From:	Charles_Sharp@fws.gov
To:	Patty_Gelatt@fws.gov
Cc:	Gina_Glenne@fws.gov
Subject:	Re: Grazing PBO w/ edits
Date:	Monday, October 01, 2012 8:41:34 AM
Attachments:	Compare_Sept2012draft_and_EditedVersion.docx

Sure, here's a Compare file that shows edits made to the Sept. 2012 draft. Note that the Compare file shows some formatting quirks that aren't present in the actual edited version, however.

I could compare edits to your and Gina's comments merged, but I think it'll get pretty messy and confusing.

(See attached file: Compare_Sept2012draft_and_EditedVersion.docx)

Charlie Sharp
Fish and Wildlife Biologist
U.S. Fish & Wildlife Service, Ecological Services
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(970) 243-2778 x18
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Patty Gelatt/R6/FWS/DOI

Patty Gelatt/R6/FWS/DOI 09/28/2012 08:00 AM	To Charles Sharp/R6/FWS/DOI@FWS cc Gina Glenne/R6/FWS/DOI@FWS Subject Re: Grazing PBO w/ edits

Charlie -

Can you provide a version that shows your changes? Let's discuss this Tuesday morning.

Thanks.

Patty
****
Patty Schrader Gelatt
Western Colorado Supervisor
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Charles Sharp/R6/FWS/DOI

Charles Sharp/R6/FWS/DOI	ToPatty Gelatt/R6/FWS/DOI@FWS, Gina Glenne/R6/FWS/DOI@FWS
09/27/2012 04:31 PM	cc SubjectGrazing PBO w/ edits

and a couple random notes:

- Gina, I agree w/ MOST of your comments/ questions; however, many of these were highlighted early on in the Draft BA, and thereafter, but never resolved/ answered due to BLM's reticence; not sure we can belabor it further
- I really overhauled the BA copy and paste sections, wordsmithing for several days; hopefully it's at a point deemed acceptable although I agree that its repetitive, kinda wonky, not very direct or clear, etc.; but you should have seen it before...
- I deleted language regarding BLM's (unbiased) opinions (i.e., "this is a problem with historic grazing, and current grazing is awesome compared to the old days"); obviously, these were areas where I disagreed w/ statements/ conclusions, and it showed
- We're kind of stuck between a rock and a hard place, given that we believe the conservation measures are insufficient, but must find no jeopardy
- waiting for RMPs, I think and agree, would be hugely beneficial; not sure BLM will bite though
- Gina, in response to your very last comment, see my notes in red

Have a good weekend.

[attachment "BLM_WesternColoradoGrazing_PBO_draft_Sept2012_withEdits.docx" deleted by Patty Gelatt/R6/FWS/DOI]

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IN REPLY REFER TO:
ES/GJ-6-CO-12-F-006
TAILS 06E24100-2012-F-0020

September 26, 2012

Memorandum

To: Northwest District Manager, Bureau of Land Management, Grand Junction, Colorado

From: Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Biological Opinion for Livestock Grazing Program Effects on Three Listed Plants in the Bureau of Land Management Grand Junction, Colorado River Valley, and Uncompahgre Field Offices

In accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this document transmits the Fish and Wildlife Service's (Service) biological opinion (BO) for impacts to three federally listed plant species resulting from livestock grazing programs in the Bureau of Land Management (BLM) Grand Junction (GJFO), Colorado River Valley (CRVFO), and Uncompahgre Field Offices (UFO). The Service received your request for formal Endangered Species Act (ESA), section 7 consultation on May 16, 2012.

This BO is based on information provided in the May 16, 2012, Biological Assessment (BA); various discussions between our staffs; field visits; and other resources. A complete administrative record of this consultation is on file at this office.

SPECIES ADDRESSED

The BLM determined that grazing programs in the three Field Offices may affect, are likely to adversely affect the federally threatened Colorado hookless cactus (*Sclerocactus glaucus*), endangered clay-loving wild buckwheat (*Eriogonum pelinophilum*) and its critical habitat, and threatened DeBeque phacelia (*Phacelia submutica*) and its designated critical habitat.

The BA did not evaluate the effects of the BLM's livestock grazing program, operations, or trailing on other federally listed or proposed species; therefore, this consultation only addresses the three listed plants ~~above~~. Currently, federally listed and proposed species across the three Field Offices potentially affected by ongoing and future grazing programs and activities include the bonytail chub (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), Colorado pikeminnow (*Ptychocheilus lucius*), ~~greenback cutthroat trout (*Oncorhynchus clarki stomias*),~~ black-footed ferret (*Mustela nigripes*), Canada lynx (*Lynx canadensis*),

Uncompahgre fritillary butterfly (*Boloria acrocnema*), Gunnison sage-grouse (*Centrocercus minimus*), Mexican spotted owl (*Strix occidentalis lucida*), Southwestern willow flycatcher (*Empidonax traillii extimus*), Ute ladies'-tresses (*Spiranthes diluvialis*), and Parachute beardtongue (*Penstemon debilis*). The BLM will address effects on these species from livestock grazing programs, operations, and trailing, under separate section 7 ~~consultation.~~consultations.

Federal candidate species potentially affected by ongoing and future grazing programs and activities include Gunnison's prairie dog (*Cynomys gunnisoni*), greater sage-grouse (*Centrocercus urophasianus*), yellow-billed cuckoo (*Coccyzus americanus*), and North American wolverine (*Gulo gulo luscus*). Federal candidates for listing as threatened or endangered have no legal protection under the ESA of 1973, as amended, although it is within the spirit of the ESA to consider project impacts to these species. While section 7 consultation is not required for these species, we encourage the BLM to consider and implement appropriate measures to advance the conservation of these species.

Spring developments, stock ponds, and other water developments associated with the BLM's livestock grazing program result in water depletions to the Upper Colorado River Basin. The Service has determined that water depletions adversely affect the Colorado River endangered fish, including the bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*), and their critical habitats. In accordance with the Service's *Programmatic Biological Opinion (PBO) for Water Depletions Associated with BLM Projects (Excluding Fluid Mineral Development) Within the Upper Colorado River Basin in Colorado* (# ES/GJ-6-CO-08-F-0010; TAILS 65413-2009-F-0042), specified conservation measures therein will be implemented, and water depletion amounts will be tracked and reported annually. Only water depletions impacts are addressed under the above PBO; any other direct or indirect effects on Colorado River endangered fishes (e.g., water quality impacts), or other listed or proposed species, associated with livestock water developments would be addressed under separate section 7 consultation. All other water depletions not meeting the requirements and conditions of the PBO, or the Service's *de minimis* water depletion policy, will require separate section 7 consultation.

The remainder of this BO addresses livestock grazing effects on Colorado hookless cactus, clay-loving wild buckwheat and its critical habitat, and DeBeque phacelia and its critical habitat.

CONSULTATION HISTORY

Three previous consultations occurred between BLM and the Service regarding effects from BLM-authorized grazing on the three listed plants, including a statewide Resource Management Plan (RMP) consultation, the BLM UFO Colona Land Health Assessment (LHA) grazing permit renewal consultation, and the Escalante LHA grazing permit renewal consultation. ~~Dtails~~Details of those consultations are described in the BA for this project. The remainder of this section includes discussions and correspondence specific to the grazing programmatic consultation.

September 26-28, 2011- Email correspondence (Alison Graff, Consultant): The Service discussed using the species' section 7 range models to define the action area for the BA. The Service provided electronic data to assist in this effort.

September 28, 2011- Phone conversation (Collin Ewing, BLM): The BLM and Service discussed the action area.

October 26, 2011- Email correspondence: The Service provided recommendations for defining the action area for the project and BA. We suggested that Service section 7 range models for each species be used to represent the full extent of potential impacts from livestock grazing programs, and to maximize the area covered under the consultation for streamlining purposes. Also, we recommended that the BA address effects on all other listed and proposed species in the action area, per BLM Manual 6840 policy and in furtherance of the purposes of section 7 consultation under the ESA.

October 31, 2011- Phone conversation (Collin Ewing, BLM): The BLM agreed to use the species' section 7 range models to define the action area (Note: Section 7 range models were not used for the analysis, however; see *Action Area* section). The BLM stated that livestock trailing would be analyzed as interrelated activities and that, in the future, they plan to address livestock trailing activities and impacts on a programmatic level across the state. The BLM also indicated that the BA would focus on listed plants only and not evaluate other listed or proposed species.

November 8 and 9, 2011- Email correspondence: Related to including other listed and proposed species in the section 7 consultation, BLM indicated that the BA would focus on just the three listed plants and that future, separate section 7 consultation would occur for other species affected by livestock grazing programs.

January 5, 2012- Email correspondence (Alison Graff, Consultant): We discussed possible effects determinations for the three listed plants, in terms of significant, discountable, and beneficial criteria. Based on the nature of the proposed action, we suggested that adverse effects (formal section 7 consultation) would be the most likely scenario for the three listed plants.

January 9, 2012- Phone conversation (Alison Graff, Consultant): We discussed a conferencing framework for DeBeque phacelia proposed critical habitat, and how to evaluate effects of the action such that a conference opinion could be confirmed once and if the proposed critical habitat was designated. We also discussed the organization and contents of the BA including effects determinations.

January 30, 2012- Phone conversation and email correspondence (Collin Ewing, BLM): We discussed timeframe for review of the Draft BA. BLM agreed that effects for each species would likely be adverse and would be analyzed as such in the BA. A Draft BA was submitted for review by our office.

February 16, 2012- Email correspondence: We provided comments and suggestions to the BLM on the Draft BA. Our comments included, but were not limited to, recommendations for implementing a species inventory and monitoring plan (e.g., a series of treatment-control studies) to guide adaptive management, including limits or thresholds and triggers; expanding the BA

content and specifics for the scope of the proposed action, environmental baseline for affected species, and effects analyses for those species; defining project design criteria related to weed treatments and programmatic consultations covering those activities; and other suggestions.

February 22, 2012- Email correspondence: We requested that the BLM provide us one more opportunity to review the BA prior to submitting a final version. We also recommend that the agencies meet in person to further discuss the BA.

February 23, 2012- Phone conversation (Anna Lincoln, BLM): We discussed some of BLM's concerns related to our February 16, 2012, comments on the Draft BA.

March 28, 2012- Email correspondence: We provided environmental baseline condition information to the consultant for clay-loving wild buckwheat critical habitat.

April 17 and 18, 2012- Phone conversation and email correspondence (Alison Graff, Consultant): The Service discussed and provided recommendations for a conferencing framework for DeBeque phacelia proposed critical habitat.

May 16, 2012- Official correspondence: The Service received the Final BA for the project. The BLM also emailed an electronic version of the Final BA and responses to our February 16, 2012, comments on the Draft BA. The BLM denied the Service's February 22, 2012, request to review the Draft BA again prior to submitting a Final BA. The BLM made minor edits to the BA in response to our comments on the Draft BA.

June 19, 2012- Phone conversation (Ken Holsinger, BLM): BLM called our office to check on the status of the consultation. I replied that we had just begun to review the Final BA and responses to our comments, and indicated that we anticipated needing the full 135-day consultation period in order to develop a BO.

July 9, 2012- Meeting (Collin Ewing, BLM; Anna Lincoln, BLM; Ken Holsinger, BLM): We discussed the need for additional conservation measures in the BA, pursuant to ESA Section 7(a)(1). The BLM cited a lack of funding and resources necessary to commit to monitoring of grazing effects on the listed plants under consideration or establishing triggers under an adaptive management approach. We proposed the concept of a plant conservation strategy and cooperative approach that would advance plant conservation and improve communication between offices. The BLM asked that we outline the components of such a strategy in writing and stated that the proposal would be presented to BLM managers.

