ARKANSAS VALLEY BARRENS
Conservation Action Plan
2011 Update

Golden blazing star © *Betsy Neely*

Brandegee wild buckwheat © *Gina Glenne*

Round-leaf four-o'clock © *Peter Gordon*

Pueblo goldenweed © *Susan Spackman Panjabi*

Plant Species of Focus

Brandegee wild buckwheat (*Eriogonum brandegeei)*
Golden blazing star (*Nuttallia chrysantha*)
Pueblo goldenweed (*Oonopsis puebloensis*)
Round-leaf four-o'clock (*Oxybaphus rotundifolius*)

Sponsored by the
Colorado Rare Plant Conservation Initiative

Workshop Dates: June 12, 2008 and July 14, 2010
Report Date: August 25, 2011

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Acknowledgements: Many thanks to all the participants of the conservation action planning workshops in 2008 and 2010 for taking the time to develop this action plan and update.

I. Introduction

This document identifies conservation strategies for four globally imperiled plant species: round-leaf four-o'clock, golden blazing star, Pueblo goldenweed and Brandegee wild buckwheat, based on an assessment of the plants' viability and threats by participants of an initial conservation action planning workshop held in June 2008 (Kram et al. 2008) and a July 2010 follow-up workshop. This report, herein, is intended as a comprehensive update to the 2008 plan. The primary audience is intended to be the workshop participants and other stakeholders interested in helping to implement the strategies.

The Arkansas Valley Barrens Priority Action Area as identified by the Colorado Rare Plant Conservation Initiative (RPCI) includes nearly all of the known occurrences of round-leaf four-o'clock, golden blazing star, and Pueblo goldenweed (and several occurrences of the Brandegee wild buckwheat). A Priority Action Area is an area needing immediate conservation action to prevent the need for listing, extinction, or further losses of imperiled plant species. Selection was based on the level of imperilment of rare plant species, quality of the occurrences, urgency of the management and protection actions, and other opportunities such as funding and land ownership patterns. These areas are based on the Potential Conservation Areas identified by the Colorado Natural Heritage Program, at Colorado State University, with input by the RPCI and the Rare Plant Technical Committee (RPTC).

Located in Pueblo, Fremont, El Paso and Custer counties, the Arkansas Valley Barrens Priority Action Area includes nearly all known occurrences of the globally imperiled plant species: round-leaf four-o'clock, golden blazing star, and Pueblo goldenweed, as well as selected occurrences of the Brandegee wild buckwheat. Occurrence information was updated by Jill Handwerk (Colorado Natural Heritage Program) in June 2011.

II. Vision and Goals for the Arkansas Valley Barrens

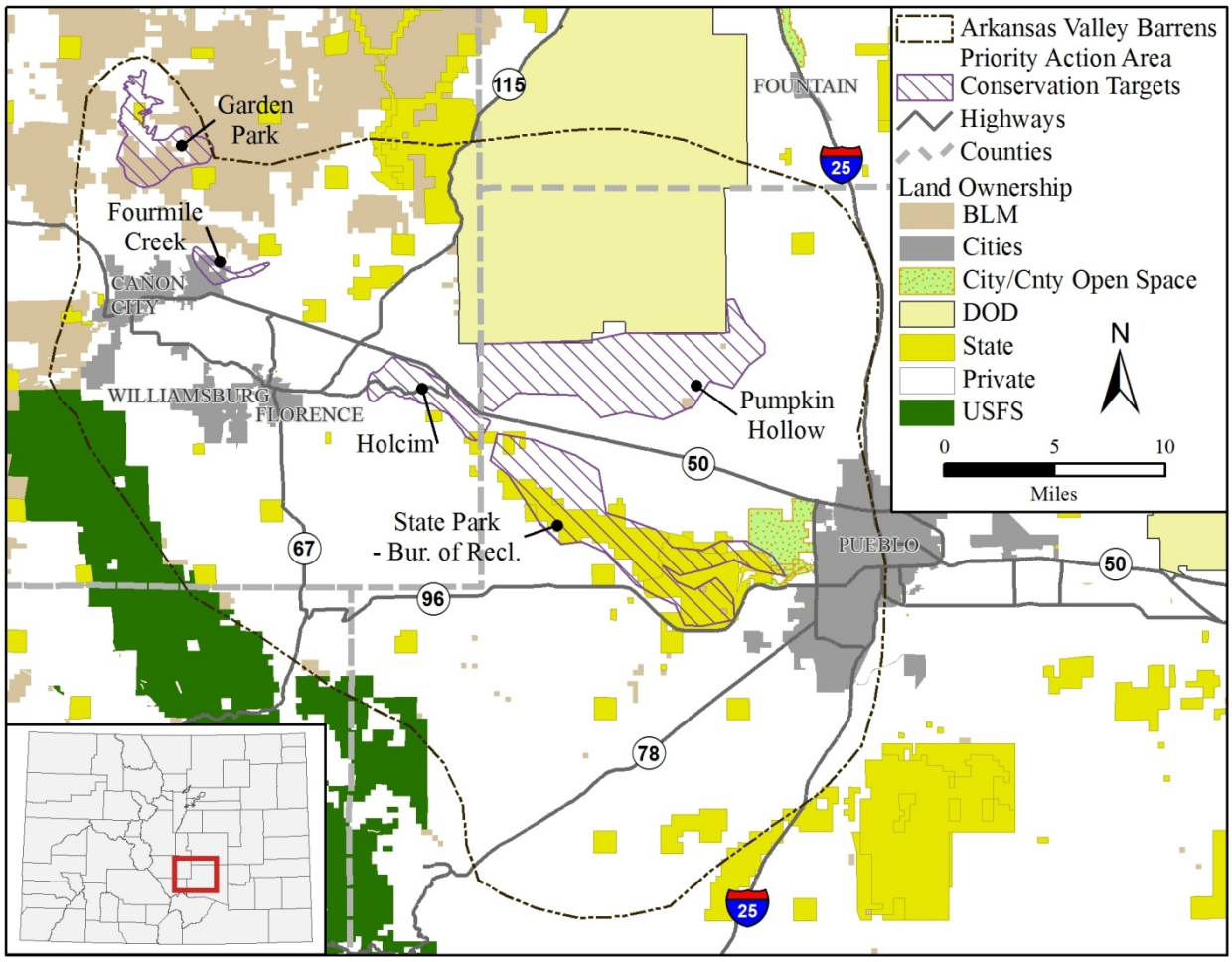
Vision:

1. To protect/manage one of the most threatened shale barren ecological ecosystems in Colorado, including a rich assemblage of rare and globally imperiled plant species, high-quality plant communities, and associated ecological processes.
2. A coalition of partners work together to ensure the long-term survival and stewardship of the imperiled species and their shale barren habitats.

Ecological Goals:

1. Maintain the viability of all viable occurrences of the imperiled plants (ranked A-B) and develop management plans to increase viability of C-D ranked occurrences.
2. Maintain/restore a mosaic of high-quality plant communities (ranked A-B) within the shale barren ecosystem.

III. Map



IV. Arkansas Valley Barrens Priority Action Area and Associated Rare Plants

This document focuses on rare plants within the Arkansas Valley Barrens Priority Action Area as identified by the Colorado Rare Plant Conservation Initiative (RPCI). A Priority Action Area is an area needing immediate conservation action to prevent the need for listing, extinction, or further losses of imperiled plant species. Selection was based on the level of imperilment of rare plant species, quality of the occurrences, urgency of the management and protection actions, and other opportunities such as funding and land ownership patterns. Priority Action Areas are based on the Potential Conservation Areas identified by the Colorado Natural Heritage Program, at Colorado State University, with input by the RPCI and the Rare Plant Technical Committee (RPTC).

Located in primarily in Pueblo and Fremont counties and including small portions of Custer and El Paso counties, the Arkansas Valley Barrens Action Area includes nearly all known occurrences of round-leaf four-o'clock (*Oxybaphus rotundifolius*, G2) golden blazing star (*Nuttallia chrysantha*, G2), and Pueblo goldenweed (*Oonopsis puebloensis*, G2), as well as

selected occurrences of the Brandegee wild buckwheat (*Eriogonum brandegeei*) (Table 1). The area also supports numerous other important rare plants that are beyond the scope of this workshop (Table 1) as well as other important species and plant communities (Attachment 1). This area occurs at the southwest edge of the Peak to Prairie Priority Landscape identified by the Colorado Conservation Partnership (http://www.keepitcolorado.org/).

The site is characterized by barrens and breaks of Late Cretaceous shale, limestone, and chalk that formed in the ancient alluvial terraces of the Arkansas River and its tributaries. The modern river course has cut a deep canyon through the sedimentary bedrock that drops off in steep slopes adjacent to the river. Late Cretaceous sedimentary layers are a composite of Carlile shale, Greenhorn limestone, and Graneros shale as well as extensive swaths of Niobrara Formation. The barrens habitat that hosts the rare plants typically has low vegetative cover (10-20%). The surface of the shale barrens generally consists of small, platy rock fragments over a shallow, fine-textured soil matrix. Soils are calcareous and moderately to strongly alkaline.

The shale breaks support a mosaic of plant communities with the unifying feature of a sparse herbaceous layer characterized by low cushion plants like woollycup buckwheat (*Eriogonum lachnogynum*), nailwort (*Paronychia jamesii, P. sessilifolia*), stemless four-nerve daisy (*Tetraneuris acaulis*), bladderpods (*Lesquerella* spp.), and Arkansas River fever few (*Parthenium tetraneuris*). The breaks vegetation mosaic includes pinon - juniper woodlands (*Pinus edulis* and *Juniperus monosperma*) and shrublands with Bigelow sagebrush (*Artemisia bigelovii*) and/or James' frankenia (*Frankenia jamesii*) as well as herbaceous-dominated patches.

The surrounding landscape is a mix of pinon - juniper savanna interspersed with grasslands. The site contains extensive stands of juniper and pinon - juniper savannas with New Mexico feathergrass (*Hesperostipa neomexicana*), side oats grama (*Bouteloua curtipendula*), and ring muhly (*Muhlenbergia torreyi*). Grasslands are dominated by galleta grass (*Pleuraphis jamesii*) and blue grama (*Bouteloua gracilis*). Scattered shrubs include cholla cactus (*Cylindropuntia imbricata*), fourwing saltbush (*Atriplex canescens*), and winterfat (*Krascheninnikovia lanata*). The portions of the site north of Highway 50 are generally less dissected by development and roads than the portions along the Arkansas River. North of Highway 50, e.g., in the Beaver Creek area, taller grasses occur, including New Mexico feathergrass. The Arkansas River runs through the site, and supports riparian vegetation dominated by cottonwood (*Populus deltoides*) degraded with invasive non-native plants including tamarisk (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*).

