

RECOVERY OUTLINE

Parachute beardtongue (*Penstemon debilis*)

Western Colorado Ecological Services Field Office
January 2013



Photo by Van K. Graham, WestWater Engineering Inc.



Photo by E. Mayo, U.S. Fish and Wildlife Service

I INTRODUCTION

This document provides an overview of the known information for Parachute beardtongue (*Penstemon debilis*) and serves to guide recovery efforts and inform consultation and permitting activities until a comprehensive recovery plan for the species is approved. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (Service). Formal public participation will be invited upon the release of the draft recovery plan.

LISTING AND CONTACT INFORMATION:

Scientific Name:	<i>Penstemon debilis</i>
Common Name:	Parachute beardtongue
Listing Classification:	Threatened rangewide
Proposed rule to list:	June 23, 2010 (75 FR35721)
Effective Listing Date:	August 26, 2011 (76 FR 45054)
Proposed Designation of Critical Habitat:	July 27, 2011 (76 FR 45078)
Final Designation of Critical Habitat:	August 13, 2012 (77 FR 48368)
Effective Critical Habitat Date:	September 12, 2012 (77 FR 48368)
Lead Agency, Region:	U.S. Fish and Wildlife Service, Region 6
Lead Field Office:	Western Colorado Field Office
Contact Biologists:	Ellen Mayo, (970) 243-2778; Ellen_Mayo@fws.gov Gina Glenne, (970) 243-2778; Gina_Glenne@fws.gov

II. RECOVERY STATUS ASSESSMENT

A. BIOLOGICAL ASSESSMENT

Taxonomy

Parachute beardtongue is a rare plant, endemic to oil shale outcrops on the Roan Plateau escarpment in Garfield County, Colorado. Traditionally, the genus *Penstemon* was included in the Scrophulariaceae (figwort) family. However, *Penstemon* is now considered to be within the Plantaginaceae (plantain) family due to recent research using DNA sequences (Oxelman *et al.* 2005, p. 415).

Genetic studies

A genetic study indicates that the extant populations of Parachute beardtongue represent relatively recent fragments of a historically larger and essentially continuous population across the steep slopes of the Parachute Creek Member of the Green River Formation (Wolfe *et al.* 2012, p. 14).

Description, Habitat, and Life History:

Parachute beardtongue is a mat-forming perennial herb with thick, succulent, bluish leaves, each about 0.8 inches. (2 centimeters) long and 0.4 in.inch (1 cm) wide. The funnel-shaped flowers are white to pale lavender, and bloom during June and July. Plants produce shoots that run along underground, forming what appear as new plants at short distances away. Individual Parachute beardtongue plants are able to survive on the steep, unstable, shale slopes by responding with stem elongation as leaves are buried by the shifting talus. Buried stems progressively elongate down slope from the initial point of rooting to a surface sufficiently stable to allow the development of a tuft of leaves and flowers (O’Kane and Anderson 1987, pp. 414–415).

Parachute beardtongue plants produce a small number of seeds that are dispersed by gravity. They require cross-pollination, and have many different pollinators that vary between occurrences (McMullen 1998, p. 26). None of the pollinators are specialists to Parachute beardtongue, nor are any of them rare (McMullen 1998, p. 31). The presence of mat penstemon (*Penstemon caespitosus*) is important for support of pollinators and connectivity between sites (77FR 48368).

Parachute beardtongue is found on the southern escarpment of the Roan Plateau above the Colorado River and the town of Parachute, Colorado. It grows on steep, continually shifting surface layers of broken shale rubble, along with sparse (less than 10 percent cover) vegetation of other oil shale-specific plants (McMullen 1998, p. 5). Known populations occur from 5,600 to 9,250 feet (1,700 to 2,820 meters) in elevation (Service 2011a, p. 3) on the Parachute Creek Member and Lower Part of the Green River geologic formations. The Service has identified a suitable elevation range from 5,250 to 9,600 ft. (1,600 to 2,920 m) that allows for pollinator habitat and changing climate (77 FR 48368).