July 16, 2012- Email correspondence: Per discussions on the July 9, 2012, meeting, we emailed a Draft Plant Conservation Strategy for BLM's consideration. The strategy included conservation measures such as identifying priority conservation areas for plants, developing a streamlined process for future actions covered under the umbrella of the programmatic consultation, expanding inventory efforts, developing a species' monitoring plan and schedule to

detect grazing effects, implementing an adaptive management approach based on inventory and monitoring data, attending regular coordination meetings, and reporting grazing activities related to the programmatic consultation.

July 25, 2012- Email correspondence (Collin Ewing, BLM): The BLM responded to our July 16, 2012, recommendation to incorporate a plant conservation strategy and conservation measures. The BLM expressed that their primary intent is to ensure that grazing programs are in compliance with ESA Section 7(a)(2) consultation requirements for listed plants. The BLM agreed to establish regular coordination meetings with the Service to review past and pending actions related to the programmatic consultation.

August 13, 2012- Critical habitat was designated for DeBeque phacelia, with an effective date of September 12, 2012 (77 FR 48368).

August 7, 2012- Meeting (BLM specialists and managers): We discussed options for improving conservation measures such as monitoring, adaptive management and triggers, inventory, and future coordination meetings. The Service suggested that the consultation be deferred until the ongoing Field Office RMPs are complete and addressed under section 7 consultation. We felt this would be advantageous to the BLM since important conservation measures (e.g., special area designations, grazing allotment closures, stipulations and standards, etc.) would be adopted, accounted for, and evaluated as part of the species' environmental baselines. The BLM expressed that they did not wish to postpone the consultation. However, they felt they could strengthen certain conservation measures in the BA. Associated with this effort, the Service requested a 30-day extension of the section 7 consultation period.

August 9, 2012- Email correspondence: The Service offered their assistance in developing conservation measures for listed plants, as related to recent discussions. ~~The BLM did not respond to our message.~~

August 22, 2012- Email correspondence (Wayne Werkmeister, BLM): The BLM agreed to our August 7, 2012, request to extend the section 7 consultation period. This extended the consultation period to September 13, 2012, with an additional 45 days to issue a BO, with a due date of October 29, 2012. Also, in response to our August 7, 2012, discussion, the BLM submitted proposed conservation measures to amend the BA. In summary, these included coordinating with the Service; depending on resources, inventorying for listed and other rare plants across the three species' ranges; providing the Service with ongoing trend monitoring data; cooperating to develop a monitoring strategy; and reporting conservation actions and adaptive management on an annual basis.

September 5, 2012- Email correspondence: We suggested edits and additions to BLM's August 22, 2012, conservation measures list. Specifically, we emphasized the need for a plant conservation strategy, thresholds and triggers to guide adaptive management, identification of problem areas and priority areas for conservation for plants, quantitative studies of the effects of livestock grazing on listed plants (in addition to trend monitoring), reporting BLM actions and

decisions covered under the programmatic consultation, and addressing known impacts to listed plants through coordination meetings under the framework of a plant conservation strategy.

September 21, 2012- Official correspondence (BLM Northwest and Southwest Colorado Districts): The BLM responded to our September 5, 2012, recommendations related to proposed conservation measures. The BLM declined to amend their proposed conservation measures beyond the list established as of August 22, 2012 (see above). Also, based on the lack of quantitative data on livestock grazing impacts to the listed plants, BLM felt that they cannot identify legally defensible impact thresholds, or triggers, for the species.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is continuation of the livestock grazing program administered by the BLM CRVFO, GJFO, and UFO within the known range of the Colorado hookless cactus, DeBeque phacelia, and clay-loving wild buckwheat. The BLM administers their livestock grazing program as part of its multiple use and sustained yield mandate established under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1752). The program includes grazing and related operational and monitoring activities such as range improvement construction and maintenance (fences, corrals, reservoirs, unimproved access routes, etc.), livestock trailing, watering, salting, bedding, and utilization and trend monitoring.

Public grazing land is divided into allotments which may include ~~may include~~ both public and private land. Allotment use is managed under a permitting program that is designed to meet the mandates of the Taylor Grazing Act of 1934 (43 USC 315, as amended). Allotments are assigned a class of livestock, stocking rate, and use period, and are permitted at a given number of animal unit months (AUMs). The terms and conditions of each allotment are set forth in the grazing permit, and permittees are assessed a grazing fee. Routine trailing of livestock onto, off of, or within an allotment, and other activities secondary to grazing are regulated via terms and conditions of the grazing permit. Trailing by one livestock operator across allotments for which he/she does not hold the grazing permit is managed separately under a trailing permit program, and is referred to as permitted trailing. Permitted trails on BLM surface are shown in Appendix I, Figure 1, of the BA. The BLM requests that the newly identified trailing be included under the umbrella of this programmatic consultation (i.e., for effects on the three listed plants only).

The BLM has the authority to issue grazing permits for a period not to exceed 10 years. Grazing permit renewal must undergo environmental review under the National Environmental Policy Act (NEPA). If an application to renew a permit cannot be fully processed through NEPA before the current grazing permit expires, and the new permit to be issued contains the same terms and conditions, including the length of the permit period, as the expiring grazing permit, the issuance of the renewed permit may be accomplished through the authority provided in the Appropriations Act for that year (BLM CO IM-2012-002). According to the Taylor Act, “during periods of range depletion due to severe drought or other natural causes”, the BLM may “remit,

reduce, refund in whole or part, or postpone payment of grazing fees" for the duration of the emergency (§ 315b).

The *Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management in Colorado* became effective for all BLM lands in Colorado on February 12, 1997. There are five Public Land Health standards that prescribe the resource conditions needed to sustain public land health and apply to all uses of public lands including livestock grazing. Standard 4 applies specifically to special status, threatened, and endangered species and their habitats. The *Guidelines for Livestock Grazing Management* set forth the best management practices that BLM routinely employs to maintain or achieve the Public Land Health Standards.

Grazing allotments are managed to meet or exceed the Public Land Health Standards. As part of the planning and permitting process, allotments are evaluated to determine whether rangeland health meets standards, meets with problems, or does not meet the five standards. LHAs are typically conducted on a landscape or watershed scale via sampling, but where threatened or endangered species are of concern, site-specific assessments are made whenever feasible. If a standard is not met on an allotment or a portion of an allotment, BLM then determines the causal factors for not meeting the standard. If existing livestock grazing management or level of use is determined to be a significant causal factor for not achieving standards or not making significant progress toward achieving rangeland health, the authorized officer must take appropriate action as soon as practicable but no later than the beginning of the next grazing year to bring grazing activities into conformance with grazing guidelines or to modify them so that significant progress can be made towards achieving Land Health Standards (BLM 4180 Manual, Sec IIID). Management actions may include reductions in AUMs, change of season, change in pasture rotation system, movement of water and salt blocks, fencing, or construction of additional water developments. These measures are included as terms and conditions of the renewed grazing permit.

Inventory and monitoring data is collected on a regular basis as needed to determine achievement of Land Health Standards, or progress toward achieving those standards (BLM 4180 Manual, Sec IIIG). Monitoring methods include utilization and vegetation trend monitoring. Utilization monitoring is conducted to monitor forage use and livestock distribution.

Trend monitoring is used to assess changes in cover and composition in the plant communities over time (BLM1999b, 1999c). For example, BLM-authorized monitoring aimed specifically at quantifying effects from livestock grazing to clay-loving wild buckwheat is underway. Results from this monitoring program and any other similar programs implemented in the future will be used to inform BLM management of livestock grazing in occupied habitat for the three focal species.

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Action Area

For the purposes of this BA, the BLM defined the action area to include all lands that may be affected by the BLM grazing program within *occupied habitat* or *reasonably certain to be occupied habitat* for the three focal species, as described below. The Service's section 7 range

models for these species were not used by the BLM in defining the action area (see Consultation History). Therefore, potential habitat or newly discovered populations of these species outside the defined action are not covered under this programmatic consultation; these areas will require future, separate consultation under section 7 of the ESA.

BLM lands affected by the grazing program include grazing allotments, unallotted lands on which trailing or allotment operation and maintenance activities occur, and unallotted lands which may be indirectly affected by grazing or maintenance activities on nearby allotments. Non-federal lands that may sustain effects from interdependent actions, as described above, are also included in the action area. The locations of these activities on non-federal land remain largely unknown. The action area on BLM land for each of the three focal species is shown in Appendix I, Figures 2-4, of the BA. *Occupied and reasonably certain to be occupied habitat* is described below for each species.

Colorado hookless cactus
Occupied and *reasonably certain to be occupied habitat* includes the Colorado hookless cactus *Recovery Outline* potential habitat (FWS 2010), plus potentially occupied areas in the following UFO grazing allotments: Milk Creek (14544), Stingley Gulch (14503), Dry Creek (14549), South Dry Creek (14548), Wilbanks (14502), Oak Mesa (14506), Juniper Knob (14505), Leroux (14550), Leroux Creek (14504), Fire Mountain Canal (14508), Roatcap/Jay Creek (14507), and Canal (14012). For allotments that fall partially inside the *Recovery Outline* potential habitat, BLM lands inside the entire allotment were included in the action area. Private lands in grazing allotments are also included in the action area.

Clay-loving wild buckwheat
Occupied and *reasonably certain to be occupied habitat* includes the Service's warranted but precluded (WBP) revised critical habitat for the species, plus potentially occupied areas within one mile of the WBP revised critical habitat. The WBP revision to critical habitat was drafted in response to a petition to amend critical habitat for this species (CNE et al. 2006), but is yet to be proposed~~.~~ in a rule making. It is defined by minimum convex polygons around all known occurrences~~,~~ (populations), plus a 100-meter buffer outside of the polygons. For allotments that fall partially inside the Service's WBP revised critical habitat and one-mile buffer, BLM lands inside the entire allotment were included in the action area. Private lands in grazing allotments are also included in the action area. Although designated critical habitat for clay-loving wild buckwheat occurs entirely on private land, it is included in the action area because it may be subject to effects related to interdependent activities.

DeBeque phacelia
Occupied and *reasonably certain to be occupied habitat* includes designated critical habitat, plus any potentially occupied areas identified in the CRVFO's Alkali Creek Common (08130) Allotment. Critical habitat is defined by minimum convex polygons around all known ~~occurrences~~populations, plus a 100-meter buffer outside of the polygons. When an allotment falls partially inside critical habitat, BLM lands inside the entire allotment are included in the action area. Private lands in grazing allotments are also included in the action area.

Allotted Lands in the Action Area
Approximately 104 allotments (704,770 acres) occur in Colorado hookless cactus habitat; 11 allotments (54,578 acres) -in clay-loving ~~wildbuckwheat~~wild buckwheat habitat; and 14 allotments (106,062 acres) in DeBeque phacelia habitat (Table 1). Many allotments contain habitat for more than one
of the three plant species. A complete list of allotments in the action area is provided in Appendix I, Figures 2-4, of the BA. Appendix II, Table A in the BA provides details on listed plant species occurring in allotments and authorized uses.

Table 1. Livestock grazing in the action area.

