitive no spray/no mow zones	M
Invasive or E	xotic Species	Invasive plants		Invasive Species Control and Prevention	Implement integrated weed/pest management plan	M
Non-consump	otive Disturbance	Motor-powered recre	eation	Compliance and Enforcement	Manage off-road travel	M
Indirect Cons (Mortality)	umptive Use	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.

Townsendia glabella	Population	n Status	Population Trend	Distribution	Type	Habitat	Primary	
Gray's townsend-daisy	Low	D	Unknown	Southern Rocky Mountains Colorado Plateau	P O	Barrens	<b>✓</b>	
•								
Tier 2 Plants General Threat	Specific Th	reat		General Conservation Action	Sne	cific Conservation Action	Priority	
Climate	Vulnerabili poor disper	ity due to	movement barriers, ity, and/or bitat features	Ex-situ Conservation	See	Seed banking (incl. protocols, collection, and cultivation)		
Climate	Habitat shi climate cha	_	alteration due to	Planning and Zoning	resp and	Model potential habitat/range shifts in response to projected climate changes and prepare adaptation plan to define in situ and ex situ conservation needs		
Climate	Phenological response to climate change of species itself and/or inter-dependent species unknown			Research and Monitoring	and clim	duct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Н	
Habitat Conversion	Housing, u developme		ex-urban	Land Protection (Public, Private) Easements, and Resource Rights		uire conservation easement for itat protection	Н	
Habitat Degradation	Roads			Voluntary Standards		lement Best Management Practices transportation projects	Н	
Lack of knowledge	Population	status un	known	Research and Monitoring	Moi	nitor population status	Н	
Climate		of normal	intensification or weather patterns, dos, etc.)	Capacity Building and Cooperation	_	age in collaborative, proactive and conservation programs	M	
Townsendia rothrockii	Population	n Status	Population Trend	Distribution	Туре	Habitat	Primary	
10wnsenata rotnrockti	1 opulation		1				•	
	Medium	D	Unknown	Southern Rocky Mountains	P	Meadow Tundra Spruce-Fir		
Rothrock townsend-daisy				Southern Rocky Mountains	P			
Rothrock townsend-daisy Tier 2 Plants	Medium	D		·		Spruce-Fir		
Rothrock townsend-daisy Tier 2 Plants General Threat	Medium  Specific Th	D	Unknown	General Conservation Action	Spe	Spruce-Fir	Priority	
Rothrock townsend-daisy Tier 2 Plants	Medium  Specific The Vulnerability poor dispersional specific The	D nreat ity due to rsal capac	Unknown movement barriers,	·	Spe	Spruce-Fir		
Rothrock townsend-daisy Tier 2 Plants General Threat	Medium  Specific TI  Vulnerability poor disperestriction	D nreat ity due to rsal capac to rare ha fting and	Unknown  movement barriers, ity, and/or	General Conservation Action	Spe See coll Moo resp and	Spruce-Fir cific Conservation Action d banking (incl. protocols,	Priority	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate	Medium  Specific TI  Vulnerabil- poor disperestriction  Habitat shi climate cha	D  nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/	Unknown  movement barriers, ity, and/or bitat features alteration due to	General Conservation Action Ex-situ Conservation	Specoll Moorespand situ Con and clim	Spruce-Fir  cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in	Priority	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate Climate Climate	Medium  Specific TI  Vulnerability poor disperestriction  Habitat shit climate characteristic of species is species unlimated.  Motor-pow	D  nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/known	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement	Spe Seeccoll Mooresp and situ Con and clim (dis	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nage off-road travel	Priority H H	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate Climate	Medium  Specific TI  Vulnerability poor disperestriction  Habitat shit climate characteristic of species in species unless the species unless the species of species unless the species are species unless the species unless	nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/ known /ered recr riability ( of normal	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent eation intensification or weather patterns,	General Conservation Action  Ex-situ Conservation  Planning and Zoning  Research and Monitoring	Spe Seecoll Mooresp and situ Con and clim (dis Mar	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms)	Priority H	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate Climate Climate Non-consumptive Disturbance	Medium  Specific TI  Vulnerability poor disperestriction  Habitat shit climate chat  Phenologic of species in species unless and the species unless and the species of species s	nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/ known //ered recr riability ( of normal hts, tornad d response	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent eation intensification or weather patterns,	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement Capacity Building and	Spe Seeccoll Mooresp and situ Con and clim (dis Mar Eng plar	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in sonse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nage off-road travel gage in collaborative, proactive	Priority H H	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate  Climate  Climate  Non-consumptive Disturbance Climate	Medium  Specific TI  Vulnerabil- poor disperestriction  Habitat shi climate cha  Phenologic of species in  Motor-pow  Climate va alteration of e.g., droug  Threats and poorly und	nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/ known vered recr riability ( of normal hts, tornad d response	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent eation intensification or weather patterns, dos, etc.)	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement Capacity Building and Cooperation	Spe Seecoll Moorespand situ Con and clim (dis Mar Eng plar Res	cific Conservation Action d banking (incl. protocols, ection, and cultivation)  del potential habitat/range shifts in conse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) nage off-road travel tage in collaborative, proactive ming and conservation programs earch species/habitat response to	Priority H H H M	
Rothrock townsend-daisy Tier 2 Plants General Threat Climate  Climate  Climate  Non-consumptive Disturbance Climate  Lack of knowledge	Medium  Specific TI  Vulnerability poor dispersestriction:  Habitat shi climate cha  Phenologic of species is species unless and the species and the species and the species and the species are poorly under the species are poorly.	nreat ity due to rsal capac to rare ha fting and ange cal respon itself and/ known //ered recr riability ( of normal hts, tornad d response erstood cology, ar known	movement barriers, ity, and/or bitat features alteration due to see to climate change for inter-dependent eation intensification or weather patterns, dos, etc.) e to change are	General Conservation Action Ex-situ Conservation  Planning and Zoning  Research and Monitoring  Compliance and Enforcement Capacity Building and Cooperation  Research and Monitoring	Spe Seecoll Moorespand situ Comand clim (dis Mar Eng plar Res mar Res com	cific Conservation Action d banking (incl. protocols, ection, and cultivation) del potential habitat/range shifts in sonse to projected climate changes prepare adaptation plan to define in and ex situ conservation needs aduct primary research on rare plant pollinator responses to changing nate, and other vulnerability factors persal mechanisms, mutualisms) mage off-road travel gage in collaborative, proactive nning and conservation programs earch species/habitat response to nagement or disturbance earch critical life history/habitat	Priority H H M M M	