Distribution, Abundance, and Trends

All of the currently known occurrences occupy about 91.8 ac (37.2 ha) in Garfield County, Colorado. The total area of the species’ *occupied* range is about 2 mi (3 km) wide and 17 miles (27 kilometers) long. Six occurrences of Parachute beardtongue were found between 1986 and 2005. Two of them are no longer considered viable because they are disjunct and they have only 2 and 3 plants each. (CNHP 2010a, pp. 9–23). A new Smith Gulch location on Federal Bureau of Land Management (BLM) land has been added to the Mt. Callahan Saddle occurrence because it is on shale deposited at the base of the cliffs directly below the saddle (Graham 2009, pp. 1-2).

It is likely that unknown occurrences exist, because many areas are inaccessible to surveyors due to cliff-side terrain or private land ownership or both. The Service has mapped a total of 16,862 acres (6,824 hectares) of *suitable* habitat [including occupied], 68 percent on private lands and 32 percent on BLM lands, with a spotty distribution measuring roughly 39 mi (63 km) east to west and 17 mi (28 km) from north to south (77 FR 48392).

Table 1. Parachute beardtongue occurrences by land ownership (acres (ac) (hectares (ha)) (CNHP 2010a, pp. 9-23; Ewing 2008a; Ewing 2009a; DeYoung 2008a, pers. comm.; DeYoung 2009b, pers. comm.; DeYoung 2009c, pers. comm.; Service 2011a, p. 4).

Occurrence	Viability	# of Plants	ac (ha)	Total Plant Mortality*	Trend	Land Ownership
Mt. Callahan Natural Area	Excellent	2,200	32.7 (13.2)	None	Stable to slightly downward	Oxy USA
Mt. Callahan Saddle Natural Area; Smith Gulch	Good	650	3.8 (1.5)	None	Stable to slightly downward	Oxy USA
	Fair	50	13.4 (5.4)	Unknown		BLM
Anvil Points Mine	Good	700	5.3 (2.1)	20	Small downward	BLM
Anvil Points Rim	Poor	2	5.7 (2.3)	250	Nearly extirpated	BLM
Mt. Logan Mine and Natural Area	Fair	483 Private	24.7 (10.1) Private	30	Small downward	OOSI**
		50 BLM	5.8 (2.3) BLM			BLM
Mt. Logan Road	Poor	3	0.4 (0.2)	7	Nearly extirpated	BLM
Total		4,138	91.8 (37.1)	307		

*Total of all dead plants reported from all sources

**Occidental Oil Shale Inc.

Approximately 19 percent of the known occupied habitat and 18 percent of the plants are on federally managed BLM land that has been disturbed by mining, roads and road maintenance. Forty percent of occupied habitat and 69 percent of the plants are on Oxy USA WTP LP. (Oxy) property under a State of Colorado Natural Area (CNA) Agreement, where the plants are minimally disturbed.. Twenty-seven percent of occupied habitat and 11 percent of the plants are on Occidental Oil Shale Inc. a separate division) property where mining, roads, and mine reclamation have disturbed the habitat and eliminated plants. In 2012, Occidental Oil Shale Inc. entered into a CNA conservation agreement for this property in exchange for exclusion from critical habitat designation (77 FR 48392, 48397).

Critical Habitat

Critical habitat represents the habitat necessary for the species' recovery. The physical and biological features essential to the conservation of Parachute beardtongue include the Rocky Mountain Cliff and Canyon plant community (NatureServe 2004, spatial data) with less than 10 percent plant cover, suitable elevational ranges of 6,318 to 9,288 ft (1,926 to 2,831 m), outcrops of the Parachute Creek Member of the Green River Formation, suitable pollinators and habitat for these pollinators, steep slopes of these soil

outcrops that provide the appropriate natural disturbance levels, and a climate with 12 to 18 in (30 to 46 cm) in annual rainfall and winter snow (76 FR 45084-85).