Species	BLM Land (acres)	BLM Land Allotted (acres)	Number of Allotments	Livestock Class and Season of Use
Colorado hookless cactus	723,366	704,770 (97%)	104	Mostly cattle and sheep; variously over the 4 seasons
Clay-loving wild buckwheat	55,491	54,578 (98%)	11	8 allotments, sheep; 2 allotments, cattle; 1 allotment, cattle and sheep; mostly winter and spring
Debeque phacelia	106,233	106,062 (99%)	14	Cattle only; mostly in the spring and winter, with fall usage in 2 allotments

Source: BLM spatial and allotment data (CRVFO, GJFO, UFO). Livestock class, season of use, and other aspects of allotment management are subject to change.

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Source: BLM spatial and allotment data (CRVFO, GJFO, UFO). Livestock class, season of use, and other aspects of allotment management are subject to change.

Interrelated and Interdependent Activities
Interrelated and interdependent actions include grazing, trailing, or other operational activities on non-federal lands that would not occur if BLM did not authorize grazing or trailing in their allotments. The locations where these activities occur are not all known. These activities can be summarized as follows:

1. Straying of BLM-authorized livestock onto adjacent non-federal land that is not controlled by the permittee is as an interdependent action. Not all BLM allotments are fenced from adjacent ungrazed private, local, or State lands, or the fences are not always maintained in a manner that absolutely prevents livestock from straying onto adjacent land. Colorado is an open range, or "fence out" state, meaning that landowners who do not want livestock on their property are required by law to fence them out.

2. Livestock trailing across non-federal lands that occurs as a result of permitted trailing activities on BLM land is another interdependent action. In order for an operator to trail across a BLM allotment for which he/she does not hold the grazing permit, it is sometimes necessary to move stock across non-federal land. This trailing across private, local, or state land would not occur but for the permit to trail across BLM land. Permitted trails on BLM land are provided in Appendix I, Figure 1, in the BA.

3. Any grazing operation or activity conducted by a permittee on non-Federal land that would not occur but for the permittee's livestock operation on BLM land is considered an interdependent action.

Conservation Measures

Conservation measures are non-discretionary actions that the BLM agrees to implement to further the conservation and recovery of listed species. The beneficial effects of conservation measures are taken into consideration for determining both jeopardy and adverse modification analyses. (Note: The following list reflects various agreements made following receipt of the BA for this project, as described in the *Consultation History* section.)

The terms and conditions of grazing permits that include habitat occupied by Colorado hookless cactus, clay-loving wild buckwheat, or DeBeque phacelia will include conservation measures designed to avoid, minimize, and/or remediate effects to species in mapped occupied habitat. Some measures are specific to individual allotments. Conservation measures to be implemented include, but are not limited to, the following:

1. In areas where there is a concern that Colorado hookless cactus, clay-loving wild buckwheat, and DeBeque phacelia may be present, a survey will be conducted prior to any livestock management actions such as range improvements or maintenance, or weed management~~, or trailing.~~. The BLM Threatened, Endangered, and Sensitive species specialist will determine the need for a survey and survey scope and intensity.

2. Maps will be provided to permittees that identify sensitive areas where restrictions may apply to particular grazing-related activities for the Colorado hookless cactus, clay-loving wild buckwheat, and DeBeque phacelia (individual occurrences or populations plus a 200-meter [656 feet] buffer). As new information becomes available, and as necessary, maps will be updated by the BLM and provided to permittees each year if new occurrences are found. (Note: Maps

provided to permittees will include sufficient buffers and randomized perimeters to avoid disclosing exact species locations.)

3. The permittee is required to notify the BLM Rangeland Management Specialist prior to any surface disturbing range project maintenance activity (fences, stock ponds, spring developments, etc.) in any allotment (standard condition for all BLM allotments). Surveys and avoidance measures will be required where effects to listed plants may occur.

- Construction of new range developments (e.g., fences, ponds, water troughs) would be designed to avoid impacts to listed species whenever feasible. New range developments that may affect listed species would not be permitted until completion of additional consultation.

4. If a permittee wishes to apply an herbicide treatment, they must obtain prior approval from the BLM. Appropriate applicator licenses must be obtained, copies of the appropriate *Pesticide Use Proposal* must be obtained from the BLM, and a *Pesticide Application Record* must be completed and returned to BLM no later than 10 days after herbicide application (standard condition for all BLM allotments).

- The permittee must consult with the BLM Rangeland Management Specialist and Biologist/Ecologist prior to applying herbicides or pesticides within 200 meters (656 feet) of individual plants or populations. Such treatments may be restricted or modified to avoid effects to the three listed species. Depending on the Field Office and weed program restrictions (see following point), additional section 7 consultation may be required prior to applying herbicides.
- All treatments will comply with the approved *Integrated Weed Management Plan* (IWMP) and section 7 consultation (completed for GJFO and CRVFO, in progress for UFO). Not all treatments are covered under those consultations and would, therefore, require separate section 7 consultation. The three field offices' IWMPs differ slightly in their requirements for avoidance distances and triggers for reinitiation of consultation. Please refer to those documents for details.

5. Within 200 meters (656 feet) of listed plants, motorized access for livestock grazing operations will be limited to existing roads and routes. Any additional access proposed for grazing operations would require additional surveys and section 7 consultation.

6. As a standard permit term and condition within occupied habitat, seasonal utilization levels on palatable perennial forage will be limited to 40 percent to the extent possible, and average utilization will not exceed 50 percent. (currently the approximate level of forage utilization in most areas on public lands). These areas will be monitored by the BLM Rangeland Management Specialist and Biologist/Ecologist to ensure compliance.

7. Permits for trailing through occupied habitat will only be issued for existing livestock trailing areas identified in Appendix I, Figure 1, of the BA.

- Where trailing occurs, minimization measures such as the following will be implemented to reduce impacts:
    - BLM will encourage the avoidance of known individuals or populations during livestock herding and trailing activities on BLM administered lands. Maps would be provided to permittees to facilitate avoidance.
    - In areas where trailing activities cannot be avoided (e.g., Escalante Canyon) monitoring of affected populations will be established. Where monitoring suggests population decline then the following measures will be considered by BLM to achieve appropriate protection:
        - Use additional herders/cowboys to direct livestock away from populations.
        - Trail smaller herds through at any given time
        - Use temporary fencing/barricades to inhibit livestock from trailing through populations during trailing activities.
        - Should all other attempts to reduce impacts from trailing not be successful, permanent drift fences may be considered.
    - Permittee will be required to notify the BLM office at least 24 hours in advance of the trailing activity.
    - Require that trailing activity be concentrated within existing road corridors as much as practicable and in a timely and efficient manner. Overnighting of livestock within occupied habitat is prohibited unless the area has been cleared for threatened, endangered, and special status species prior to overnight activity.
    - Trailing will not be allowed during flowering or germination periods where possible.
- Any future identified trailing activities through occupied habitat will be managed according to the above stated conservation measures.

8. No concentrations of livestock activities including but not limited to herding, routine trailing, bedding, salt or supplement, portable watering, and new stock ponds will be allowed within 200 meters (656 feet) of individual plants or populations, except as provided below:

- Concentration may be allowed where separated by a fence or topographic feature (cliff) that will render the impacts to listed plants insignificant, discountable, or if impacts are wholly beneficial (distribute livestock away from listed plants).
- In allotments in which sheep bedding must occur within the 200 meter (656 feet) buffer, only dispersed bedding will be allowed. Dispersed bedding allows sheep to bed however the band has dispersed throughout the day, rather than gathering or congregating the band in any one common locale.
- To minimize sheep grazing impacts in allotments containing clay-loving wild buckwheat, limit sheep grazing within 200 meters (656 feet) of occupied habitat to 5 nights per use area.
- The BLM Rangeland Management Specialist will collaborate with the permittee to develop and employ appropriate grazing strategies for the allotment pastures and use areas to meet Colorado Public Land Health Standards, specifically standard 3 for upland plant communities and standard 4 for TES species. Where possible, grazing should be

limited to 15 days or less in each pasture or use area during the germination, flowering, and fruiting period for the three focus species to ensure reproduction and recruitment.

9. Monitoring will be conducted (e.g., LHAs, utilization, trend, Ecological Site Inventory) to evaluate rangeland health. If monitoring/LHAs conclude that an allotment with occupied habitat is not meeting the standards for special status plants, vegetation, or soils, and livestock grazing is identified as a significant causal factor to not meeting those standards, grazing permit modifications, mitigation, or other prescriptive measures will be required by BLM, such as:

- The BLM Rangeland Management Specialist will work with the permittee to pursue opportunities to allow portions of the allotment(s) to receive yearlong rest or deferment in order to increase plant vigor.
- Exclosures or drift fences may be considered in certain areas where individual plants or populations require special protections from livestock grazing or associated activities, as determined by the BLM.
- Permit terms and conditions may be modified to minimize impacts to listed plants (e.g., improved distribution, changes in season of use/class of livestock).

10. The BLM will seek to implement monitoring programs to assess grazing-related impacts to the species. Results from the monitoring will be used to inform future grazing management.

- BLM Field Offices will continue to partner with the BLM Colorado State Office and other organizations (e.g., the Service, Denver Botanic Gardens [DBG], Colorado Natural Heritage Program [CNHP], Colorado Native Plant Society, Colorado Natural Areas Program [CNAP]) to monitor listed plants.
- In areas where grazing has been identified as a threat to individuals or populations, the BLM will explore opportunities to modify existing monitoring and develop new monitoring to assess grazing-related impacts to the species.

11. To ensure the conservation of the three listed species, the BLM will coordinate with the Service to identify important areas for species conservation. This coordination may result in actions to improve species conservation, initiate adaptive management strategies to reduce grazing impacts to the three listed species, or place greater management emphasis on their conservation through BLM's planning and decision process.

12. The BLM intends to continue a similar annual inventory effort as in recent years (between 2,000 and 10,000 acres) across the three species' ranges, consistent with funding and priorities. Results will be submitted to the CNHP to ensure data is compiled in a centralized database.

13. The BLM will provide the Service with monitoring data collected and will work with the Service to develop a cooperative monitoring strategy that will capitalize on partnerships to augment existing monitoring studies and data. With the Service's assistance, the BLM will work on creating partnership opportunities to design and carry out additional monitoring needs.

14. The BLM will report conservation actions taken annually to the Service highlighting the adaptive management occurring in the grazing programs. Future BLM actions, monitoring (trend, grazing, and LHA), and decisions covered under or related to this programmatic consultation will be reported annually to the Service.

15. BLM Field Offices will individually schedule coordination meetings throughout the year with the Service and will work to address grazing impacts to listed plants.

If impacts to any of the three plant species occur that were not analyzed in this consultation, or are found likely to occur due to future grazing-related activities, further section 7 consultation will occur.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Colorado Hookless Cactus

Colorado hookless cactus is a small ball or barrel-shaped cactus endemic to Montrose, Delta, Mesa, and Garfield Counties in western Colorado. Current data indicate that this species is currently known from about 98 occurrences totaling approximately 19,000 individuals (FWS 2010). These occurrences cover approximately 1,700 square miles, with an estimated 618,000 acres of potential habitat (FWS 2010). This species has two population centers, one associated with the Gunnison River and its tributaries near the City of Delta, and the other with the Colorado River and its tributaries near DeBeque, Colorado. Colorado hookless cactus was originally listed as threatened on October 11, 1979 (44 FR 58868), with revised listing due to taxonomic changes published on September 15, 2009 (74 FR 47112). Critical habitat has not been proposed for this species. The *Recovery Outline* (FWS 2010) presents an updated and thorough review of the species' status.