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**

		-	
Group	Species	Common Name	Primary
Plants	Eriogonum coloradense	Colorado wild buckwheat	<b>V</b>
Plants	Castilleja puberula	Downy Indian-paintbrush	<b>✓</b>

Draba graminea

San Juan whitlow-grass

**Tier 2 Species** 

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	Н
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	Н

Plants

### Very High Priority Exposed Rock (alpine) Alpine Tier 1 Species Tier 2 Species

		1	
Group	Species	Common Name	Primary
Plants	Oreoxis humilis	Pikes Peak spring parsley	
Plants	Aliciella sedifolia	Stonecrop gilia	<b>✓</b>

		1	
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	<b>✓</b>

## Very High Priority Meadow Tundra Alpine Tier 1 Species Group Species Common Name Primary Plants Botrychium tax. nov. "furcatum" Fork-leaved moonwort "furcatum" ✓ Plants Draba exunguiculata Clawless draba Plants Delphinium ramosum Colorado larkspur

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

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

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	Н
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	Н
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

#### **Very High Priority**

#### **Barrens**

#### **Sparsely Vegetated**

#### **Tier 1 Species**

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

Group	Species	Common Name	Primary
Plants	Oenothera harringtonii	Arkansas Valley evening primrose	<b>✓</b>
Plants	Physaria bellii	Bell's twinpod	<b>✓</b>
Plants	Lomatium concinnum	Colorado desert-parsley	
Plants	Astragalus debequaeus	DeBeque milkvetch	<b>✓</b>
Plants	Townsendia fendleri	Fendler's townsend-daisy	<b>✓</b>
Plants	Nuttallia chrysantha	Golden blazing star	<b>✓</b>
Plants	Penstemon grahamii	Graham beardtongue	✓
Plants	Townsendia glabella	Gray's townsend-daisy	✓
Plants	Oreocarya osterhoutii	Osterhout cat's-eye	<b>✓</b>
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	<b>✓</b>
Plants	Physaria rollinsii	Rollins twinpod	<b>✓</b>
Plants	Oxybaphus rotundifolius	Round-leaf four o'clock	<b>✓</b>
Plants	Thalictrum heliophilum	Sun-loving meadow rue	<b>V</b>

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		Н
			purpose	
Habitat Degradation	Oil and gas development	Compatible Resource Use	Implement compatible mining practices	Н

#### **High Priority**

#### Pinyon-Juniper

#### Forestlands

#### **Tier 1 Species**

		1	
Group	Species	Common Name	Primary
Plants	Lygodesmia doloresensis	Dolores River skeletonplant	<b>✓</b>
Plants	Penstemon gibbensii	Gibben's beardtongue	
Plants	Cryptantha gypsophila	Gypsum Valley cat's- eye	<b>✓</b>
Plants	Astragalus lonchocarpus var. hamiltonii	Hamilton milkvetch	<b>V</b>
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**

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

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

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 Restore natural fire regime Processes		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

#### **High Priority**

#### **Eastern Plains Streams**

#### Riparian/Wetlands

#### **Tier 1 Species**

Group	Species	Common Name	Primary
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	<b>✓</b>

Group	Species	Common Name	Primary
Plants	Gaura neomexicana ssp. coloradensis	Colorado butterfly plant	<b>&gt;</b>

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered hydrological regime ( aquifer)	Maintain or Restore Natural Processes	Natural Reduce ground-water pumping	
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	
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	<b>✓</b>
Plants	Spiranthes diluvialis	Ute ladies'-tresses	<b>✓</b>