About 70% of the site is privately owned and about 25% is part of the Fort Carson Military Reservation; the remainder is a mixture of State and BLM lands. Included within the boundary is the Pueblo State Wildlife Area and Lake Pueblo State Park managed by the Colorado Division of Wildlife and Colorado State Parks.

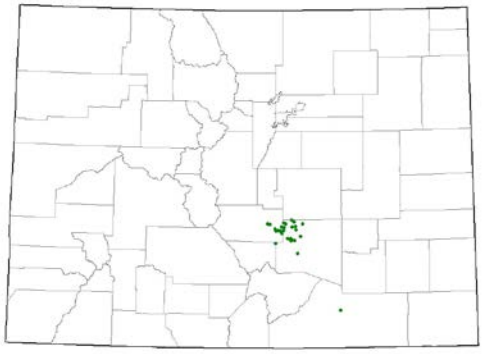
Table 1. Globally imperiled plants known from the Arkansas Valley Barrens (AVB) Priority Action Area.

Common name	Scientific name	Known occurrences	Global rank*	Status	CNHP Rare Plant Field Guide Link
Focus of the workshop and this document					
Golden blazing star	*Nuttallia chrysantha*	26 in the world, 24 of which are in the AVB area.	G2	Forest Service/ Bureau of Land Mgmt. Sensitive	http://www.cnhp.colostate.edu/rareplants/PDLOA03080.html
Pueblo goldenweed	*Oonopsis puebloensis*	28 in the world, 26 of which are in the AVB area.	G2	[none]	http://www.cnhp.colostate.edu/rareplants/PDASTDQ050.html
Round-leaf four-o'clock	*Oxybaphus rotundifolius*	38 in the world, 36 of which are in the AVB area.	G2	[none]	http://www.cnhp.colostate.edu/rareplants/PDNYC0A140.html
Brandegee wild buckwheat	*Eriogonum brandegeei*	6 in the world, 2 of which are in the AVB area.	G1G2	BLM	http://www.cnhp.colostate.edu/rareplants/PDPGN080U0.html
Other important rare plants – focus of future efforts					
Arkansas Valley evening primrose	*Oenothera harringtonii*	62 in the world, 21 of which are in the AVB area	G3	[none]	http://www.cnhp.colostate.edu/rareplants/PDONA0C1U0.html
Barneby's fever-few	*Bolophyta tetraneuris*	34 in the world, 29 of which are in the AVB area.	G3	[none]	http://www.cnhp.colostate.edu/rareplants/PDAST6V090.html
Dwarf milkweed	*Asclepias uncialis*	38 in Colorado, 6 of which are in the AVB area	G3G4 T2T3 (treated as G2)	Forest Service/ Bureau of Land Mgmt. Sensitive	http://www.cnhp.colostate.edu/rareplants/PDASC02220.html
Fendler's townsend-daisy	*Townsendia fendleri*	<5 in Colorado, 3 of which are in the AVB area.	G2	[none]	Not included in guide
Rocky Mountain bladderpod	*Lesquerella calcicola*	36 in the world, 16 of which are in the AVB area.	G3	[none]	Not included in guide

*G1 = critically imperiled. G2 = imperiled. G3=vulnerable. For more detail on global ranks please visit the Colorado Natural Heritage Program's website at http://www.cnhp.colostate.edu/heritage.html.

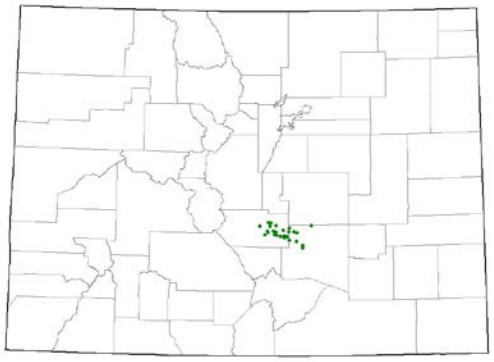
Round-leaf four-o'clock, known only from Las Animas, Fremont, and Pueblo counties in southeastern Colorado and no place else in the world, is a showy member of the Nyctaginaceae (Four-O'Clock) family. Plants stand about 2-3 dm tall and support bright magenta flowers with 1 cm long petals and five exerted stamens. The flowers open before dawn, and generally close by mid-morning. This species is found on barren chalk outcrops of the Smoky Hill Member of the Niobrara Formation in sparse shrublands or woodlands.

Round-leaf four o'clock © Peter Gordon



Golden blazing star is a yellow-flowered member of the Loasaceae (Stickleaf) family known from only about 30 locations in the world and is limited to Fremont and Pueblo counties, Colorado. The plants stand about 20-75 cm tall and support bright yellow flowers with 10 petals, 15-20 mm long. The flowers of golden blazing star open at about 6 pm and remain open until about 9 pm. Golden blazing star is found on barren slopes in soils derived from limestone, shale, or clay.