Habitat

Colorado hookless cactus grows primarily in the salt desert shrub community on alluvial terraces associated with the Gunnison and Colorado Rivers. Soils are commonly derived from Mancos shale often with a thin over layer of alluvium, and range from fine silty clay to coarse gravel with volcanic cobbles and boulders scattered on the surface. The dominant co-occurring plant species include *Atriplex confertifolia, Artemisia nova, Opuntia* spp., *Echinocereus triglochidiatus, Pleuraphis jamesii,* and *Acnatherum hymenoides*. Populations also occur in big sagebrush and the transition zone with pinyon-juniper woodland. Within these communities, Colorado hookless cactus is often found under small nurse shrubs, especially *Atriplex confertifolia*. In many Colorado hookless cactus populations, exotics occur, especially *Bromus tectorum* and/or *Halogeton glomeratus*, and *Acroptilon repens* along drainages. Typical elevations for the species range from 4,593 to 6,562 feet (1,400 to 2000 meters) above mean sea level (Heil and Porter 2004). According to the North Delta LHA report, BLM considers the Mancos shale communities that the cactus occurs in to have little resilience to disturbance due to soil chemistry and structure and the small amount of available moisture (BLM 2002).

Species Description and Life History

Colorado hookless cactus grows from a taproot and typically has a single stem that can grow to about 5 inches (12 cm) tall, with large individuals attaining heights of 11 inches (28 cm). Mature stem diameter may reach to 3.5 inches (9 cm) (Heil and Porter 2004), with large individuals growing to 4 or so inches (10 cm) in girth. Tubercles are arranged into prominent longitudinal ribs. On the apex of each tubercle is an areole from which clusters of spines radiate. The central spine in each cluster is typically hookless. The large, funnel-shaped, pink flowers bloom from late April to May, with the small barrel-shaped fruits maturing in May and June. Flowers are hermaphroditic. Based upon preliminary breeding system studies by Tepedino, this species is believed to be primarily outcrossing (Heil and Porter 1994). Outcrossing presumably requires an insect vector for pollen transfer. Seed longevity in the ground, germination cues, and seed dispersal mechanisms for this species remain unstudied.

In addition to reproducing sexually, Colorado hookless cactus can produce new stems vegetatively by budding. New stem buds appear from beneath the main stem base, and may number from one to many. Field observations indicate that mild to moderate tissue damage, including herbivory by rodents and rabbits and crushing by vehicles, can stimulate budding (Conner 2011, pers. comm.). Presumably if the caudex is sufficiently damaged, no new buds can sprout and an individual dies. Individual cactus stems also appear to be able to sustain physical damage. Partially uprooted cacti and those with apparent herbivore or crushing damage have been observed to heal over and survive (BLM 2009b; Conner 2011, pers. comm.).

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Abundance and Viability

For each occurrence in their database, CNHP assesses the estimated viability of a species or ecological integrity of its community using ranks from A to D for excellent to poor. Of the 98 CNHP occurrences of Colorado hookless cactus, approximately 22 percent are ranked excellent to good (A, B, or BC), 10 percent fair (C), and 6 percent fair to poor (CD or D). The remainder are either considered historic because they have not been confirmed in over 20 years (42 percent, H rank), extirpated (1 percent, E rank), or they could not be ranked for a variety of reasons. The 21 occurrences ranked A or B represent at least 1,000 individuals (FWS 2010).

In addition to the known 98 occurrences recorded by CNHP, more than 6,000 individuals were recently found during surveys for an electric transmission line and a proposed wastewater evaporation pond facility in Delta County (BIO-Logic 2008, 2009). These additional 6,000 plants bring the estimated total individuals range-wide to approximately 19,000 (FWS 2010). Those 6,000 individuals would most likely be ranked A-B by CNHP, with the result that at least 37 percent of the estimated known individuals are in occurrences currently considered viable or ecologically intact.

Land Ownership and Special Management Designations

According to the *Recovery Outline*, 80 plus occurrences are fully or partially on land managed by the BLM, 45 are fully or partially on private land, and 9 are fully or partially on lands owned by the State of Colorado (FWS 2010). A number of BLM special management areas provide ~~additional~~limited protections to this species, such as no leasing areas for oil and gas development: Dominguez-Escalante National Conservation Area (DENCA) including the Escalante Canyon ACEC and Dominguez Canyon Wilderness; Adobe Badlands Wilderness Study Area; Gunnison Gorge National Conservation Area

(GGNCA); and Pyramid Rock ACEC/Research Natural Area (RNA). Pyramid Rock ACEC encompasses the Pyramid Rock Natural Area, which is managed by the Colorado Natural Areas Program for the protection of several special status plant species, including Colorado hookless cactus. Gunnison Gravels RNA, located within the DENCA, and Rough Canyon RNA both occur inside *occupied* and *reasonably certain to be occupied habitat* for this species, but neither are known to support Colorado hookless cactus. Approximately 55 percent of occupied habitat for this species, as defined by the action area, falls inside these special management areas. BLM livestock grazing management within these areas is the same as areas outside.

Demography

A large number of site inventories have been conducted over the years for Colorado hookless cactus, mostly as part of environmental clearance for proposed development projects. These have expanded our understanding of the species range and individual abundance. However, very little is known about population trends. Several monitoring efforts have been undertaken to better understand trends for this species. Summarized below, these efforts have been conducted by various groups. In general, monitoring has not occurred long enough to provide trend information.

1. BLM: ~~Monitoring~~Inventories conducted by the BLM UFO ~~is~~are summarized in *Sclerocactus glaucus Monitoring Projects and Trends in the BLM Uncompahgre Field Office, 1978 – 2009* (BLM 2009b). Between 1983 and 1986, the UFO inventoried Colorado hookless cactus at 31 sites in Montrose, Delta, and Mesa Counties, and recorded approximately 4,979 plants total. In 1993, they resurveyed 26 of these sites, with data recovered for only 21. Although the estimates of individuals at any given site were not entirely comparable between years due to divergent monitoring methods and the lack of permanent plots, 12 of the sites showed a stable or upward trend, and 9 showed a downward trend. Declines in plant numbers were greater than 50 percent at several sites.

In 1986, the UFO collaborated with CNAP to establish seven square meter monitoring plots in the Escalante Canyon ACEC, with a total of 36 individuals across all plots. When the plots were revisited in 1993, an 11 percent reduction in plant number and a shift towards the seedling and mature size classes was found~~.~~ (immature plants decreased). In 2010, the UFO was unable to relocate these plots (BLM 2009b).

Between 1985 and 1988 the CRVFO ~~coducted~~conducted extensive surveys for Colorado hookless cactus across potential habitat east of DeBeque (DeYoung 2012a, pers. comm.). A total of 16 sites were identified at that time with a total of 144 plants. ~~Periodic monitoring~~Resurveys of 10 sites between 1993 and 2007 found an upward trend in population size through 2001 and then a downward trend at seven of eight sites visited in 2007. Annual monitoring begun in 2008 has identified an increase in abundance since the low of 2007, with an all-time high at three sites in 2011. Seven new sites were discovered in 2010 and 2011, increasing the previously known numbers within CRVFO by 57 percent. Additional monitoring needs to occur before long-term trends can be determined.

2. Denver Botanic Gardens: The BLM State Office and DBG are working together to establish permanent demographic monitoring plots for Colorado hookless cactus rangewide on lands managed by the BLM (DBG 2007, 2008, 2010b). As of 2010, 10 plots had been established, three in the Escalante

Canyon area north of Delta, three near DeBeque, and four in areas leased by Black Hills Exploration and Production in Mesa County. Additional monitoring needs to occur before trend can be determined at these sites.

3. Colorado Natural Heritage Program: Within the DENCA, CNHP inventoried and updated element occurrence records of Colorado hookless cactus in 2009 and 2010. Trends were not assessed.

4. Colorado Natural Areas Program: CNAP began monitoring Colorado hookless cactus at the Pyramid Rock Natural Area in 1998 (CNAP 1999, 2000). Two different populations were visited in 1998, and one of these was revisited in 1999 and found to be "undisturbed" compared to the previous year.

5. Consultants: In 2009, WestWater Engineering, Inc. began a 5-year monitoring effort of 135 individual cactus stems in 5 subpopulations of Colorado hookless cactus along the Collbran natural gas pipeline route in Mesa County, on the north side of Plateau Creek (WWE 2010). Between 2009 and 2010, six of the cactus stems died, resulting in a four percent mortality rate. Sufficient data are not yet available to analyze trends.

Field observations by consultants and agencies indicate that Colorado hookless cactus population size can change rapidly (England 2008, pers. comm., cited in BIO-Logic 2008; Conner 2011, pers. comm.). The North Delta LHA 2002 report (BLM 2002) from the BLM UFO noted that: "Population fluctuations for the Uinta Basin hookless cactus [now Colorado hookless cactus] are much more rapid than originally expected, and in some cases significant recruitment events, such as the one in the early nineties near Escalante Creek, result in substantial increases in the number of individuals in the population. Cactus borers and other mortality factors seem to keep this species' populations in a constant state of change." Monitoring of the federally listed congener *Sclerocactus wrightiae* has also shown extreme fluctuations in mortality rates between years, often correlated with changes in precipitation (Clark and Clark 2007).

Land Health Assessments

Approximately 81 percent of the action area for Colorado hookless cactus lies within the following LHA units: North Delta, Escalante, Gunnison Gorge, North Fork, Roubideau, Kannah Plateau, DeBeque-Roan Creek, Whitewater Common-North Fork Kannah Creek, Northern DENCA, and Rifle-West Watershed. The remaining 19 percent of the action area occurs in units that have not yet been assessed. Based on a combination of BLM spatial data and the most recent available LHA reports, Standard 4 is being met in 95 percent, not meeting in 3 percent, meeting with problems in 2 percent, and undetermined in less than one percent of the action area for Colorado hookless cactus.

~~More detailed information for the species is provided in LHA reports.~~ The most recent assessment of the North Delta LHA unit found that all 74,583 acres met Standard 4 and that the Colorado hookless cactus populations in the area were in good condition, with only isolated effects from sheep bedding grounds (BLM 2002).

When last assessed in 2001, the Gunnison Gorge LHA unit met Standard 4. Colorado hookless cactus populations appeared "to be as healthy as they have been over the last twenty years (BLM 2001)", although insufficient information was available to determine trends. There were minor differences

between the LHA reports and the spatial data provided by the BLM. According to the spatial data for the North Delta and Gunnison Gorge units, less than one percent of the acres in each unit that occur inside the Colorado hookless action area met Standard 4 with problems; all the remaining acreage met the standard. The spatial data does not provide an indication of causal factors for areas not meeting a standard.

When the Escalante LHA unit was assessed in 1998 and 1999, 100 percent of the area met Standard 4, and the Colorado hookless population in the area "appear[ed] to be in good condition" (BLM 1999a). Roughly 107,362 of the 120,000 acres in this unit are inside the action area for Colorado hookless cactus. When the unit was re-assessed in 2009 and 2010, 28 percent met, 37 percent "met assumed", 17 percent met with problems, 9 percent did not meet, and 9 percent were not evaluated for Standard 4. The report noted that historic and on-going monitoring efforts and field visits identified a decline in Colorado hookless cactus abundance and narrowing of its distribution in the unit (BLM 2010).