#### **Tier 2 Species**

**Tier 2 Species** 

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

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

#### **High Priority**

Group

Plants

#### **Mountain Streams**

#### Riparian/Wetlands

#### **Tier 1 Species**

	-	
Species	Common Name	Primary
Draba weberi	Weber's draba	<b>✓</b>

Group	Species	Common Name	Primary
Plants	Aquilegia chrysantha var. rydbergii	Golden columbine	<b>✓</b>
Plants	Carex stenoptila	Small-winged sedge	<b>✓</b>

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Invasive or Exotic Species	Invasive plants	Invasive Species Control and Implement integrated weed/pest Prevention 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

1 able 4	t Continuea.								
]	High Priority	· 1 C		Play	as		T	Riparian/W	etlands
	11	ier 1 Species					Tier	2 Species	
					Group	Species		Common Name	Primary
				=	Plants	Cleome mul	lticaulis	Slender spiderflower	
General T	hreat	Specific Threat		Genera	al Conserv	ration Action	Specific	Conservation Action	Priority
Habitat C	onversion	Conversion to cropland		Mainta	in or Rest	tore Habitat	Restore	native prairie	Н
Lack of k	nowledge	Complete distribution in Colorac unknown	do	Resear	ch and Mo	onitoring	Conduction distributed	t field inventory to refine know	n H
Habitat D	egradation	Replace ephemeral playa with lo term water catchment	onger-	Mainta	in or Rest	tore Habitat	Restore	playa	M
	High Priority	Shr	ub-do	mina	ted We	<u>tlands</u>		Riparian/W	etlands
	Ti	ier 1 Species					Tier	2 Species	
Group	Species	Common Name	Primar	у	Group	Species		Common Name	Primary
Plants	Gaura neomexica	ana Colorado butterfly plant			Plants	Salix arizon	ica	Arizona willow	<b>✓</b>
	ssp. coloradensis	3			Plants	Carex steno	ptila	Small-winged sedge	<b>V</b>
General T	hreat	Specific Threat		Genera	ıl Conserv	ation Action	Specific	Conservation Action	Priority
Habitat D	egradation	Altered native vegetation (riparia deforestation, woody encroachm chaining sagebrush, seral stage imbalance, etc.)		Mainta	in or Rest	tore Habitat	_	grazing for compatible on height, structure, etc.	Н
Invasive of	or Exotic Species	Invasive plants - tamarisk		Invasiv		Control and		ent integrated weed/pest	Н
Habitat D	egradation	Altered hydrological regime (sur aquifer)	face or	Mainta Proces		tore Natural		pperation of dam and ditches	M
Invasive of	or Exotic Species	Invasive plants		Invasiv Preven	-	Control and	-	ent integrated weed/pest ment plan	M
]	High Priority		Seeps	s and	Spring	<u>ts</u>		Riparian/W	etlands
	Ti	ier 1 Species					Tier	2 Species	
Group	Species	Common Name	Primar	У	Group	Species		Common Name	Primary
Plants	Mimulus gemmi	parus Budding monkey flower	~		Plants	Limnorchis	zothecina	Alcove bog orchid	
Plants	Gaura neomexica ssp. coloradensis	J I			Plants	Aquilegia ch var. rydberg	-	Golden columbine	<b>V</b>
General T	hreat	Specific Threat		Genera	ıl Conserv	ation Action	Specific	Conservation Action	Priority
Habitat D	egradation	Invasive or exotic species		Invasiv	-	Control and		ent integrated weed/pest ment plan	M
Habitat D	egradation	Invasive or exotic species		Invasiv Preven		Control and		ed infestations and sensitive no o mow zones	о М
Habitat D	egradation	Altered hydrological regime (sur aquifer)	face or	Mainta Proces		tore Natural	Restore	natural hydrological regime	M

#### **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	Н

#### High Priority

#### **Desert Shrub**

#### Shrublands

Tier		

		-	
Group	Species	Common Name	Primary
Plants	Aletes latilobus	Canyonlands aletes	
Plants	Eriogonum pelinophilum	Clay-loving wild buckwheat	<b>~</b>
Plants	Sclerocactus glaucus	Colorado hookless cactus	<b>✓</b>
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	

Group	Species	Common Name	Primary
Plants	Lepidium crenatum	Alkaline pepperwort	<b>✓</b>
Plants	Eriogonum clavellatum	Comb Wash buckwheat	<b>✓</b>
Plants	Caesalpinia repens	Creeping rush-pea	
Plants	Astragalus cronquistii	Cronquist milkvetch	<b>✓</b>
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
-			T · T · · ·	