Golden blazing star © Betsy Neely

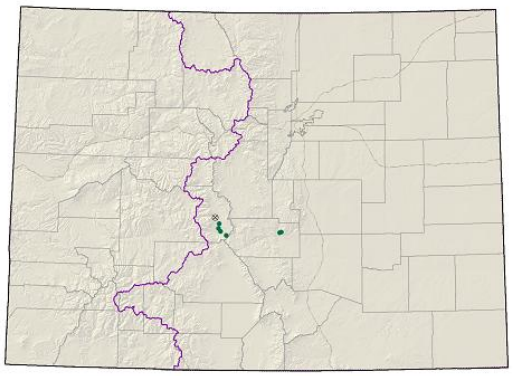


Pueblo goldenweed is a yellow-flowered member of the Asteraceae (Sunflower) family. Pueblo goldenweed is only known from a limited distribution in El Paso, Fremont and Pueblo counties in Colorado, and no place else in the world. The plants stand about 15-30 cm tall and support an inflorescence of bright yellow ray and disk flowers. Pueblo goldenweed is found in barren shale outcrops in sparse shrublands or pinyon-juniper woodlands, in soils derived from the Smoky Hill Member of the Niobrara Formation. This species was discovered in 1982, and is still awaiting formal publication by Greg Brown, University of Wyoming.

Pueblo goldenweed © Susan Spackman Panjabi

Brandegee wild buckwheat is a mat-forming perennial herb from the Polygonaceae (Buckwheat) family. It is known from Fremont and Chaffee counties in Colorado, and nowhere else in the world. This species is found on barren outcrops of white to grayish soils

within open sagebrush and pinyon-juniper communities. Brandegee wild buckwheat is typically 10 to 25 cm tall, and produces leafless, un-branched flowering stalks that bear terminal clusters of white to pink or rose-colored flowers. Its deep, woody taproot, along with its spreading habit, leaves it well adapted to surviving on steep, unstable slopes. Plants have been observed on "pedestals," with much of their woody root exposed. Its leaves are erect and densely hairy on both sides, giving the plant a blue-green appearance.



Brandegee wild buckwheat © *Gina Glenne*

Although the focus of the workshop was on the globally imperiled plants, Attachment 1 includes other significant species and plant communities in this area. A full suite of biodiversity values should be considered during more expansive conservation planning efforts for this area.

V. About the Workshops

Purpose: The purpose of the 2008 workshop was to identify strategies for conserving the round-leaf four-o'clock, golden blazing star, and Pueblo goldenweed, based on an assessment of the viability and threats to their occurrences. In 2010, workshop participants came together to assess progress towards implementation, update threats and strategies, and determine priorities and roles.

Origin: The Colorado Rare Plant Conservation Initiative (RPCI) is a diverse partnership of public and private organizations dedicated to conserving Colorado's natural heritage by improving the protection and stewardship of the state's most important plants. RPCI has developed a statewide strategy for the conservation of Colorado's most imperiled plant species (Neely et al. 2009). As part of this effort, the group is working with partners to identify statewide and site-specific strategies in areas with (a) the most imperiled species, and (b) a reasonable likelihood of conservation success. For site-specific strategies, RCPI partners have identified priority action areas around the state, including the Arkansas Valley Barrens. For each area, The Nature Conservancy and the Colorado Natural Heritage Program hosted workshops in 2008 with local partners to identify priority conservation

strategies and follow-up workshops in 2010 to update strategies and review progress towards implementation.

Workshop dates: The initial workshop was held on June 12, 2008; the follow-up workshop was held on July 14, 2010.

2008 Participants:

Participant	Affiliation
Attended	
Susan Panjabi (co-facilitator)	Colorado Natural Heritage Program
Stephanie Neid	Colorado Natural Heritage Program
Mo Ewing	Colorado Open Lands
Sigrid Meiris	Palmer Land Trust
Steve Spaulding	Palmer Land Trust
Megan Kram (co-facilitator)	The Nature Conservancy
Betsy Neely	The Nature Conservancy
Steve Kettler (RPCI lead for Arkansas Valley Barrens)	U.S. Fish & Wildlife Service

2010 participants:

Participant	Affiliation
Attended	
Rick Bunn	Fort Carson
Gina Glenne	US Fish and Wildlife Service
Jill Handwerk (co-facilitator)	Colorado Natural Heritage Program
Tass Kelso	Colorado College
Brian Kurzel	Colorado Natural Areas Program
Alicia Langton	US Fish and Wildlife Service
Kevin League	Palmer Land Trust
Nathan Meyer	Palmer Land Trust
Betsy Neely (co-facilitator)	The Nature Conservancy
Steve Olson	US Forest Service
Ed Schmal	Colorado Division of Wildlife
Jeff Thompson	Colorado State Parks
Brian Vanden Heuvel	Colorado State University-Pueblo

VI. Workshop Results

A. Conservation Targets

Using The Nature Conservancy's (TNC) site conservation planning workshop methodology, "conservation targets" are a limited suite of species, communities, and/or ecological systems, or specific locations of these elements of biodiversity (e.g., occurrences, sub-occurrences, or other areas) that are the basis for setting goals, identifying conservation strategies, and measuring conservation effectiveness.