Approximately 20,764 acres of the North Fork LHA unit fall inside the Colorado hookless cactus action area. During the most recent assessment in 2006 and 2007, over 99 percent of that area met Standard 4. Less than one percent of the area did not meet Standard 4, and that acreage was all in unallotted areas. The report noted evidence that current management was having an impact on Colorado hookless populations on public lands. Occupied habitat was characterized by a combination of poor plant diversity, weed infestations, and soil erosion. Overgrazing by livestock and wildlife was cited as one of the sources of these problems (BLM 2007b).

In the Roubideau LHA unit, last assessed in 2004 and 2005, 98.5 percent of the 23,995 acres inside the Colorado hookless action area met Standard 4; the remaining 1.5 percent met the Standard with problems. The problem areas were all associated with degraded riparian habitat for special status fish species. According to the BLM, current BLM land management was not affecting Colorado hookless cactus within the assessment area (BLM 2005b).

The Whitewater Common-North Fork Kannah Creek and DeBeque-Roan Creek LHA units were last assessed in 2006 (BLM 2008c, 2010b), and the Northern DENCA LHA unit in 2007 and 2009 (BLM 2010c). At that time, Standard 4 was being met for Colorado hookless cactus in 100 percent all three LHA units. More than 9,000 individuals occur within the Whitewater Common allotment, and although Standard 4 was being met for them, the report noted that poor habitat conditions exist due to exotic invasive plants and surface disturbance. Six of the 34 known Colorado hookless cactus occurrences in the DeBeque-Roan Creek LHA were found to be at risk due to poor habitat conditions, due largely to *Bromus tectorum* infestations.

The West Rifle Watershed LHA unit contains 18 known locations of Colorado hookless cactus, all within the County Line (08923) and Smith Gulch (08922) allotments (BLM 2005a). When last assessed in 2005, population trend inside the unit was considered stable. Standard 4 was being met for this species, although neither allotment was meeting Standard 3 for healthy plant communities. Dominance by *Bromus tectorum*, lack of cool season grasses and perennial forbs, and a reduction in sagebrush and greasewood were contributing to poor habitat conditions. Although mature Colorado hookless cacti appeared to persist in areas with a high percent cover of *Bromus tectorum*, no recruitment of young cacti

was observed where infestations were most dense. *Bromus tectorum* was only affecting a few of the cactus locations. Subsequent monitoring determined that current livestock grazing was a significant contributing factor in the failure to achieve Standard 3, so livestock grazing was indefinitely deferred in the County Line Allotment DeYoung 2012b, pers. comm.).

Threats

Primary threats to Colorado hookless cactus identified in the *Recovery Outline* include destruction, modification, fragmentation, or curtailment of habitat and range; species collection; livestock grazing and trampling; predation; herbicides and pesticides; hybridization; and climate change. Factors contributing to habitat destruction and modification include (1) mineral and energy development; (2) utility corridors; (3) invasive species; (4) off-road vehicle (ORV) recreation; (5) water developments; (6) livestock grazing and trampling; and (7) herbicides and pesticides (FWS 2010). The effect of past and present threats on the status of the species is described in the *Environmental Baseline* section.

Clay-loving Wild Buckwheat

Clay-loving wild buckwheat is a low, slow-growing, and long-lived subshrub known only from Delta and Montrose Counties, Colorado. Thought to be confined to one occurrence at the time of listing, this species is currently known from 14 element occurrences totaling approximately 278,600 individuals. Close to 90 percent of all known individuals are concentrated in a single core population east of the City of Montrose. Occupied habitat totaling over 582 acres is distributed across a range approximately 11.5 miles wide (east to west) and 28.5 miles long (north to south) (FWS 2009b). Clay-loving wild buckwheat was listed as endangered on July 13, 1984, with critical habitat designated concurrently (49 FR 28562). The *5-Year Review* of this species by the Service (FWS 2009b) presents a thorough review of the species' status.

Habitat

Clay-loving wild buckwheat is endemic to clay soils derived from Mancos shale, locally known as adobe soils. These soils are alkaline due to high concentrations of calcium carbonate, are high in selenium, and highly erosive. Adobe soils have a dramatic shrink-swell capacity, resulting in desiccation cracking and a lumpy, un-compacted surface due to freeze-thaw expansion. They may be particularly sensitive to compaction when wet, but even when dry, any pressure can easily compact the expansion created by freeze-thaw action during colder temperatures. The importance of surface cracking and freeze-thaw expansion of soils to this species is unknown.

Clay-loving wild buckwheat occurs in mat saltbush or black sagebrush dwarf shrublands. *Atriplex corrugata* and *Artemisia nova* are the dominant species associates, with other common species including *Xylorhiza venusta, Atriplex confertifolia, Atriplex gardneri,* and *Picrothamnus desertorum*. Plants are typically found in the basin portions of the adobe badland system of draws and ridges, at elevations ranging from 5,180 to 6,350 feet (1,579 to 1,935 meters) above mean sea level (FWS 2009b). At a finer scale, plants are often concentrated on the north or east face of small hummocks where snow drifts and moisture remain later into the spring than on surrounding flat or exposed areas.

Species Description and Life History

Mature clay-loving wild buckwheat plants grow 4 to 8 inches (10 to 20 cm) in height, forming densely branching and low, rounded subshrubs with woody bases. The needle-like, deciduous leaves are very

short and narrow, typically less than one centimeter long and several millimeters wide. Flowers are hermaphroditic, with a mixed mating system requiring an insect vector for pollen transfer (Bowlin et al. 1993). Tepedino (2009) reported that flowers are visited by a large array of common bees, wasps, flies, and ants and concluded that pollination service is not a conservation concern for this species. Plants bloom from late May to early September, with fruits maturing from late June through October. Seed longevity, germination cues, and seed dispersal mechanisms have not been studied.

Abundance and Viability

~~In addition to the known 14 element occurrences, there are 7 historic buckwheat populations that have not been revisited recently to determine species presence or status. Based on past estimates, these occurrences may contain 3,500 individuals, which would bring the estimated total number of known plants to roughly 282,100.~~Fourteen element occurrences of clay-loving wild buckwheat are known, with approximately 282,100 total plants. Roughly 90 percent of all known individuals (250,000 of 278,600 if historic occurrences are not counted) are concentrated in the Fairview South-Wacker Ranch occurrence. The CNHP assigned a viability ranking to 12 of the 14 known occupied occurrences: two of the sites encompassing 38 percent of occupied habitat ranked as A, including the core Fairview South-Wacker Ranch population; six sites representing 39 percent of occupied habitat ranked as B; three representing 21 percent of occupied habitat ranked as C; and one representing 1.4 percent of occupied habitat ranked as D. Geospatial analysis conducted by the Service estimated that 12,765 acres of suitable habitat exists for clay-loving wild buckwheat in association with known occupied and historical sites (FWS 2009b).

Land Ownership and Special Management Designations

According to the *5-Year Review* for clay-loving wild buckwheat, over half (54 percent) of the known occupied acreage is managed by BLM or CNAP, with the remainder on private land (FWS 2009b). Four of the 14 known occurrences have some special protections in place. Conservation easements protect most of the Lawhead Gulch occurrence and a portion of the Selig Canal occurrence on private land in the action area.

The BLM has designated the Fairview North (174 acres) and Fairview South (213 acres) ACECs specifically to protect clay-loving wild buckwheat. Livestock are excluded from the Fairview North ACEC and grazing inside the Fairview South ACEC is currently limited to five nights per year, with grazing prohibited every fourth year. Both ACECs are also designated as CNAP Natural Areas. Adjacent to the Fairview South ACEC, the Wacker Ranch Natural Area (43 acres) is owned by CNAP and managed jointly with The Nature Conservancy (TNC) to protect the species, where livestock are excluded (but livestock trespass has occurred in the past). The Fairview South ACEC and Wacker Ranch Natural Area together contain an estimated at 250,000 plants, or 90 percent of all known individuals (FWS 2009b). The remainder of this occurrence is on private land. A portion of the Selig Canal and Candy Lane/Peach Valley occurrences are located inside the GGNCA. No special restrictions for livestock grazing are in place inside the GGNCA.

Demography

A series of clay-loving wild buckwheat monitoring efforts have been concentrated in the Fairview South/Wacker Ranch occurrence. From 1990 to 1994, Carpenter and Schulz of TNC monitored six transects at Wacker Ranch (Lyon 2008). The resulting data do not provide population vital rates.

Changes in abundance and recruitment varied between sites, and mortality averaged about six percent over a four-year period. A follow-up study authorized by TNC in 2008 relocated 73 percent of the tags in 5 of the original 6 transects (230 of 314 tags, with one tag per individual). Of the 230 tags relocated, 53 percent were still attached to live individuals, indicating that the species is long-lived. A 59 percent increase in abundance (from 314 in 1990 to 502 in 2008) was evident in the relocated transects (Lyon 2008). When the transects were re-read in 2009, plant numbers appeared to be stable (DBG 2010a).

Two additional monitoring studies are ongoing (Lyon 2008). In 2008, a pair of monitoring transects was established by TNC at Wacker Ranch, where grazing is excluded, and another on adjacent land managed by BLM, where grazing is permitted. Data were collected in 2009 and 2011, but have not yet been analyzed to determine possible effects from grazing. Also in 2008, CNAP established a transect along an access road to Wacker Ranch to monitor potential effects from foot traffic on the species.

Preliminary demographic data from the Fairview South population are available based on recent monitoring studies. The UFO underwent formal consultation with the Service for renewal of the Colona LHA unit grazing permit (BLM 2008a). In accordance with the Service's concurrence letter for the permit renewal (FWS 2008), the UFO began monitoring potential effects from livestock grazing in the Fairview South ACEC which occurs in the Colona LHA unit. Four permanent transects were read annually starting in 2008. Analysis of the 2008 and 2009 data indicated no significant change in the number of individuals, although there was a shift in size class away from mature individuals (those > 225 cm^2 in canopy cover) (DBG 2010a). Looking at the raw data (BLM 2011), seedling (> 9 cm^2) abundance totaled across all 4 transects dropped from a high of 2,791 in 2008 to a low of 171 in 2009, rising somewhat again in 2010 to 388. This extreme fluctuation may indicate that germination flushes are episodic in this species. Notes on sheep sign inside the transects are not linked in any quantitative fashion to the monitoring data. Plant vigor in the transects was excellent to good in 2008, and good to fair in 2009 and 2010. The four transects at Fairview South could be paired with older transects with different protocols at the adjacent Wacker Ranch where livestock grazing is not authorized (but where periodic livestock grazing trespass has occurred in the past). Data from these transects have not yet been compared.

Land Health Assessments

The action area for clay-loving wild buckwheat lies within the Colona and Gunnison Gorge LHA units. Based on spatial data from UFO, 82 percent of the 55,491-acre action area meets Standard 4 for special status, threatened, and endangered species; 16 percent meets with problems, 2 percent does not meet, and less than one percent remains undetermined. When the Colona LHA unit was last assessed in 2007 and 2008, BLM did not estimate the health of the clay-loving wild buckwheat population except to note that recent inventories had increased the number of known individuals substantially, and recommended that grazing, recreation, and weeds be monitored for effects on the species (BLM 2008b). When the Gunnison Gorge LHA unit was last assessed in 2001, all lands occupied by clay-loving wild buckwheat met Standard 4 and the populations on public land were reported to be stable and healthy, with little exposure to negative impacts (BLM 2001).

Threats

The primary threats identified for this species in the *5-Year Review* include destruction, modification, or curtailment of habitat and range; livestock use; herbicide use; and climate change. Factors contributing

to habitat loss and modification include: (1) agricultural, urban, and residential development; (2) ORV recreation; (3) non-native invasive plants; (4) livestock use; and (5) oil and gas development (FWS 2009b). The effects of past and present threats on the status of the species are described in the *Environmental Baseline* section.