On August 13, 2012, four units of critical habitat including about 15,510 ac (6,217 ha) were designated for Parachute beardtongue (77 FR 48368). Two of these units include potential habitat that has not been surveyed for plants, to provide more potential habitat for future recovery and introduction efforts on federal lands (77 FR 48387). No Oxy or Occidental Oil Shale Inc. lands are included in critical habitat. The three Oxy occurrences are also necessary for the species recovery, but they are excluded from critical habitat because they are being managed as Colorado Natural Areas with conservation agreements to protect Parachute beardtongue and its habitat (77 FR 48385).

B. VULNERABILITY AND THREATS ASSESSMENT

Parachute beardtongue is classified by the Colorado Natural Heritage Program (CNHP) as a G1 and S1 species, which means it is considered critically imperiled across its entire range and within the State of Colorado (CNHP 2010b, pp. 6-10).

Extremely low numbers and a highly restricted geographic range make Parachute beardtongue particularly susceptible to becoming endangered in the foreseeable future due to the current threats. Threats to the species and its habitat include oil and gas development, oil shale extraction and mine reclamation, road maintenance, and vehicle access through occurrences, as described in the final rule (76 FR 45054).

Oil and gas development

Natural gas wells on Mt. Callahan and the Mt. Callahan Saddle have been developed and managed according to Natural Areas agreements and best management practices, which have been effective in avoiding impacts to the plants and habitat (see II. C.). These 2 natural areas support 40 percent of the occupied habitat and 69 percent of the plants. The Smith Gulch population is not included in the Natural Areas agreement or the designated critical habitat. It has 15 percent of the occupied habitat and about 1 percent of the plants (76 FR 45064)). The persistence of plants in Smith Gulch near a well pad on BLM land is uncertain because the plants are subject to natural erosion within an ephemeral (short-lived) streambed.

Oil shale extraction and mine reclamation

Anvil Points mine and Logan Wash mine were oil shale mines, which are now closed. Logan Wash mine road maintenance and reclamation activities have impacted habitat and destroyed plants on private and BLM land, and some of these activities are ongoing (76 FR 45054, CNAP 2012, p. 3). The extensive disturbance by earth movers at this site may present an opportunity for experimental introduction and translocation of seeds, soil seed banks, seedlings and plants in areas accessible for management and monitoring (Lincoln 2012, pers. comm.).

Vehicle access through occupied habitat

Continuing use of the Anvil Points mine road to access a Garfield County communications facility prevents natural reclamation of the road by young plants on

shifting shale. The road cuts through the middle of this largest population of plants on BLM land.

Climate Change, Drought, and Impacts to the Vegetative Community

Climate change is likely to affect long-term survival of native species, including beardtongue, especially if longer or more frequent droughts occur. However, species' response to climate change are complex and current information does not allow us to draw strong conclusions regarding the effects of climate change on Parachute beardtongue. Critical habitat for this species has been extended 328 ft. (100 m) upward and downward from the known occupied range in an attempt to provide areas where the plant could migrate, given shifting climates (77 FR 48368).

Invasive Species

Invasive weeds are often able to out-compete native species under drought conditions (Everard *et al.* 2010). An invasion of large thistles among the beardtongue plants was observed one year on the bank above the Logan Mine road. We have no data to describe the impacts of invasive plants on Parachute beardtongue.

C. CONSERVATION ASSESSMENT

Natural Areas agreements and best management practices (CNAP 2012)

Oil and gas development, reclamation or other activities on the Natural Areas will be conducted in accordance with best management practices (BMPs) included in the agreement. Termination of the agreements must be preceded by 2 years notice.

These BMPs include specific provisions to minimize impacts to the species, pollinators, and habitat by the following measures:

- Controlled collection of plant materials
- Controlled surface disturbances
- Reclamation and revegetation
- Updated rare plant surveys, monitoring, and reporting
- Noxious and invasive weed management and revegetation
- Pollinator promotion –maintenance of nesting habitat
- Placement of surface facilities
- Fugitive dust control

BLM actions

At Anvil Points mine BLM worked with the Service and contractors to minimize impacts to plants during closure of several mine tunnel openings, transplant unavoidable individuals, and monitor the effects to plants and habitat. One section of the road through plant habitat was ripped up to make it impassable to vehicles. The majority of transplants survived, some marked plants were buried by sliding shale, and the ripped road surface is not being recolonized because too much soil is mixed in with the shale (DeYoung 2012, pers. comm.).