At the Arkansas Valley Barrens Priority Action Area our targets are specific locations of the imperiled plants, identified more specifically based on land ownership. We organized the

highest quality known occurrences (ranked A or B by the Colorado Natural Heritage Program) of round-leaf four-o'clock, golden blazing star, and Pueblo goldenweed into six target areas (see Map and Table 2).

Table 2. Total of six target areas based on the highest quality known occurrences of round-leaf four-o'clock, golden blazing star, and Pueblo goldenweed.

Target area (see map for specific locations)	**Landownership**
BLM/Garden Park	▪ BLM, town of Black Hawk, and private
Fort Carson	▪ Department of Defense
Four Mile	▪ Private
Private mining company	▪ Private
Lake Pueblo State Park and Pueblo State Wildlife Area	▪ Bureau of Reclamation, State of Colorado
Pumpkin Hollow	▪ Private

B. Viability

"Viability" per TNC terminology is the "health" or "functionality" of the conservation targets. During the Workshop we attempted to answer two key questions through the viability assessment: *How do we define 'health' (viability) for each of our targets?* and *What is the current status of each of our targets?*

There are four possible viability ranks: A = very good; B = good; C = fair and D = poor. The Arkansas Valley Barrens Priority Action Area has so many A- and B-ranked occurrences that we only focused on these occurrences during the workshop. In other words, we assessed threats and identified strategies only for those target areas containing A- and B-ranked occurrences.

Table 3 shows overall viability of rare plants across target areas. All areas are ranked as "good" or "very good" overall, primarily because we only assessed A- and B-ranked occurrences of the plants with the areas. That being said, it is still useful to recognize that Pumpkin Hollow and the State Park/Bureau of Reclamation areas are the highest ranked target areas across the Arkansas Valley Barrens.

Table 3. Overall viability of rare plants across Target Areas.

Target area name	**Target species known from area**	**Overall viability of target plants at area**	**Other globally rare plants at target area**
Lake Pueblo State Park and Pueblo State Wildlife Area	golden blazing star, Pueblo goldenweed, round-leaf four-o'clock	A = Very Good	dwarf milkweed, Barneby's fever-few, Rocky Mountain bladderpod, Arkansas Valley evening primrose
Pumpkin Hollow	golden blazing star, Pueblo goldenweed, round-leaf four-	A =Very Good	Barneby's fever-few, Arkansas Valley evening

Target area name	Target species known from area	Overall viability of target plants at area	Other globally rare plants at target area
	o'clock		primrose
BLM/Garden Park	golden blazing star, Brandegee wild buckwheat,	B = Good	dwarf milkweed
Fort Carson	golden blazing star, Pueblo goldenweed, round-leaf four-o'clock	B = Good	dwarf milkweed, Barneby's fever-few, Arkansas Valley evening primrose
Four Mile	round-leaf four-o'clock, Pueblo goldenweed	B = Good	dwarf milkweed, Barneby's fever-few, Rocky Mountain bladderpod
Private Mining Company	golden blazing star, Pueblo goldenweed, round-leaf four-o'clock	B = Good	Barneby's fever-few, Rocky Mountain bladderpod, Arkansas Valley evening primrose

The overall viability rankings of A-D for each plant occurrence were based on a systematic assessment of the components of viability, or indicators and associated indicator ratings as shown in the table below. These components of viability are "rolled up" into the overall viability rank (Table 4).

Table 4. Basis for viability ratings for Arkansas Valley Barrens rare plants.

		Indicator rating criteria			
Key Attribute	Indicator	**D** - Poor	**C** - Fair	**B** – Good	**A** - Very Good
Intactness of occurrence and surrounding area	% fragmentation	Highly fragmented	Moderately fragmented	Limited fragmentation	Unfragmented
Population structure & recruitment	Evidence of reproduction	Little or no evidence of successful repro. (few seedlings and/or no flowering or fruiting)	Less productive, but still viable with evidence of flowering and/or fruiting and mixed age classes	Good likelihood of long-term viability as evidenced by flowering, fruiting, and mixed age classes.	Excellent viability as evidenced by high % flowering and fruiting, and mixed age classes
Species composition / dominance	Percent ground cover of invasive species	>50% cover	11-50% cover	1-10% cover	<1% cover

		Indicator rating criteria			
Key Attribute	Indicator	**D** - Poor	**C** - Fair	**B** – Good	**A** - Very Good
Population size & dynamics for the **Brandegee wild buckwheat**	# individuals	<20	10-99	100-500	500+
Population size & dynamics for the **Golden blazing star**	# individuals	<10	10-99	100-500	500+
Population size & dynamics for the **Pueblo goldenweed**	# individuals	<20	20-99	100-500	500+
Population size & dynamics for the **round-leaf four-o'clock**	# individuals	<25	25-99	100-500	500+

C. Threats

With the viability analysis complete, participants then identified the primary threats to each target area. They identified and ranked threats based on their expertise, local knowledge, and sense of the key issues facing each target (Table 5). Identifying and ranking threats is an important input, along with understanding viability, to ultimately identifying efficient and effective strategies.