#### High Priority Sagebrush Shrublands

Tier	1	<b>Species</b>
1101	1	Species

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

#### **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	<b>✓</b>
Plants	Lomatium concinnum	Colorado desert-parsley	<b>✓</b>
Plants	Boechera crandallii	Crandall's rock-cress	<b>✓</b>
Plants	Astragalus debequaeus	DeBeque milkvetch	
Plants	Penstemon fremontii var. glabrescens	Fremont's beardtongue	<b>V</b>
Plants	Penstemon teucrioides	Germander beardtongue	<b>✓</b>
Plants	Astragalus anisus	Gunnison milkvetch	<b>✓</b>
Plants	Thelypodiopsis juniperorum	Juniper tumble mustard	
Plants	Oenothera acutissima	Narrow-leaf evening primrose	
Plants	Astragalus naturitensis	Naturita milkvetch	
Plants	Mertensia humilis	Rocky Mountain bluebells	<b>✓</b>
Plants	Astragalus iodopetalus	Violet milkvetch	<b>✓</b>

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	Н
Habitat Degradation	Altered native vegetation (low forb and grass diversity)	Compatible Resource Use	Implement compatible grazing management	Н
Habitat Degradation	Oil and gas pipelines	Planning and Zoning	Promote consideration of biodiversity issues in transportation and land use planning processes	Н
Habitat Degradation	Fragmentation	Voluntary Standards	Implement Best Management Practices for energy development and mining (reduce footprint and/or extend implementation timeline)	Н
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 <u>Upland Shrub</u> Shrublands

#### Tier 1 Species

Common Name

Penland penstemon

Group

Plants

Species

Penstemon penlandii

#### Primary

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	Н
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

Group

Plants

Group

Plants

#### **High Priority**

#### **Saltbrush Fans and Flats**

**Shrublands** 

Tier	1	Species
1101		Species

The Topeens		
Species	Common Name	Primary
Sclerocactus mesae-	Mesa Verde	
verdae	hookless cactus	

		_	
Group	Species	Common Name	Primary
Plants	Cirsium perplexans	Adobe thistle	
Plants	Eriogonum clavellatur	m Comb Wash buckwheat	
Plants	Camissonia eastwoodiae	Eastwood evening primrose	<b>V</b>

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	M
			purpose	

High Priority	<b>Deciduous Oak</b>		Shrublands
Tier 1 Species		Tier 2 Species	

	-	
Species	Common Name	Primary
Physaria pulvinata	Cushion bladderpod	

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

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

#### **High Priority**

#### **Cliff and Canyon**

#### **Sparsely Vegetated**

#### Tier 1 Species

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

#### **Tier 2 Species**

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

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

#### **High Priority**

#### Tier 1 Species

#### **Exposed Rock** Sparsely Vegetated

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

#### Medium Priority Mixed Forest Forestlands

Tier 1 Species	Tier 2 Species
----------------	----------------

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

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

# Medium Priority Tier 1 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 <u>Mixed Conifer</u> Forestlands

Tier 1 Species Tier 2 Species

Group	Species	Common Name	Primary
Plants	Cirsium scapanolepis	Mountain-slope thistle	<b>✓</b>

		-	
Group	Species	Common Name	Primary
Plants	Hackelia besseyi	Bessey's stickseed	<b>V</b>
Plants	Telesonix jamesii	James telesonix	
Plants	Botrychium lineare	Narrowleaf grape fern	
Plants	Ipomopsis aggregata ssp. weberi	Rabbit Ears gilia	<b>V</b>