Surveys and monitoring of plants at the Mt. Callahan populations and Anvil Points mine are conducted annually. Surveys at Logan Wash mine may not be complete; monitoring is not yet implemented. The current draft BMPs for Logan Wash may differ from those at Mt. Callahan because reclamation must continue around the mine site.

In 2008, BLM designated the Anvil Points Area of Critical Environmental Concern (ACEC), as an area for management of sensitive resources including Parachute beardtongue (BLM 2008b, p. 4). The objective for the Anvil Points ACEC is to “protect occupied habitat and the immediately adjacent ecosystem processes that support candidate plants.” Oil and gas development is also authorized in the ACECs. Anvil Points ACEC covers the entire Anvil Points Mine occurrence and most of the formerly occupied occurrence area at Anvil Points Rim. At present, no oil and gas development activities are allowed. Implementation of the Resource Management Plan amendment, including development of leases, is dependent on the outcome of litigation. To protect Parachute beardtongue in the ACEC, no surface occupancy (NSO) and no ground disturbance (NGD) stipulations are established for both of the Anvil Points populations (BLM 2007b, p. 26). The term NGD applies to all activities except oil and gas leasing and permitting, while the term NSO applies only to oil and gas leasing and permitting (BLM 2008b, ROD p. 6). The NSO designation prohibits long-term use or occupancy of the land surface for fluid mineral exploration or development to protect identified resource values (BLM 2006, pp. 2–3). This designation means that an area is protected from permanent structures or long-term ground-disturbing activities (i.e., lasting longer than 2 years) (BLM 2006, pp. 2–3). For example, an NSO designation would preclude construction of a well pad (because it would last longer than 2 years) but not a typical pipeline (because it would be revegetated within 2 years) (BLM 2006, pp. 2–3). Also, an NSO does not preclude the extraction of underlying fluid minerals if they can be accessed from outside the area by directional drilling (BLM 2006, pp. 2–3). Directional drilling may not disturb the overlying surface, including Parachute beardtongue habitat. Except for specified situations, individual NSOs may include exceptions so that BLM may allow a ground-disturbing activity if it meets specific, stated criteria (BLM 2006, pp. 2-3). For example, the NSO designation for these occurrences allows the BLM to grant exceptions for short-term ground disturbing activities if a conference with the Service indicates that proposed activity would not impair maintenance or recovery of the species (BLM 2007c, pp. F6-F7). (76 FR 45054).

D. SUMMARY STATEMENT OF RECOVERY NEEDS

A recovery plan is needed for Parachute beardtongue. All plants, occupied habitat, and critical habitat need permanent protection from anthropogenic (human-influenced) disturbances. Primary sources of protection are Colorado Natural Areas agreements and BLM ACEC stipulations. Populations on Natural Areas and ACECs should be monitored for compliance with BMPs and stipulations. Site-specific management plans, survey protocols and monitoring plans should be developed and implemented for all populations. Newly propagated plants should be introduced and monitored on critical habitat as identified on federal lands. Additional suitable habitat should be surveyed.

III. PRELIMINARY RECOVERY STRATEGY

A. RECOVERY PRIORITY NUMBER WITH RATIONALE

The Parachute beardtongue is assigned a recovery priority of 8C based on the following

criteria:

- Distinct species status
- Moderate degree of threat
- High potential for recovery
- Conflict with development activities or other forms of economic activities

The moderate degree of threat is linked to its occurrence within a limited range, which is subject to the ongoing threat of habitat destruction due to energy development and reclamation, and inadequacy of existing regulatory mechanisms. Recovery potential is high because of the potential for protection of known populations on federal and private lands and likelihood of discovery of new populations. Climate change also may be an issue in the species' recovery, but improved projections are needed to better understand this potential threat.