Although the occurrences we considered appear to be in good to very good condition, the habitat of these imperiled species continues to be threatened by motorized recreation, residential development, mining, and road construction and maintenance.

Table 5. Primary threats to each target area. Red = high threat, orange = medium threat; yellow = low threat.

Target Area	Mechanized training & recreation	Motorized recreation. or training	Altered fire regime	Development - construction	Development - maintenance	Road construction	Road Maintenance	Utility const (SDS, wind, solar)	Utility maintenance	Excessive Livestock grazing	Invasive non-native species	Reservoir Expansion	Mining/ quarrying	Climate change
Garden Park/BLM		Med	Low	Med						Low	Med		Low	Med
Fort Carson	Low	Med	Low			Low	Low	Low	Low		Low		Med	Med
Four Mile Private	Med			High	Med	Med	Med	Med	Med		Med			Med
Private mining company						Med	Med			Med	Low	Low	High	Med
Pumpkin Hollow				Med				Med	Med		Low	Low		Med
State Park – BoR, State Wildlife Area	Med	Low		Low			Med	Med			Low	Low		Med
Private				High		Med		Med	Med		Med		Med	Med

Notes on Threats:

Garden Park Fossil site: Cutleaf vipergrass *(Podospermum laciniatum*), a member of the Asteraceae family, is an aggressive weed that tolerates hostile environments has been detected in this area. Check into forest management; there is some mechanical thinning of pinyon- juniper on BLM and private lands.

All sites: The changing moisture regime is of concern, as the area used to have wet winters and springs, but now winter and spring moisture is highly variable. The rare plants are heat adapted and likely lived through hotter periods, but losing the August monsoonal moisture could be a big problem (Tass Kelso, Colorado College).

State Park: If the reservoir is expanded and the water level is raised, increased weeds could be a problem. Establishment of plants may be difficult in other substrates, plants need low competition, and increased herbivory could result from climate change.

Fort Carson: Motorized training is a medium threat-Fort Carson is studying impacts. Altered fire regime may not be a threat. Will be burning grasses on shale. Road maintenance spraying is localized and likely not an issue. Russian thistle is a low threat. Potential for

small wind farm on shale barrens but this would occupy a small footprint (threat from utilities the same). Non-motorized training is a low threat.

Four Mile Private: Betsy, Megan, and Susan drove by this target area following the 2008 workshop and observed new housing development in close proximity to the boundary. This area supports high-quality barrens but is largely an unknown area – need to check with BLM. Road construction is a medium threat.

Private mining company: Largely unknown as it hasn't been inventoried recently. Need to update information. Horses are more of an issue than cattle. Invasives may or may not be an issue. Need to update status of occurrences.

Pumpkin Hollow: Threats mostly abated due to conservation easements, although temporary easements may not be renewed. Check on status of various short and long-term conservation easements. Add utility construction as medium threat due to SDS that goes through this area (need to verify where the line will go). Check on status of Tri-State transmission line.

State Park: Plants are threatened by potential expansion of Pueblo Reservoir-estimated 20% of the habitat within the park would be impacted or flooded. SDS is a medium threat to *Mentzelia.* Weeds include Russian thistle and other species. Russian thistle and kochia, roadside grasses, *Descurainia,* and other weeds line moving in. Pueblo motor-park (unclear-Susan) but is in the State Park-localized, OEHA, MECH, hikers near campground populations. CNAP monitoring ongoing. Some bike trails but not in concentration areas.

Private: Adjacent to the State Wildlife Area. Development and associated infrastructure threats are high, as there is at least one large tract currently for sale.

Climate change: 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. In Colorado, temperatures have already increased by approximately 2 degrees F between 1977 and 2006 (Ray et al. 2008). Climate models project Colorado will warm by 2.5 degrees F by 2025 and 4 degrees F by 2050 (Ray et al. 2008). There will likely be more frequent and severe droughts and other extreme weather events in the future. Colorado will likely become hotter and drier with shorter snow seasons, earlier snow melt, and longer fire seasons. These potential impacts will likely interact with other stresses to rare plants, e.g., loss or fragmentation of habitat from development, mining, and increase of invasive species. Other concerns include: altered seedling establishment associated with changes in August monsoons and/or herbivory could increase with changes in precipitation. The full impacts of climate change on the Arkansas Valley imperiled plant species are unknown, but it is likely to reduce habitat, which is particularly problematic for rare plants that demand very specific growing conditions, such as the golden blazing star, roundleaf four o'clock, Brandegee wild buckwheat and Pueblo goldenweed.

D. Strategies

Based on an understanding of viability and threats, participants identified strategies (a) across all target areas for the three globally imperiled plants and (b) for specific target areas. After brainstorming strategies, participants prioritized them as high, medium, or low based on their anticipated effectiveness (Table 6). Specific to private land protection efforts, the RPCI is also evaluating opportunities to work with willing private landowners and local land trusts to conserve these species and their habitats using voluntary tools such as conservation easements. An overarching goal is to avoid the need for listing the species on the Endangered Species List.