**Aspen Forest** 

Forestlands

#### **Table 4. - Continued.**

**Medium Priority** 

Meur	uiii i i ioi ity Tior	1 Species	Aspe	en rorest		Tion	2 Species	suanus
Group	Species	Common Name	Primary	Group	Species	1101	Common Name	Primary
Plants	Draba malpighiacea	Whitlow-grass		Plants	Botrychium 1	lineare	Narrowleaf grape fern	<b>V</b>
	1.0			Plants	Carex stenop		Small-winged sedge	
				Plants	Draba smithi	i	Smith whitlow-grass	
				Plants	Delphinium i	robustum		
General Thr	reat S <sub>1</sub>	pecific Threat	Ge	eneral Conserva	tion Action	Specific	Conservation Action	Priority
Habitat Deg	gradation A	ltered fire regime		aintain or Resto ocesses	re Natural	Restore 1	natural fire regime	Н
Natural Fac		radication of aspen sprouts by rowsing animals		aintain or Resto ocesses	re Natural	Manage	natural herbivory	Н
Disease	Si	udden Aspen Death	Re	esearch and Mor	nitoring		ue research on causes and nent options	M
Disease	Si	udden Aspen Death	Sŗ	ecies Managem	ent	burning,	e clone regeneration through cutting, or other methods oot systems become too weak	M to
Medi	um Priority		Ponde	erosa Pine			Fore	estlands
	Tier	1 Species				Tier	2 Species	
Group	Species	Common Name	Primary	Group	Species		Common Name	Primary
Plants	Physaria pulvinata	Cushion bladderpod		Plants	Aletes humili	is	Larimer aletes	
Plants	Ipomopsis polyantha	a Pagosa skyrocket		Plants	Astragalus missouriensis var. humistra		Missouri milkvetch	$\checkmark$
				Plants	Lesquerella c		Rocky Mountain bladderpod	
General Thr	reat S	pecific Threat	Ge	eneral Conserva	tion Action	Specific	Conservation Action	Priority
Habitat Cor	iversion H	ousing, urban, and ex-urban evelopment		and Protection (Inserted as American Report of the Inserted and Inserted as American Report of the Inserted American Repor		Purchase	habitat or Acquire tion easement for conservation	H on
Habitat Deg		Itered native vegetation (increases)	ased tree M	aintain or Resto	re Habitat		trees/shrubs	Н
Habitat Deg	gradation A	ltered fire regime		aintain or Resto	re Natural	Restore 1	natural fire regime	Н
Habitat Cor		ousing, urban, and ex-urban evelopment		and Protection (Insements, and R			nt Purchase/Transfer ment Rights program for rotection	M
Habitat Deg	gradation Fi	ragmentation	Pl	anning and Zon	ing		zoning that concentrates use ects habitat	M
Habitat Deg	gradation R	oads or Railroads		vasive Species ( evention	Control and		nt integrated weed/pest nent plan	L
Medi	um Priority		<u>Spr</u>	uce-Fir			Fore	estlands
	Tier	1 Species				Tier	2 Species	
Group	Species	Common Name	Primary	Group	Species		Common Name	Primary
Plants	Botrychium tax. nov "furcatum"	7. Fork-leaved moonwort		Plants Plants	Townsendia :		Rothrock townsend-daisy Small-winged sedge	<b>✓</b>
Plants	Physaria scrotiformi							
Plants	Draba malpighiacea	Whitlow-grass						
General Thr	reat S <sub>j</sub>	pecific Threat	Ge	eneral Conserva	tion Action	Specific	Conservation Action	Priority
Climate		abitat shifting and alteration d limate change		egislation, Polici egulations	es and	Reduce (	CO2 emissions	M
Climate		abitat shifting and alteration d limate change	ue to Re	esearch and Mo	nitoring	response and prep	otential habitat/range shifts in to projected climate changes are adaptation plan to define tion needs	

#### **Medium Priority**

#### **Shortgrass Prairie**

#### Grasslands

Tier 1 Species

#### **Tier 2 Species**

Group	Species	Common Name	Primary
Plants	Oenothera harringtonii	Arkansas Valley evening primrose	<b>✓</b>
Plants	Asclepias uncialis ssp. uncialis	Dwarf milkweed	<b>V</b>
Plants	Oonopsis puebloensis	Pueblo goldenweed	<b>✓</b>
Plants	Oonopsis foliosa var. monocephala	Rayless goldenweed	<b>V</b>

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	Н
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	Н
Habitat Conversion	Conversion to cropland	Maintain or Restore Habitat	Avoid destruction of large tracts of native habitat (e.g., ski area development, sod-busting)	Н
Habitat Degradation	Altered animal community (loss of herbivores, esp. BTPD complexes, predators, pollintors, etc.)	Education and Communication	Implement landowner outreach/education program	Н
Habitat Degradation	Roads or Railroads (super slab)	Research and Monitoring	Research habitat response to management	Н
Indirect Consumptive Use	Grazing	Maintain or Restore Habitat	Maintain appropriate patch size and habitat mosaic	Н
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**

Species

Cirsium scapanolepis

Group

Plants

#### Foothill/Mountain Grassland

#### Grasslands

#### Tier 1 Species

Common Name	Primary
Mountain-slope thistle	

Group	Species	Common Name	Primary
Plants	Machaeranthera coloradoensis	Colorado tansy-aster	<b>~</b>
Plants	Eriogonum coloradense	Colorado wild buckwheat	<b>✓</b>
Plants	Penstemon degeneri	Degener beardtongue	
Plants	Astragalus missouriensis var. humistratus	Missouri milkvetch	
Plants	Botrychium lineare	Narrowleaf grape fern	<b>✓</b>
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

#### **Medium Priority**

Group

Plants

#### **Sandy Areas**

#### **Sparsely Vegetated**

Tier 1	Species
--------	---------

	~Peeres	
Species	Common Name	Primary
Corispermum navicula	Boat-shaped bugseed	

Group	Species	Common Name	Primary
Plants	Boechera crandallii	Crandall's rock-cress	
Plants	Caesalpinia repens	Creeping rush-pea	<b>✓</b>
Plants	Astragalus piscator	Fisher Towers milkvetch	<b>~</b>
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	M
			management	

## 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 neomexicanassp. 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: <a href="http://www.fs.fed.us/r2/projects/scp/assessments/mentzeliachrysantha.pdf">http://www.fs.fed.us/r2/projects/scp/assessments/mentzeliachrysantha.pdf</a> [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: <a href="http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf">http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf</a> [accessed April 2011].
- California Native Plant Society. 1992. Policy on appropriate application of ex situ conservation techniques. <a href="http://www.cnps.org/archives/ex\_situ.htm">http://www.cnps.org/archives/ex\_situ.htm</a>.
- 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. <a href="http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/">http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/</a>.
- 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. <a href="https://www.nrel.colostate.edu/projects/comap">www.nrel.colostate.edu/projects/comap</a>.
- 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. <a href="http://www.ipcc.ch/ipccreports/assessments-reports.htm">http://www.ipcc.ch/ipccreports/assessments-reports.htm</a>.
- 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. <a href="http://cumuseum.colorado.edu/Research/Botany/Databases/catalog.html">http://cumuseum.colorado.edu/Research/Botany/Databases/catalog.html</a>.