Clay-loving Wild Buckwheat Designated Critical Habitat

Critical habitat for clay-loving wild buckwheat was designated at the time of listing on July 13, 1984 (49 FR 28562). Critical habitat is comprised of approximately 120 acres divided between two parcels of privately held land in Delta County, Colorado. The unit encompasses the type locality for the species, or what was once the species' principal occurrence at the time of designation. In 2006, the Service received a petition to revise critical habitat for this species (CNE et al. 2006), and on September 29, 2009 ~~they~~we issued a 12-Month Finding concluding that revisions to critical habitat were precluded by other priorities (74 FR 49835).

Status of the Primary Constituent Elements

The primary constituent elements (PCEs) noted in the 1984 final rule include: (1) alkaline clay soils within (2) sparsely vegetated Mancos shale badlands. According to the 2009 12-Month Finding, approximately 65 acres within designated critical habitat are still occupied by about 2,000 plants in what is known as the Lawhead Gulch occurrence (74 FR 49835). About half of the mapped occupied habitat within critical habitat has been lost to an agricultural field, and much of the area west of Lawhead Gulch that supports white Mancos shale soils but does not currently support plants was heavily disturbed at one time (Glenne 2012, in litt.). During sites visits in 2009 and 2010, the Service observed that occupied habitat within critical habitat is somewhat weedy, with little biological soil crust, which may be affecting the PCE of sparsely vegetated shale badlands. Despite the weeds, the Service determined that the PCE of Mancos shale soils appeared to be in reasonable condition (Glenne 2012, in litt.).

Land Ownership and Special Management Designations

Critical habitat occurs entirely on private surface. The majority of the extant occurrence within critical habitat is currently protected by a conservation easement with the Black Canyon Regional Land Trust. The terms of the easement provide some protections to the species (74 FR 49835) (Bartlett 2012, pers. comm.).

Land Health Assessments

Critical habitat is entirely on private land; therefore, LHA data are unavailable for clay-loving wild buckwheat designated critical habitat.

Threats

According to the final rule, the following activities may adversely modify critical habitat: (1) concentrated grazing by horses within fenced pastures and corrals, which has resulted in direct impacts to clay-loving wild buckwheat; and (2) soil compaction due to trampling by horses and the use of vehicles to manage and maintain the livestock operation. The Service visited designated critical habitat twice in the summer since 2009 and did not observe any sign of livestock grazing within occupied

habitat (Glenne 2012, in litt.). The effect of past and present threats on the status of critical habitat is described further in the *Environmental Baseline* section.

DeBeque Phacelia

DeBeque phacelia is an herbaceous annual currently known from 22 occurrences distributed among nine populations spanning the Mesa and Garfield County line near DeBeque, Colorado. The total known distribution includes approximately 625.9 acres within an area 19 miles long and 11 miles wide (76 FR 45054). This species was listed as threatened on July 27, 2011 (76 FR 45054). The Final Listing Rule provides a thorough review of the species' status.

Habitat

DeBeque phacelia is endemic to clay badland soils derived from the Atwell Gulch and Shire members of the Wasatch formation. It occurs in small patches (1 to 100 m^2) on uniquely textured soils that differ in an as yet unquantified way from adjacent soils. Preliminary results from studies conducted by the United States Geological Survey indicate that soils in occupied habitat have higher clay content than adjacent unoccupied soils. Soil color ranges from chocolate to purple brown to gray or tan and are alkaline (pH 7 to 8.9), highly erosive, and exhibit dramatic shrink-swell activity due to their high clay content. They are especially susceptible to compaction when wet (76 FR 45054; 76 FR 45078).

The badlands occupied by DeBeque phacelia support stands of salt desert scrub and big sagebrush shrubland within pinyon-juniper woodland. Cover of other plant species is typically less than 10 percent. Associates include *Grindelia fastigiata, Eriogonum gordonii, Monolepis nuttalliana, Oenothera caespitosa,* and *Bromus tectorum*. Occurrences are typically located on moderately steep slopes, benches, and ridge tops adjacent to valley floors at elevations ranging from 5,000 to 7,150 feet (1,524 to 2,179 meters) above mean sea level (76 FR 45054; 76 FR 45078).

Species Description and Life History

DeBeque phacelia is a low-growing spring annual establishing from a thin tap root. Stems reach 0.8 to 3 inches (2 to 7.6 cm) in length, and typically branch at the base, with most branches held low to the ground in a rosette pattern. The tubular flowers are hermaphroditic, yellowish-white, and very small in size, with petals generally not exceeding 0.19 inches (4 to 5 mm) in length (76 FR 45054). Preliminary results from a breeding system study indicate that breeding occurs by self-pollination within individual flowers, without the need for an insect vector (Langton 2011, in litt.). The blooming period is from late April to late June, with fruits maturing from mid-May through early July, and seed dispersal complete by early July.

Once the plants have set fruit, they dry in the summer heat and are dislodged or disintegrate, often leaving no trace. Seed dispersal appears to be by gravity and possibly dislodged plants. It is thought that this species depends upon cracks in the soil surface to provide a favorable environment for seed germination. Germination cues remain unknown, but based on research on other rare desert annuals (Levine et al. 2008) may involve interactions between temperature and moisture (76 FR 45054).

DeBeque phacelia depends on its seed bank for long-term survival. By storing viable genetic stock in the ground, individuals can "wait out" unfavorable environmental conditions. The buffering effect of a seed bank depends upon seed and germinant survival rates and how these factors are affected by

environmental variation (Doak et al. 2002; Meyer et al. 2006). Seed bank vital rates remain unknown for this species. Given the importance of the seed bank to species health, preventing damage to or destruction of the seed bank is an important management consideration for DeBeque phacelia. Identifying occupied habitat can be challenging since plants may remain dormant underground during certain years and because emerged plants often disappear shortly after the growth period.

Abundance and Viability

New occurrences of this species have been found as recently as ~~2010~~2011. The estimated total number of plants range-wide varies between 7,767 and 68,371 per year. Of the 22 occurrences in the CNHP database, 7 have been ranked as A or B (two of these were ranked as B-C). ~~These seven occurrences~~Nine populations account for 66 percent of the known individuals based on counts recorded in good years in which germination rates were high (76 FR 45054).

Land Ownership and Special Management Designations

According to the Final Listing Rule, of the 625.9 known occupied acres of DeBeque phacelia, approximately 80.9 percent are on lands managed by BLM, 11.9 percent are on private lands, 6.6 percent are on lands managed by the United States Forest Service (USFS), and 0.7 percent are on lands managed by the Colorado Division of Wildlife (now Colorado State Parks and Wildlife [CPW]) (76 FR 45054). The Pyramid Rock occurrence, which supports up to 3,050 individuals (4 percent of all known plants), is within the Pyramid Rock ACEC/ RNA and the Pyramid Rock Natural Area, which are ~~managed for the~~ provide limited protection ~~of~~for the species by restricting activities that would otherwise impact DeBeque phacelia or its habitat. Livestock grazing management inside the designated areas is the same as in areas outside.

Demography

As is typical for annual plant species, the number of DeBeque phacelia individuals in any given occurrence can fluctuate dramatically between years depending upon environmental conditions. According to the final listing rule, individual plant numbers at the Horsethief Mountain population fluctuated from 1,700 plants in 1986, to 50 in 1992, 1,070 in 2003, ~~and down to~~ a few from 2006 to 2008 (76 FR 45054~~).~~), and no plants in 2012 (Gina Glenne, pers. comm.). A portion of the Pyramid Rock population was monitored annually by CNAP between 1997 and 1999. Numbers varied from 750 in 1997 to zero in 1998 to 6 in 1999 (CNAP 1997, 1999, 2000). Monitoring of DeBeque phacelia adjacent to the Collbran pipeline between 2009 and 2010 identified roughly a 250 percent increase in abundance in one plot, with no change in another plot (WWE 2010).

Land Health Assessments

The action area for DeBeque phacelia lies within the DeBeque-Roan Creek (66 percent), Kannah Plateau (21 percent), and Rifle-West Watershed (7 percent) LHA units, with a small portion (6 percent) inside another LHA unit not yet assessed. BLM spatial data from these units are not adequate to determine the status of Standard 4. LHA reports for Rifle-West and DeBeque-Roan Creek units provide more specific information on the status of DeBeque phacelia. The written report for the Kannah Plateau unit has not yet been drafted. The following overview of Standard 4 for the action area is based on a combination of spatial and LHA data.

Within the DeBeque-Roan Creek unit, last assessed in 2006, no determination was made on the status of DeBeque phacelia because no individuals germinated that year (BLM 2008c). The Rifle-West Watershed LHA unit contains two known occurrences of DeBeque phacelia, both in the County Line Allotment (BLM 2005a). When last assessed in 2005, Standard 4 was being met for this species, although the County Line Allotment was not meeting Standard 3 for healthy plant communities. Increased cover by exotics, especially *Bromus tectorum*, lack of diversity and abundance of cool season perennial grasses and perennial forbs, and reduced abundance of sagebrush and greasewood were contributing to the poor habitat conditions. According to spatial data, Standards 3 and 4 combined were meeting in 82 percent, not meeting in 16 percent, meeting with problems in one percent, and undetermined in one percent of the Kannah Plateau LHA unit. Combining all the available sources of information, Standard 4 has not been assessed (or the assessment was inconclusive) across 72 percent, was meeting over 24 percent, was not meeting over 3 percent, and was meeting with problems over less than one percent of the action area.

Threats
The primary threats identified for this species in the final listing rule are destruction, modification, fragmentation, or curtailment of habitat and range, and climate change. The factors contributing to habitat loss and fragmentation include: (1) oil and natural gas exploration and development with attendant pipeline, road, and utility line expansions; (2) development of new electricity transmission and distribution facilities within the Westwide Energy Corridor; (3) ORV recreation; (4) trampling from livestock and wild ungulates; and (5) potential water reservoirs. The effect of past and present threats on the status of the species is described in the *Environmental Baseline* section.

DeBeque Phacelia Designated Critical Habitat
~~Note: The following section was updated by the Service to reflect the~~The recent designation of critical habitat for DeBeque phacelia~~, which~~ occurred after the BA for this project was submitted by the BLM. In the BA, BLM requested conferencing for proposed critical habitat for the species, with the goal of confirming the conference opinion once the critical habitat was designated. Therefore, the analysis, conclusions, and effects determinations provided by the BLM for proposed critical habitat were carried forward in this BO, but updated to address the current status of critical habitat as designated.

Critical habitat for DeBeque phacelia was proposed on July 27, 2011 (76 FR 45078). The Final Rule for critical habitat for DeBeque phacelia was published by the Service on August 13, 2012, with an effective date of September 12, 2012 (77 FR 48368). The Final Rule provides a comprehensive review of the characteristics, extent, and status of critical habitat for the species. Designated critical habitat for the species includes approximately 25,484 acres across 9 units covering Federal, state, and private lands. Critical habitat was defined primarily by a minimum convex polygon around all known and historic ~~occurrences~~populations, plus a 100-meter buffer outside of the polygons. Therefore, critical habitat coincides well with *occupied* and *reasonably certain to be occupied habitat*, as defined in this BA.