Further information from future studies, including rangewide surveys, long-term demographic and monitoring studies, and experimental reintroduction could influence the recovery priority number. Therefore, this recovery priority number will be reviewed during the upcoming recovery planning process by the Service and as new data are available.

B. RECOVERY VISION

We envision recovery for the Parachute beardtongue to include stable populations of existing and introduced plants maintained on conserved suitable habitat, which includes sufficient pollinator habitat. Populations must be maintained to provide sufficient representation, resiliency, and redundancy to ensure a high probability of survival for the foreseeable future. Meeting these goals requires that threats be sufficiently understood and abated, and that propagation and introduction methods are successful. Rangewide monitoring is necessary to ensure that these needs are fulfilled.

C. INITIAL ACTION PLAN

Recovery needs for Parachute beardtongue include:

- (1) Surveys to locate additional populations.
- (2) Protection and restoration of occupied habitat including pollinator habitat.
- (3) Protection for individual plants and populations from direct and indirect threats.
- (4) Introduction of new populations onto federal lands.
- (5) Permanent conservation easements or the acquisition of land to protect the species on private lands.
- (6) Regulations and/or agreements that balance conservation with energy development in areas that would affect the species and its pollinators on federal lands.
- (7) Protection of additional areas with specific provisions and protections for the plant.
- (8) Elimination or avoidance of activities including monitoring where they alter the morphology and status of the shale slopes.
- (9) Continuation of adequate management for the species through the CNA Agreements with Oxy and ACEC stipulations on BLM lands.
- (10) Avoidance of road construction or maintenance that would impact the plants, habitat, or pollinators.

Specific actions include:

Surveys and Monitoring

- Completion of a comprehensive plant survey on suitable habitat throughout the species' range.
- Continue ongoing trend monitoring efforts and expand monitoring to include areas impacted by reclamation activities and invasive species.

Threats Abatement

- Identify sites in urgent need of habitat protection, set protection priorities, and implement protective measures. Land management agencies should establish formal land management designations and stipulations to provide for long-term protection of important populations and habitat.
- Oil and gas leasing and oil shale extraction activities should avoid occupied, critical, and suitable habitat.
- Closed oil shale mines in plant habitat should remain closed.
- Develop and implement standard conservation recommendations to minimize future project and use impacts on both private and federal lands.
- Coordinate with land management agencies, project proponents, private landowners and other partners early in the planning process to limit direct and indirect impacts of planned activities.
- Continue to implement Colorado Natural Areas agreements and extend best management practices for habitat adjacent to the CNAs to protect pollinators and habitat
- The Garfield County communications site on Anvil Points mine road should be moved out of occupied habitat and the site reclaimed in a manner that will allow recolonization of Parachute beardtongue.

Research

- Continue research into Parachute beardtongue life history and ecology, including pollinators.
- Experiment with propagation techniques, soil (shale) and habitat conditions, and management needed to maximize the success of Parachute beardtongue introduction efforts with seeds, soil seed banks, seedlings, and transplants.
- Study population dynamics and conduct a population viability analysis.
- Encourage investigations that project the species' vulnerability and response to climate change.
- Monitor changes in invasive species prevalence and impacts on Parachute beardtongue; explore approaches to minimize the risk posed by invasives and associated remediation actions.

IV. PREPLANNING DECISIONS

A. PLANNING APPROACH

A recovery plan will be prepared for the Parachute beardtongue pursuant to Section 4(f) of the Act. The recovery plan will include objective, measurable criteria which, when met, will result in a determination that the species be removed from the Federal List of Endangered and Threatened Plants. Recovery criteria will address all threats meaningfully impacting the species. The recovery plan also will estimate the time required and the cost to carry out those measures needed to achieve the goal for recovery and delisting. This plan will be a single-species plan.