Although many of the known occurrences of the three plants appear to be in good to very good condition, the habitat of these imperiled species is increasingly being converted for residential development, motorized recreation and road construction and maintenance. In addition, if Pueblo Reservoir were to undergo future expansion, potential habitat and existing plants would be destroyed. Protection and management of habitat on private and public lands would ensure that populations of these species remain viable throughout the Arkansas Valley Barrens and avoid the need for listing under the Endangered Species Act by the US Fish and Wildlife Service. Land protection through conservation easement, purchase/transfer of development rights, or other incentives could be used to support local landowners in their efforts to maintain the existing landscape would benefit the rare plants.

On public lands, appropriate maintenance of transportation right-of-ways and management of recreation would be important contributions to the protection of these plants. The Colorado Department of Transportation is aware of the significance of state highway right-of-ways to these plants, and plans are underway to employ best management practices along state and federal highways in the area. Similar efforts by the County to govern maintenance of local roads would be useful. In addition, careful planning to avoid excessive impacts from hiking, ORV use, fishing and hunting access, and camping at the Pueblo State Wildlife Area and Pueblo State Recreation Area would benefit the rare plants.

Table 6 focuses on future strategies, which should be considered in the context of conservation activities that have already been completed:

1. Private lands activities: The Palmer Land Trust is active in this priority area and is a key conservation leader in the Arkansas Valley Barrens. TNC, FWS and CNHP have met with the Palmer Land Trust to discuss private land conservation priorities. The team identified private lands sites important for rare plant conservation and of these, most are being followed up on. Follow-up ranges widely from initial contacts with private land owners to gauge conservation interest, to more detailed discussion and negotiations on conservation easements and funding options.
2. Working with Ft. Carson: Natural Resources and US Fish and Wildlife Service staff at Ft. Carson have been provided a summary of the status, distribution, and conservation issues related to the rare plants and the GIS locations. Ft. Carson staff provided feedback on the current and future plans for military training and potential impacts. They intend to use the GIS information provided as one of the layers that they overlay

with training plans to avoid and minimize impacts to the rare plants and other natural resources.

3. Contact with private mining company, a major landowner in the area. TNC has been in contact with natural resources and planning staff, held a conference call in 2010, and is planning a meeting and tour in July 2011 to discuss potential collaborative efforts.

Table 6. Prioritized list of strategies for conserving the rare plants within target areas in the Arkansas Valley Barrens.

Threat	Target Area	Owner / Manager	Strategy	Priority	Lead	Notes
Strategies across all Target Areas						
All threats	All	All	Develop materials to show status and trends of populations and share with major landowners, land trusts, counties, cities etc. with statewide insert. Grow rare plants and demo at the native garden at State Park visitor center; upgrade exhibit-need funding (Darcy); media coverage-Mary Porter (native plant master). Invite Linda McMulkin (Pueblo County extension agent) to participate on team to help with outreach efforts (mcmulkin@co.pueblo.co.us)	High	RPCI, CNAP, State Park (Darcy), NPS, County CSU Extension	Include a more comprehensive list of species than only these occurrences. See packet from Colorado Natural Areas Program (B. Kurzel)
Development	All	Private	Rivers Arroyos and Ranchland Project: PLT developing conservation plan with partners using CNHP data, prioritize tracts, pursue conservation easements and other land protection tools, working with local landowners	High	Palmer Land Trust	PLT-planning for area funded by GOCO conservation excellence grant. Build off Peak to Prairie plan. 18 months. Include scenic vistas, ag lands, conservation. Use CNHP data for entire AVB south of Hwy. 50, rivers, arroyos and ranchlands.
All threats	All	All	Conduct inventories and update CNHP data base with recent survey work	Med	CNHP	Rick Bunn to provide data to Jill.
Road maintenance	All	All	Develop and share BMP with stakeholders (CDOT, counties, etc.)	Med	RPCI w/ assistance from CNHP	
Climate	All	All	Monitor plants to assess	Med	CNHP	Report authors felt

Threat	Target Area	Owner / Manager	Strategy	Priority	Lead	Notes
change			status and trends.			that this may be a higher priority than medium.
Road maintenance	All	All	Ensure CDOT, County, and other landowners are aware of issues with maintenance and spraying thru use of placards or other means	Med	RPCI, CNAP, CNHP	Already talking with CDOT. Determine who maintains which roads. Give CDOT and/or County detailed maps and BMPs
Development	All	Private	Pursue conservation easements and other land protection tools, working with land trusts	High	Palmer Land Trust	
Development	All	Private	Encourage the development of city and county open space programs and transfer of development rights (TDR) programs.	Med	Palmer Land Trust	
Lack of knowledge about taxonomic status of plants	All	All	Need genetics studies for MIRO, OOPU, MECH, ERBR, PATE; need to understand relationships with other closely related taxa	High	Tass/Brian	Is PATE distinct from PA alpinum? Ron Hartman thinks they are the same. Determine researchers working on genetics of these species. CNAP has funding. Contact Greg Brown at UWY, Rich Spellenburg (FNA), and Jennifer Barnes or Paul McFarlan.
Strategies for Specific Target Areas						
Development	Ft. Carson	All	Work with DoD to conserve plants on private lands adjacent to DoD (e.g. conservation easements)	Med	TNC/PLT	Include broader list of species rather than "targets"
Mechanized training	Ft. Carson	DoD	Work with DoD to ensure that activities (i.e., mechanized training, spraying) do not impact the rare plants (e.g., special botanical areas).	Med	RPCI	Nat. Resources staff are aware of the plants, and will incorporate into their guidance for training and management plans.
Motorized Recreation	Garden Park	BLM	Work on road obliteration project in 2011 to help make roads disappear (collect native seeds and revegetation of roads). Implement the Travel Management Plan.	Med	CNAP	CNAP worked with BLM to place rocks and a sign to prevent motorbikes from damaging the plant habitat.
Development	Garden Park	Private	Protect plants (Blazing Star #10) on private parcels	High	Palmer Land Trust	PLT working on this now.