Primary Constituent Elements
The Final Rule identifies the following PCEs for critical habitat:

1. Suitable soils and geology: Within the Atwell Gulch and Shire members of the Wasatch formation, areas 1 to 100 m^2 in size on colorful exposures of chocolate to purple brown to

gray or tan soils. These areas have a higher clay content and different texture than adjacent soils. Areas include clay soils that shrink and swell dramatically, and are alkaline, with a pH between 7 and 8.9.

2. Topography: Moderately steep slopes (2 to 42 degrees), benches, and ridge tops adjacent to valley floors.
3. Elevation and climate: Elevations ranging from 4,600 to 7,450 feet, and climatic conditions similar to those around DeBeque, Colorado.
4. Plant community: Barrens from 1 to 100 m^2 in size with less than 20 percent plant cover in the least vegetated portions of the site. Clay badlands occurring in patches of salt desert scrub and big sagebrush shrubland within pinyon-juniper woodland. Associates include *Grindelia fastigiata, Eriogonum gordonii, Monolepis nuttalliana, Oenothera caespitosa*, and nonnatives such as *Bromus tectorum*.
5. Maintenance of the seed bank and appropriate disturbance levels: Within suitable soils and geology, undisturbed areas, and areas with light disturbance when dry, and no disturbance when wet.

Land Ownership and Special Management Designations

Of the 25,484 acres of designated critical habitat, approximately 22,013 acres (86 percent) occur on Federal lands (with the majority on BLM), 192 acres (.75 percent) occur on State lands, and 3,278 acres (13 percent) occur on private land. The Pyramid Rock Unit is the largest of the nine critical habitat units, comprising 61 percent of total designated critical habitat. The 552-acre Pyramid Rock ACEC/ RNA and the Pyramid Rock Natural Area, both managed for the protection of the species, occupy the southeast corner of this unit. Livestock grazing management inside these designated areas is managed the same as in areas outside.

Land Health Assessments

Critical habitat for DeBeque phacelia occurs inside the DeBeque-Roan Creek, Rifle-West Watershed, and Kannah Plateau LHA units. PCEs are not directly addressed in the LHA reports or spatial data. For example, assessment of Standard 1 for upland soils may provide some insight into the status of the soil PCE in the units, but the reports do not specifically address soil texture. Also, Standard 3 for healthy upland plant communities is not considered useful for assessing the condition of the vegetation-based PCE since the LHA reports did not specifically evaluate barren areas.

Within the Rifle-West Watershed LHA unit, soils falling inside critical habitat all met Standard 1 (BLM 2005a). Within the DeBeque-Roan Creek LHA unit, which covers the majority of critical habitat, three allotments were assessed that contain critical habitat: Coon Hollow (06712), Logan Gulch (06733), and Winter Flats/Deer Park (06713). Standard 1 for soils was met throughout the Coon Hollow allotment. A small portion of Logan Gulch (7 percent) met the standard with problems, and a small area in Winter Flats/Deer Park (0.4 percent) did not meet the standard. Erosion was cited as a concern in all three allotments, and spring grazing was viewed as an existing or potential causal factor contributing to less than optimal soils conditions (BLM 2008c). Standard 1 data are not available for the Kannah Plateau LHA unit.

Threats

~~According to the Service, special management practices would be required within all nine critical habitat units to address threats to the PCEs (76 FR 45078).~~ Activities with the potential to alter PCEs include: (1) oil and natural gas exploration and development with attendant pipeline, road, and utility line expansions; (2) development of new electricity transmission and distribution facilities within the Westwide Energy Corridor; (3) ORV recreation; (4) trampling from livestock and wild ungulates; and (5) potential water reservoirs. The final rule designating critical habitat stated that special management practices would be required within all nine critical habitat units to address threats to the PCEs (76 FR 45078). Another threat to critical habitat is invasive weed species, in particular *Bromus tectorum* and *Halogeton glomeratus*. Within the DeBeque Unit, residential and agricultural development is listed as an additional threat. The effect of past and present threats on the status of critical habitat is described in the *Environmental Baseline* section.

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR §402.02). The implementing regulations for section 7(a)(2) define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 *CFR* 402.02).

Past and Current Uses

This section provides an analysis of the past and ongoing human and natural factors that have affected and continue to affect the current status of the three focal species and their habitat, including critical habitat, in the action area. All three species and associated critical habitat are treated together, given that effects to all from the various factors are generally similar.

Past and current human uses of BLM-managed land within the action area include: major utility line rights-of-way (ROW); natural gas development; water developments and pipelines, especially check dams and irrigation projects; military training; road construction and highway expansion; livestock grazing; ORV use and other recreational activities; and illegal collection. Past and current human uses of other lands in the action area include primarily agriculture, both crop- and rangeland, and residential development. Natural factors contributing to the status of the species include herbivory by animals and insects and trampling by wildlife. Effects from climate change are also possible. These anthropogenic and natural factors have undoubtedly contributed to changes in the distribution and abundance of the three focal species and altered important habitat characteristics, including PCEs in critical habitat.

Utility Lines

Expansion of utility lines has kept pace with population growth in the region. Rights-of-way issued for development of these lines have resulted in both direct and indirect effects to the three focal species and their habitats. Examples of transmission lines in the action area that have undergone section 7 consultation for effects to Colorado hookless cactus include the Xcel Grand Junction Conversion Transmission Line, which pass through eight miles of the action area for Colorado hookless cactus; the Tri-State Starr Nelson-Doughspoon-Garnet Mesa 115kV Transmission Line, which passes through nine

miles of the action area for Colorado hookless cactus; and the Public Service Company of Colorado Cameo-Grand Valley Power Line that passes through approximately 3.5 miles of Colorado hookless habitat on BLM land. The Tri-State line resulted in transplantation of 78 cacti. The Grand Junction-Montrose 115kV transmission line has also impacted Colorado hookless cactus. The planned East Montrose Transmission Line passes 15 miles through occupied clay-loving wild buckwheat habitat, with no direct take anticipated from construction (BIO-Logic 2011).

In addition to the direct effects that transmission line construction has had on the focal species, transmission line ROWs may promote the spread of noxious weeds, affecting native plant communities and listed plant habitat. Transmission line corridors and associated access roads also provide new access into otherwise roadless areas, indirectly increasing effects to plants and critical habitat from recreation, especially ORV use. Utility ROW also create extensive linear disturbance that fragments habitat; a discussion of fragmentation effects is provided in the *Road Construction and Highway Expansion* section. The most recent Escalante LHA report from UFO indicated that Colorado hookless cactus habitat in the area has been degraded by power and telephone line ROWs (BLM 2010a).

Natural Gas Development

Natural gas development has occurred within occupied habitat for Colorado hookless cactus and DeBeque phacelia, with none to date in clay-loving wild buckwheat habitat. Approximately 84 percent of the action area for DeBeque phacelia, 35 percent for Colorado hookless cactus, and 2 percent for clay-loving wild buckwheat are currently leased for oil and gas drilling. Based on current spatial data available from BLM, there are 78 gas wells within the action area for Colorado hookless cactus, and 55 for DeBeque phacelia. The Final Listing Rule for DeBeque phacelia noted that 60 gas wells occur within the same legal section as 18 of the 22 known occurrences, and that gas facilities are found in 11 of the 22 DeBeque phacelia mapped element occurrences (76 FR 45054). According to the Final Rule for critical habitat rule for DeBeque phacelia, the species occurs within the second largest natural gas producing area in Colorado (76 FR 45078). Colorado hookless cactus also occurs in this area.

Effects to DeBeque phacelia and Colorado hookless cactus from oil and gas development have been direct through loss of plants and habitat, and indirect through such factors as changes in drainage patterns and infiltration rates, soil contamination, increased spread of noxious weeds, potential changes in pollinator service (Colorado hookless cactus only), and effects from fugitive dust~~.~~, pollutants, and erosion. In addition to effects from pads, development of oil and gas service roads and pipelines have created extensive linear disturbance within occupied habitat that has resulted in habitat loss and fragmentation. Examples of large-scale gas pipeline disturbance that underwent section 7 consultation include the TransColorado Pipeline, which traverses 5 and 46 miles, respectively, of the action area for DeBeque phacelia and Colorado hookless cactus, and the Collbran Pipeline, which also travels through the action area for these two species. The TransColorado Pipeline led to transplantation of approximately 1,200 Colorado hookless cacti, with an estimated 19 percent mortality rate over a five-year period (BIO-Logic 2008 and references therein), whereas the Collbran pipeline was expected to have only indirect effects to Colorado hookless cactus and DeBeque phacelia (WWE 2010).

Although surface disturbance from oil and gas development can be viewed as temporary if the life of a gas well is about 30 years, reclamation success on abandoned pads, roads, and pipelines is often poor, and original habitat characteristics are seldom recovered. Pipeline corridors often open otherwise

roadless areas to recreational use, especially by ORVs, creating indirect effects to plants and their habitat.

Water Developments
The arid Grand and Uncompahgre Valleys, where the majority Colorado hookless cactus and clay-loving wild buckwheat plants occur, were transformed into major agricultural regions by the Bureau of Reclamation Grand Valley and Uncompahgre Projects during the early part of the 20th century, before the ESA was enacted. Based upon what is known of the current distribution of these two species, it is possible that the extensive system of irrigation canals and ditches may have directly affected plants and altered habitat. Some clay-loving wild buckwheat plants occur directly adjacent to ~~an~~ historic ~~canal~~canals or lateral ~~line~~lines. Much of the development has occurred on BLM land, although laterals and delivery ditches extend onto private lands in the action area. The South, East, Loutsenhizer, Peach Valley, Selig, and North Canals—all ~~-~~major canals that are part of the Uncompahgre Project—intersect occupied clay-loving wild buckwheat habitat east of Montrose, Colorado. All of these canals, in part or full, are serviced by parallel access roads that pose a threat noxious weed invasion and that may improve access by recreational uses. Recent canal maintenance may have affected at least two clay-loving wild buckwheat occurrences (FWS 2009b), indicating that potential effects from irrigation systems are not just historic.

Four canals serve the DeBeque area, and may have affected DeBeque phacelia and its critical habitat.

In the mid-20th century, BLM undertook watershed improvement projects in occupied Colorado hookless cactus and clay-loving wild buckwheat habitat, including check dams and contour furrows to control erosion and the flow of salts to the Gunnison and Colorado Rivers. According to BLM spatial data, 807 check dams have been recorded within the action area for Colorado hookless cactus, and 1,035 within the action area for clay-loving wild buckwheat. Effects to the species from these improvements likely occurred, although this has not been confirmed.

Military Training
Two National Guard artillery ranges were located on BLM lands within the Colorado hookless cactus action area: The Cactus Park Training Area (1,366 acres) and Delta Militia Rifle Range (79 acres). Both sites have since been closed, but operations likely affected cacti. Also, the recent removal of unexploded ordnance from the Delta Militia Site may have affected cacti.

Road Construction and Highway Expansion
The proliferation of roads in the action area has affected the three plant species and critical habitat for DeBeque phacelia (Table 2). The expansion of State Highway 50 to four lanes between Montrose and Grand Junction is an example of a road project that underwent section 7 consultation for direct and indirect effects to Colorado hookless cactus on BLM lands. According to the listing rule for DeBeque phacelia, “frequently traveled” roads bisect or otherwise cross nine occurrences (76 FR 45054).