Plan preparation will be under the stewardship of the Western Colorado Ecological Services Field Office. At the present time, this species does not warrant the appointment of a recovery team. The Service will coordinate recovery efforts with an informal network of experts and involved parties (see Stakeholder Involvement below). A recovery team may be formally appointed, if deemed necessary. Periodically, meetings among these parties may be convened for the purpose of sharing information and ideas about advancing Parachute beardtongue recovery.

B. INFORMATION MANAGEMENT

General: All information relevant to recovery of Parachute beardtongue will be housed in administrative files in our Western Colorado Ecological Services Field Office in Grand Junction, Colorado. The lead botanist will be responsible for maintaining the official record for the recovery planning and implementation process. Copies of new study findings, survey results, records of meetings, comments received, and other relevant information should be forwarded to this office (see Listing and Contact Information section above).

Reporting Requirements: Information needed for annual accomplishment reports, the Recovery Report to Congress, expenditures reports, and implementation tracking should be forwarded to this office (see Listing and Contact Information section above). Copies of the completed reports can then be disseminated to all contributors upon request.

C. RECOVERY PLAN PRODUCTION SCHEDULE

The following dates are dependent on personnel and funding being available to complete the recovery planning process:

- Internal review draft: December 2013
- Public review draft: April 2014
- Public comment period ends: July 2014
- Final plan: January 2015

D. STAKEHOLDER INVOLVEMENT IN THE RECOVERY PROCESS

Possible Stakeholders:

- Public land managers with Parachute beardtongue occurrences on their lands, including representatives of BLM (State Office; Grand Junction and Colorado River Valley Field Offices).
- State agencies including the Colorado Natural Areas Program (CNAP)
- The Colorado Natural Heritage Program (CNHP).
- Landowners, including Oxy USA WTP LP and Occidental Oil Shale, Inc., and private owners of designated critical habitat.
- Federal and academic researchers including the Denver Botanic Gardens.
- County officials for Garfield County, Colorado.
- Nongovernmental organizations including the Colorado Rare Plant Conservation Initiative and The Nature Conservancy.

Stakeholder Involvement Strategy:

Early in the recovery planning process, we will hold a meeting of individuals with an interest in Parachute beardtongue to exchange status information and identify recovery issues. The information emanating from this discussion will help shape the initial draft recovery plan. We will reach out to the above potential stakeholder groups to facilitate involvement of all interested parties. When needed, additional meetings or conference calls will be held to discuss particular issues.

Targeted stakeholders will be invited to participate in these calls when relevant for the purposes of recovery planning. We will take advantage of all opportunities to interact with stakeholders in a productive and meaningful way. Stakeholders also may be asked to contribute directly in developing implementation strategies for planned recovery actions.

Parachute beardtongue (*Penstemon debilis*) Recovery Outline

Approve:  _____
Deputy Regional Director, Region 6

Date 1.11.13

References Cited

- Bureau of Land Management. 2006. Roan Plateau Proposed Resource Management Plan Amendment and Final Environmental Impact Statement Volume 1. Colorado River Valley Field Office, Silt, Colorado. 440 pp.
- Bureau of Land Management. 2007b. Record of Decision for the Approval of Portions of the Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement . Colorado River Valley Field Office, Silt, Colorado. 70 pp.
- Bureau of Land Management. 2007c. Record of Decision for the Approval of Portions of the Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement . Colorado River Valley Field Office, Silt, Colorado. Appendix F 38 pp.
- Bureau of Land Management. 2008a. Competitive Oil & Gas Lease Sale Summary of August 14, 2008, Sale. Colorado State Office, Bureau of Land Management, Lakewood, CO. 4 pp.
- Bureau of Land Management. 2008b. Record of Decision for the Designation of Areas of Critical Environmental Concern for the Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement. Colorado River Valley Field Office, Silt, Colorado. 33 pp.
- Colorado Natural Areas Program and Oxy USA. 2012. Draft Mount Callahan Natural Area, Mount Callahan Saddle Natural Area and Logan Wash Mine Natural Area Articles of designation, Exhibit E. 7pp.
- Colorado Natural Heritage Program. 2010a. *Penstemon debilis* Element Global Rank Report 44168. Fort Collins, CO. 5 pp.
- Colorado Natural Heritage Program. 2010b. *Penstemon debilis* Element Occurrence Reports, and summary spreadsheet (created by U.S. Fish and Wildlife Service). Fort Collins, CO. 4 pp.
- DeYoung, C. 2008a. Memo from Carla DeYoung, Ecologist, Bureau of Land Management, Colorado River Valley Field Office (July 16, 2008). 2 pp.
- DeYoung, C. 2009b. Telephone interview Regarding Anvil Points Mine with Carla DeYoung, Ecologist, Bureau of Land Management, Colorado River Valley Field Office (February 26, 2009).
- DeYoung, C. 2009c. Notes from Carla DeYoung, Ecologist, Bureau of Land Management, Colorado River Valley Field Office (June 23, 2009). 1 p.
- Everard, K., E.W. Seabloom, W.S. Harpole, and C. deMazancourt. 2010. Plant water use