## 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.)
	Hunting, trapping, fishing
Direct Consumptive	Poisoning
Use (Mortality)	Gathering
	Scientific research
	Collision (e.g., auto, turbine, aircraft)
	Housing, urban, and ex-urban development
	Conversion to cropland
Habitat Conversion	Recreation area developments
	Water storage
	Commercial and industrial development
	Commercial hog farm or feedlot
	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
Habitat Degradation	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 plants
	Invasive plants - tamarisk
Invasive or Exotic	Invasive animals
Species	Pathogen - chytrid fungus
·	Pathogen - sylvatic plague
	Introduced genetic material
	Problematic native species
	Complete distribution in Colorado unknown
	Population status unknown
Lack of knowledge	Reproductive and/or pollination biology unknown
Ç	Phenological response to climate change of species itself and/or inter- dependent species unknown
	Response to climate change of ecological systems and processes unknown
	Scarcity (leading to inbreeding depression)
Natural Factors	Herbivory (e.g., resource competition, changes in habitat structure)
	Altered animal community (change in herbivores, predators, pollinators, etc.)
	Motor-powered recreation
Non-consumptive	Non-motorized recreation
Disturbance	Scientific research
	Flight paths
	Proximal non-recreation disturbance
	Lack of coordination
Organizational capacity	Lack of funding
and management	Lack of common goals
	Confused or gaps in authorities
	Legislation/policy changes
	Chemicals and toxins
	Herbicide/pesticide spraying or runoff
Pollution	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
	Oil and gas drilling
Resource Extraction	Mining (coal, sand/gravel, etc.)
	Water use, management
	Wind energy

Table A2. Conservation Action taxonomy for species

General Action	Specific Action
	Develop partnerships among agencies, NGOs, and stakeholders
Capacity Building and Cooperation	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
Companible Resource Use	Implement compatible grazing management
	Monitor water quality standards
	Enforce wildlife and habitat protection laws
	Enforce hunting, fishing, collecting regulations
Compliance and	Enforce 404 wetlands regulations
Enforcement	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
	Promote ecotourism
Economic Incentives	Promote green building, development, and lifestyle
Loononiic incentives	Increase efficiency of water use
	Provide economic assistance for private land habitat improvements and/or species conservation
	Publish educational material/sponsor educational programs to raise public awareness
Education and Communication	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)
	Map weed infestations and sensitive no spray/no mow zones
	Implement integrated weed/pest management plan
Invasive Species Control and Prevention	Control bullfrogs
and Prevention	Control non-native fish
	Avoid transfer of chytrid fungus
	Dust for fleas to prevent plague outbreaks
	Create protected park, preserve, wildlife area
	Expand existing protected park, preserve, wildlife area
	Purchase habitat for conservation purpose
	Acquire conservation easement for habitat protection
Land Protection (Public, Private), Easements, and	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area)
Resource Rights	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)
	Regulate lethal control methods
	Establish mitigation requirements for developments and other projects that impact species/habitats
Legislation, Policies and Regulations	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	Restore native prairie
Habitat	Restore riparian vegetation
	Plant trees/shrubs

General Action	Specific Action
	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
Maintain or Restore	Improve erosion and excess sedimentation conditions
Habitat, cont.	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
	Restore natural fire regime
	Remove dam
	Adjust operation of dam
Maintain or Restore	Remove road(s)
Natural Processes	Manage for balance of interspecific interactions (predator, prey, pollinator, dispersor, etc.)
	Manage natural herbivory
	Improve erosion and excess sedimentation conditions
	Maintain linkages and connectivity
	Write management plan for species or habitat
Planning and Zoning	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
	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.)
Research and Monitoring	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
	Reintroduce extirpated native species
	Provide artificial nesting boxes/platforms
	Maintain genetic connection/integrity within and between populations
	Maintain comprehensive species database
Species Management	Develop collaborative management agreements
Species Management	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
	Implement Best Management Practices for transportation projects
Voluntary Standards	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,	Implement Best Management Practices for agricultural production
cont.	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.)
	Housing, urban, and ex-urban development
	Conversion to cropland
Habitat Canyaraian	Recreation area developments
Habitat Conversion	Water storage
	Commercial and industrial development
	Commercial hog farm or feedlot
	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
Habitat Degradation	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
	Forest and woodland management
Indirect Consumptive Use	Grazing
·	Water use (e.g., de-watering of streams)