Threat	Target Area	Owner / Manager	Strategy	Priority	Lead	Notes
			adjacent to BLM through conservation easements or other protection tools.			
Mining	Private mining company	All	Ensure that surface disturbance will avoid key occurrences through planning and/or conservation easements. Seek permission to conduct inventories and discuss win-win solutions.	High	TNC	TNC is in contact
Utilities (SDS)	State park, Pumpkin Hollow	State and private	Review EIS for SDS status, monitor, and minimize impacts to plants, determine what/where it will impact within the park. If goes thru MECH occurrences, possibly salvage and replant, get spatial data for pipeline for Jill at CNHP	High	Brian V., SE Chapter of NPS-EIS review, Brian coordinate construction response	250 and 500 ft construction buffer? BK found MECH north of reservoir

VII. Next Steps

1. The leads for all high- and medium-ranked strategies (Table 6) are responsible for ensuring their implementation.

2. The group proposed to meet annually to gauge progress toward implementing strategies.

3. Need to identify a local leader to be responsible for continuing the implementation of the Arkansas Valley Barrens Priority Action Area.

VIII. References

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Attachment 1. Additional key species and plant communities in the Arkansas Valley Barrens

Although the focus of the workshop was on the globally imperiled plants, other key species and plant communities are known from the Arkansas Valley area as shown in the table below (Colorado Natural Heritage Program, http://www.cnhp.colostate.edu/). Specifically, the table identifies rare species and rare and/or high quality examples of plant communities in the Arkansas Valley area. These and other biodiversity values should be considered for more detailed planning efforts for this area.

Major group	**Scientific name**	**Common name**	**Global rank**	**State rank**
Birds	*Buteo regalis*	Ferruginous Hawk	G4	S3B,S4N
	Charadrius montanus	Mountain Plover	G2	S2B
	Haliaeetus leucocephalus	Bald Eagle	G5	S1B,S3N
	Strix occidentalis lucida	Mexican Spotted Owl	G3T3	S1B,SUN
Fish	*Etheostoma cragini*	Arkansas Darter	G3G4	S2
	Phoxinus erythrogaster	Southern Redbelly Dace	G5	S1
Insects	*Euphilotes rita coloradensis*	Colorado Blue	G3G4T2T3	S2
Mammals	*Conepatus leuconotus*	Common Hog-nosed Skunk	G4	S1
	Cynomys ludovicianus	Black-tailed Prairie Dog	G4	S3
Reptiles	*Aspidoscelis neotesselata*	Triploid Colorado Checkered Whiptail	G2G3	S2
	Elaphe guttata	Corn Snake	G5	S3
Natural Communities	*Artemisia bigelovii / Achnatherum hymenoides* Shrubland	Plains Escarpment Prairies (Limestone Breaks)	G3Q	S3Q
	Carex nebrascensis Herbaceous Vegetation	Wet Meadows	G4	S3
	Frankenia jamesii / Achnatherum hymenoides Shrubland	Foothills Shrubland	GU	SU
	Hesperostipa comata Colorado Front Range Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G1G2	S1S2
	Hesperostipa neomexicana Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G3	S3
	Populus angustifolia - Juniperus scopulorum Woodland	Montane Riparian Forest	G2G3	S2S3
	Populus angustifolia / Alnus incana Woodland	Montane Riparian Forest	G3	S3
	Populus angustifolia / Betula occidentalis	Montane Riparian Forest	G3	S2

Major group	Scientific name	Common name	Global rank	State rank
	Woodland			
	Populus tremuloides / Alnus incana Forest	Montane Riparian Forests	G3	S3
	Pseudotsuga menziesii / Betula occidentalis Woodland	Montane Riparian Forest	G3?	S3
	Sarcobatus vermiculatus / Distichlis spicata Shrubland	Saline Bottomland Shrublands	G4	S2
	Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation	Great Plains Marsh	G4	S2S3
Vascular Plants	*Aquilegia chrysantha* var. *rydbergii*	golden columbine	G4T1Q	S1
	Pellaea wrightiana	Wright's cliff-brake	G5	S2
	Penstemon degeneri	Degener beardtongue	G2	S2
	Sarcostemma crispum	twinevine	G4G5	S1

For more information about these and other biodiversity values, see reports including but not limited to the following:

- Colorado Wildlife Action Plan http://wildlife.state.co.us/WildlifeSpecies/ColoradoWildlifeActionPlan/
- The Nature Conservancy Ecoregional Assessments. http://conserveonline.org/workspaces/cbdgateway/era/reports/index_html The Central Shortgrass Prairie Ecoregional Assessment describes the ecological significance of the 518,000 acre Arkansas Valley Conservation Area (Appendix O: page 24).