- affects competition for nitrogen: why drought favors invasive species in California. *The American Naturalist* 175:85-97.
- Ewing, C. 2008a. Field visit Notes from Collin Ewing, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Grand Junction, Colorado (August 20, 2008). 5 pp.
- Ewing, C. 2009a. Field visit Notes from Collin Ewing, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Grand Junction, Colorado (July 7, 2009). 5 pp.
- Federal Register. 2011. Volume 76, Pages 45054-45075. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Ipomopsis polyantha* (Pagosa skyrocket) and Threatened Status for *Penstemon debilis* (Parachute beardtongue), and *Phacelia submutica* (DeBeque phacelia); Final rule.
- Federal Register. 2011. Volume 77, Pages 45078-45127. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Ipomopsis polyantha* (Pagosa skyrocket), *Penstemon debilis* (Parachute beardtongue), and *Phacelia submutica* (DeBeque phacelia); Proposed Rule
- Federal Register. 2012. Volume 77, Pages 48368-48418. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Ipomopsis polyantha* (Pagosa skyrocket), *Penstemon debilis* (Parachute beardtongue), and *Phacelia submutica* (DeBeque phacelia); Final Rule
- Graham, V.K. 2009. Colorado Natural Heritage Program Plant Element Occurrence Field Form, map and photos. WestWater Engineering. Grand Junction, Colorado (June 1, 2009). 6 pp.
- Lincoln, A. 2012. Telephone interview regarding potential recovery actions at the Logan Wash mine site, with Anna Lincoln, botanist, BLM Grand Junction Office (September 20, 2012)
- McMullen, A.L. 1998. Factors Concerning the Conservation of a Rare Shale Endemic Plant: The Reproductive Ecology and Edaphic Characteristics of *Penstemon debilis* (Scrophulariaceae). Unpublished Master's Thesis Submitted to Utah State University, Logan. 115 pp.
- O'Kane, S.L., Jr., and J.L. Anderson. 1987. *Penstemon debilis* (Scrophulariaceae): a New Species from Colorado Endemic to Oil Shale. *Brittonia* 39(4):412-416.
- Oxelman, B., P. Kornhall, R. G. Olmstead, B. Bremer. 2005. Further Disintegration of Scrophulariaceae. - *Taxon* 54 (2): 411 - 425.
- U.S. Fish and Wildlife Service (Service). 2011a. Occupied, critical habitat, and threat areas for *Ipomopsis polyantha*, *Penstemon debilis*, and *Phacelia submutica* with ownership. 13 pp.
- U.S. Fish and Wildlife Service (Service). 2011c. Physical features for *Ipomopsis polyantha*, *Penstemon debilis*, and *Phacelia submutica*. 3 pp.

Wolfe, A. D., A. McMullen-Sibul, V. J. Tepedino, L. Kubatko, T. NeCamp, and S. Fassnacht. 2012. Conservation genetics and breeding system of *Penstemon debilis* (Plantaginaceae), a rare beardtongue endemic to oil shale talus in western Colorado, USA; submitted to American Journal of Botany.