General Threat	Specific Threat
	Invasive plants
Invasive or Exotic Species	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
Lack of knowledge	Status unknown
	Scarcity
Natural Factors	Herbivory (e.g., resource competition, changes in habitat structure)
	Altered animal community (change in herbivores, predators, pollinators, etc.)
	Motor-powered recreation
Non-consumptive Disturbance	Non-motorized recreation
	Proximal non-recreation disturbance
	Lack of coordination
Organizational capacity	Lack of funding
and management	Lack of common goals
	Legislation/policy changes
	Chemicals and toxins
	Herbicide/pesticide spraying or runoff
	Nutrient loads
	Solid waste
Pollution	Waste or residual materials (mine tailings, excess sediment loads, etc.)
	Air pollution
	Radioactive materials
	Salt
	Septic system failures
	Oil and gas drilling
Resource Extraction	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
0 171 5 11	Implement compatible logging practices
Compatible Resource Use	Implement compatible grazing management
	Monitor water quality standards
	Enforce 404 wetlands regulations
Compliance and Enforcement	Enforce state/federal/local pollution standards
	Identify and control point-source and non-point source pollution
	Promote ecotourism
	Promote green building, development, and lifestyle
Economic Incentives	Increase efficiency of water use
	Provide economic assistance for private land habitat improvements and/or species conservation
	Reduce ground-water pumping
	Publish educational material/sponsor educational programs to raise public awareness
	Improve knowledge of habitats, problems, via professional meetings and other venues
Education and Communication	Improve communication among researchers and policy/decision-makers
	Implement landowner outreach/education program
	Educate development industries about avoiding and/or mitigating habitat impacts
	Map weed infestations and sensitive no spray/no mow zones
	Implement integrated weed/pest management plan
Invasive Species Control and	Control bullfrogs
Prevention	Control non-native fish
	Avoid transfer of chytrid fungus
	Dust for fleas to prevent plague outbreaks
	Create protected park, preserve, wildlife area
Land Protection (Public, Private),	Expand existing protected park, preserve, wildlife area
Easements, and Resource Rights	Purchase habitat or Acquire conservation easement for conservation purpose

General Action	Specific Action
	Establish legal designation to protect habitat (e.g., wilderness, Research Natural Area)
	Implement Purchase/Transfer Development Rights program for habitat protection
Land Protection (Public, Private), Easements, and Resource Rights, cont.	Establish in-stream flow rights
	Acquire water rights
	Mitigate species/habitat loss (e.g., grass banking, mitigation banking, credits for off-site habitat protection)
Lariabetian Ballaian and	Establish mitigation requirements for developments and other projects that impact species/habitats
Legislation, Policies and Regulations	Encourage use of Farm Bill programs
	Reduce CO2 emissions
	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
Maintain or Restore Habitat	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
	Restore natural fire regime
	Remove dam
Maintain or Restore Natural	Adjust operation of dam
Processes	Remove road(s)
	Manage for predator/prey balance
	manago for productor/proy bullution

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

### <u>Section A - Exposure to Local Climate Change</u>

**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
-0.0970.119
-0.0740.096
-0.0510.073
-0.0280.050
>-0.028

## <u>Section B – Indirect Exposure to Climate Change</u>

- 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 <i>Neutral</i> 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 coolwater 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
	( <i>Euphydryas editha quino</i> ), 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).
	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.
Increase Vulnerability:	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.

	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.
Somewhat Increase Vulnerability:	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.
variorability.	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.
	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.
Neutral:	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:

	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
Increase Vulnerability:	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	The natural history/requirements of the species are known to be incompatible with
Increase	mitigation-related land use changes that may possibly occur within its current and/or
Vulnerability:	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 <b>very small (&lt; 37° F/20.8° C)</b> 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 <b>small (37 - 47° F/20.8 - 26.3° C)</b> temperature variation in the past 50 years.
Somewhat Increase Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced <b>slightly lower than average (47.1 - 57° F/26.3 - 31.8° C)</b> temperature variation in the past 50 years.
Neutral:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced <b>average (57.1 - 77° F/31.8 - 44.0° C)</b> temperature variation in the past 50 years.
Somewhat Decrease Vulnerability:	Considering the mean seasonal temperature variation for occupied cells, the species has experienced <b>greater than average (&gt; 77° F/43.0° C)</b> 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	Species is completely or almost completely (> 90% of occurrences or range) restricted to
Increase	relatively cool or cold environments that may be lost or reduced in the assessment area
Vulnerability:	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	Considering the range of mean annual precipitation across occupied cells, the species
Increase	has experienced very small (< 4 inches/100 mm) precipitation variation in the past 50
Vulnerability:	years.
Increase Vulnerability:	Considering the range of mean annual precipitation across occupied cells, the species has experienced <b>small (4 - 10 inches/100 - 254 mm)</b> precipitation variation in the past 50 years.
Somewhat	Considering the range of mean annual precipitation across occupied cells, the species
Increase	has experienced slightly lower than average (11 - 20 inches/255 - 508 mm)
Vulnerability:	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	Considering the range of mean annual precipitation across occupied cells, the species
Decrease	has experienced greater than average (> 40 inches/1,016 mm) precipitation variation in
Vulnerability:	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	Highly dependent (>80% of subpopulations or range) on ice- or snow-associated
Increase	habitats; or found almost exclusively on or near ice or snow during at least one stage
Vulnerability:	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 ( <i>Ptychocheilus lucius</i> ) 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 <b>clear preference</b> 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:	<b>Highly generalized</b> 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 ( <i>Achillea millefolium</i> ) and coyote ( <i>Canis latrans</i> ) 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 ( <i>Athene cunicularia</i> ) 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	Completely or almost completely (roughly > 90%) dependent on a small number of
Increase	species for propagule dispersal. For example, a freshwater mussel for which only a few
Vulnerability:	species of fish can disperse larvae.
Neutral:	Disperses on its own (most animals) OR propagules can be dispersed by more than a
iveutiai.	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	Requires an interaction with a single other species for persistence.
Vulnerability:	
Somewhat Increase Vulnerability:	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

percentage of the range falls within the scoring category.

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

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

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

Scoring Factor	Score	Number of Species
	Somewhat Increase	0
	Neutral	88
	Somewhat Decrease	0
	Unknown	3
	Greatly Increase	33
	Increase	48
Historical Hydrological Nicho	Somewhat Increase	17
Historical Hydrological Niche	Neutral	12
	Somewhat Decrease	0
	Unknown	11
	Greatly Increase	19
	Increase	88
Dhysiological Hydrological Nicks	Somewhat Increase	1
Physiological Hydrological Niche	Neutral	11
	Somewhat Decrease	0
	Unknown	2
	Increase	0
	Somewhat Increase	44
Diatushanaa Dagima	Neutral	75
Disturbance Regime	Somewhat Decrease	0
	Decrease	0
	Unknown	2
	Greatly Increase	1
	Increase	0
Dependence on Ice/Snow	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
	Greatly Increase	0
	Increase	0
Dependence on Other Species to Generate Habitat	Somewhat Increase	0
	Neutral	119
	Unknown	2
	Increase	1
Pollinator Versatility	Somewhat Increase	13
Polimator versatility	Neutral	49
	Unknown	58
	Increase	0
Dependence on Other Species for	Somewhat Increase	0
Propagule Dispersal	Neutral	117
	Unknown	4
	Increase	15
Other Species Interactions (e.g.,	Somewhat Increase	2
mutualisms)	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		Tempe Scc	ppe		Moistur	on AET:PI e Metric S		-0.028	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	- -0.073	- -0.05							_	Ph				De		Dep		
Aletes humilis	Larimer Aletes	60	40			100	0.075	0.00	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	Ν	Inc	Inc	SI	N	N	Ν	Ν	Ν	Inc	EV
Astragalus cronquistii	Cronquist milkvetch	100					28	72	N	N	Inc	Inc	Ν	Ν	Inc	Inc	SI	N	N	Ν	Ν	N	Inc	EV
Astragalus debequaeus	DeBeque milkvetch	100				99	1		Inc	N	Inc	Inc	SD	Ν	Inc	Inc	N	N	SD	5	Ν	Ν	Inc	EV
Astragalus deterior	Cliff-palace milkvetch	100				100			Inc	Inc-SI	N	Inc	Ν	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			Hamon AET:PET Moisture Metric Scope					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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05			5		_	풉	His	Phys	De	Δ	P	Depe		Deper	0	
Astragalus Ionchocarpus var. hamiltonii	Hamilton milkvetch	100			100				Inc	SI	N	Inc	SD	N	GI	Inc	SI	N	Ν	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	Ν	N	N	Ν	Ν	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	С	N	N	SI	Ν	N	N	Ν	C	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		erature ope	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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05			⋾		_	뚭	His	Phys	De	Δ	₹	Depe		Deper		
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	J	N	U	EV
Corispermum navicula	Boat-shaped bugseed	100			33	67			Inc	N	Z	Inc	N	N	GI	Inc	Ν	N	Inc	N	כ	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	כ	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	Ν	SI	N	N	N	N	N	EV

NatureServe		-	erature ope	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	nd 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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05			ס		_	듄	ij	Phys	De	Δ	<u> </u>	Depend		<b>Depe</b>	J	
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		Tempe Scc	erature ope	Hamon AET:PET Moisture Metric Scope						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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05			5			옵	His	Phys	De	٥	¥.	Depe		Deper		
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	Z	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	Ν	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	Ν	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	Ν	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

NatureServe		Tempe Sco		Hamon AET:PET Moisture Metric Scope						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						<b>a</b>	Ï	Phy	٥	_		Dep		Depe		
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	Ν	Ν	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	С	U	U	U	U	С	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

NatureServe			erature ope			non AET:P re Metric S	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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05			ō			ā	Ĭ	Phys	Ğ		۵	Dep		Depe		
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

NatureServe		Tempe Scc			Hamon AET:PET Moisture Metric Scope						Climate Change mitigation	rsal/Mo	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 <b>–</b> -0.096	-0.051 - -0.073	-0.028 - -0.05		Anthropogenic barriers	ij			Ph	His	Physi	Del	ă	됩	Depe		Deper	O	
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; <a href="www.cnhp.colostate.edu">www.cnhp.colostate.edu</a>

### 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