The deleterious effects to plants from roads are numerous and well-documented. Roads fragment habitat, and fragmentation decreases patch size and increases edge effects, with possible consequences to pollinator behavior and gene flow (Ågren 1996; Bhattacharya et al. 2003; Honnay and Jacquemyn 2007). Roads facilitate the spread of noxious weeds (Hansen and Clevenger 2005; Christen and Matlack 2009) and unpaved roads create dust that can alter soil chemistry (Brown 2009) and interfere with gas exchange (Vardaka et al. 1995; Rasoul Sharif et al. 1997). Roads also promote public access to occupied habitat with attendant effects on plants, soils, and overall habitat quality.

Table 2. Estimated existing roads (miles) in the action area.

	US Highway and Interstate	County or State Road	Roads	Primitive Roads
Colorado hookless cactus	72	328	948	1,271
Clay-loving wild buckwheat	--	23	108	140
Debeque phacelia	17	41	70	186

Source: BLM spatial data (CRVFO, GJFO, UFO).

	US Highway and Interstate	County or State Road	Roads	Primitive Roads
Colorado hookless cactus	72	328	948	1,271
Clay-loving wild buckwheat	--	23	108	140
Debeque phacelia	17	41	70	186

Source: BLM spatial data (CRVFO, GJFO, UFO).

Livestock Grazing

This section includes a summary of inferred effects from historic grazing in the action area and a discussion of effects from post-FLPMA grazing. Effects from domestic livestock operations on private lands that may be affected by BLM-authorized grazing are also described. Effects from future livestock grazing and grazing operations are discussed in the *Effects Analysis* section.

Since the region was settled in the late 1880s, there has been widespread use of public lands for livestock grazing. It was not until the Taylor Grazing Act became effective in 1934 that grazing on public lands became regulated within a system of allotments with use restrictions. According to BLM, anecdotal accounts of the early history of grazing in the area indicate that grazing intensity was once much greater than it is today, resulting in widespread changes to vegetation communities and soils in the area. Potential effects to vegetation include a lack of cool season grasses and forbs in communities where they would otherwise be expected, and unnatural dominance by annuals, exotics, and woody species (BLM 1999a, 2002, 2005b, 2008b, 2010a). It is possible that such modification of habitat has influenced the abundance and distribution of the three plant species. Historic effects from range improvement projects and management of livestock operations very likely occurred as well. These effects would be similar to those caused by current livestock management activities, as described in the *Effects Analysis* section.

Post-FLPMA rangeland management has likely resulted in on-going effects from livestock grazing to Colorado hookless cactus, clay-loving wild buckwheat, DeBeque phacelia, and critical habitat.

Approximately 97 to 99 percent of the action area for each species is currently allocated to grazing. Impacts may be caused by livestock or grazing operations such as trailing, watering, herbicide application, and construction and maintenance of associated range improvement projects (Table 3). These effects are described in the *Effects Analysis* section.

Domestic livestock operations on private land in BLM allotments or nearby may have also affected the three species. In one case, a livestock operation on private land impacted clay-loving wild buckwheat critical habitat (49 FR 28562). At the time the species was listed and critical habitat designated, the PCE of sparsely vegetated shale badlands had been affected by trampling and grazing from livestock concentrated within corrals and fenced pasture, and an estimated 50 percent of buckwheat individuals had been extirpated (Patterson et al. 1983, cited in FWS 2009). It is likely that other ranching operations occur on private lands inside the action area and that these operations have affected the three species and critical habitat. Effects from future livestock grazing and management on private lands within BLM allotments are discussed in the *Cumulative Effects* section.

Table 3. Estimated existing range improvements on BLM lands in the action area.

Action Area	Range Improvement			
	Fence (miles)	Stock Trails (miles)	Water Pipelines (miles)	Water Developments[1] (count)
Colorado hookless cactus	192.4	110.1	20.4	704
Clay-loving wild buckwheat	3.6	5.7	0	9
Debeque phacelia	45.6	5.5	3.7	139

[1] Water developments include stock ponds, reservoirs, retention dams, and developed springs.
Source: BLM spatial data (CRVFO, GJFO, UFO).

Action Area	Range Improvement			
	Fence (miles)	Stock Trails (miles)	Water Pipelines (miles)	Water Developments[1] (count)
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[1] Water developments include stock ponds, reservoirs, retention dams, and developed springs.
Source: BLM spatial data (CRVFO, GJFO, UFO).

Agricultural and Residential Development

Agricultural and residential development is identified by the Service as a threat to all three species and critical habitat (76 FR 45054; 76 FR 45078; FWS 2009b, 2010). Agricultural and residential development may affect the three species and critical habitat in a myriad of ways, including direct loss of plants and habitat, and indirect effects from fragmentation, herbicide application, proliferation weeds, and an increase in recreational activities.

Off-road Vehicle (ORV) Use and Other Recreational Activities

Large parts of the action area are open to ORV use. Although use restrictions apply in occupied habitat, ORV use is notoriously difficult to control. Off-road vehicle use in the action area has been observed to affect all three species and their habitats (76 FR 45054; 76 FR 45078; FWS 2009b, 2010) or is identified as a potential threat (BLM 2002, 2007b, 2009b, 2010a). Reveal (2006) noted the near destruction of a clay-loving wild buckwheat occurrence by ORVs. BLM has documented direct effects to Colorado hookless cactus from ORV activity in the North Delta ORV Open Area (Sharp 2012a, pers. comm.). In addition to direct effects to plants from crushing, indirect effects may be induced by soil disturbance and habitat fragmentation (Ouren et al. 2007). In the badland soils in which all three species occur, ORVs break the surface crust created by the high clay content, or damage biological soils crusts if they are present, exposing soils beneath to erosion from wind and water and altering water infiltration (Belnap 1995; Ouren et al. 2007). In addition to the above effects, ORV use can also introduce and promote the spread of noxious weeds.

Other examples of recreational activities known to impact Colorado hookless cactus include golfing and panning for gold. The Devil's Thumb Golf Course, which involved the sale of public land to the City of Delta, underwent section 7 consultation for effects to Colorado hookless cactus. Gold panning along the Gunnison River (Rattlesnake Gulch) near a Colorado hookless cactus occurrence was halted by BLM due to observed impacts to habitat adjacent to cacti (approximately 50 cacti were found in the vicinity) (BLM 2009b).

Illegal Collection of Plants

The listing rule for the Uinta Basin hookless cactus complex states that severe over-collection of the species has already occurred (44 FR 58868). Based on Colorado hookless cactus monitoring results in the 1980s, BLM thought a major decrease in abundance at one site may have been due to illegal collection (BLM 2009b). In the *Recovery Outline*, vandalism of cacti was noted as a concern, but there were no known problems with illegal collection (FWS 2009b). ~~Illegal~~However, there have been several instances more recently that suggest illegal collection ~~does not appear to~~may be ~~a significant issue for~~threatening Colorado hookless cactus in the action area~~.~~ (Gina Glenne, pers. comm.).

Herbivory and Trampling by Wildlife

Trampling of plants or habitat by big game has been noted at several sites. In 2011, CRVFO documented five mature Colorado hookless cactus plants that had been uprooted. The plants had been kicked out of the ground and the roots exposed, causing all plants to die. Since there was no authorized livestock grazing in these areas in 2011, and since large hoof prints were seen in the vicinity, trampling was attributed to elk (DeYoung 2012b, pers. comm.). Big game may browse clay-loving wild buckwheat to some degree, based upon the species' apparent palatability to domestic sheep (Sharp 2012b, pers. comm.), ~~but such use~~and heavy trampling by elk has ~~not~~ been ~~documented.~~observed (Gina Glenne, pers. comm.).

Tent caterpillars nest in clay-loving wild buckwheat (BLM 2007c). These animals consume the buckwheat leaves and may cause mortality in some plants (Sharp 2012c, pers. comm.). The cactus borer (Moneilema semipunctatum) has widespread effects on Colorado hookless cactus (BLM 2009b; WWE 2010), and herbivory by rodents and lagomorphs (rabbits) has been widely noted (BIO-Logic 2008; FWS 2010 and references therein). The population-level effects to clay-loving wild buckwheat and Colorado hookless cactus from these herbivores remain unstudied. Herbivory may interact with

anthropogenic disturbance or stochastic events to tip the balance towards decline in some populations, especially in small habitat patches under fragmented conditions.

Climate Change

~~The Service provided a~~A thorough review of the potential for climate change to affect all three species and their critical habitat ~~(~~can be found in the following documents: 76 FR 45054; 76 FR 45078; FWS 2009b, 2010~~)~~. Predicted changes in temperature and precipitation patterns are expected to influence plant establishment and survivorship, as well as seed bank dynamics. Related effects to the species' habitats are also expected to affect the distribution and abundance of the three species.

EFFECTS OF THE ACTION

Livestock Grazing Effects on Soils and Terrestrial Vegetation

Domestic livestock grazing can affect plants and their habitats through physical impact from herbivory and trampling; deposition of nutrient-rich feces and urine; and by dispersal of plant propagules over the landscape on their hooves, hides, and in their guts. Effects may be direct, through herbivory, crushing, or burial of individual plants and their seeds. Effects may also be indirect, through modification of habitat components such as soil, biological soil crusts, and vegetation community. The magnitude and intensity of these effects on rare plants depends on many factors, including grazing intensity and timing, livestock species, plant species' habit and life history, and the nature of the soils and vegetation community the plants grow in. Following is a brief overview of the various ways in which livestock may affect plants and their habitats.

Herbivory

Direct damage from grazing herbivory will not kill a plant unless an individual is uprooted or its meristem is destroyed. Low to moderate amounts of herbivory can stimulate new growth, whereas overgrazing can stunt growth and cause hedging in woody species. If grazing occurs during the flowering and fruiting period, reproductive structures may be eaten, causing a decrease in reproductive success or even reproductive failure. Different livestock species target different groups of plants: Cattle consume mostly grass and herbaceous forbs, whereas sheep prefer grasses and forbs, but will also browse on woody plant tissue. Sheep are known to show seasonal preferences, consuming more woody forage in the winter when their preferred herbaceous forage is absent (Pollock et al. 2007; NRC 2008), although there are exceptions. Within the action area cattle have been observed to browse heavily on *Sarcobatus vermiculatus* during the winter (Conner 2012, pers. comm.).

Herbivory can affect rare plant species indirectly by changing vegetation community composition and structure. Livestock preference for some species and age classes can interfere with successional processes and decrease density and biomass of some species (Fleischner 1994), potentially altering the function and value of a site for rare plant species. Such changes may be especially important for species whose presence is correlated with associates or a certain level, or range, of vegetation canopy cover. Livestock and cattle in particular may prefer native

vegetation over weeds under certain conditions, leading to changes in vegetation community composition (Belsky and Gelbard 2000).

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Trampling
Trampling can affect plants through crushing and is thought to bury seeds of one rare annual so deeply that they can no longer germinate (Meyer et al. 2005, 2006). Trampling may also affect plants and their communities indirectly by disturbing soils. Soil compaction and disturbance to physical and biological soil crusts are other potential effects. Soil compaction has been shown to inhibit root growth (Ouren et al. 2007; Potter et al. 1985) and alter hydrologic processes important to plants (Fleischner 1994; Jones 2000). Disturbance to biological soil crusts can increase wind and water erosion of soils (Belnap 2001; Belnap et al. 2009), with resulting loss of nutrients (Belnap 2002; Neff et al. 2005) and decrease in water infiltration (Belnap 1995), both of which are likely to have disproportionate effects in arid ecosystems. These effects can alter the function and utility of habitat for rare plant species, especially edaphic endemic species.

Other factors will also determine the level of effects due to trampling. When wet, soils with high clay content are susceptible to compaction and damage. Therefore, the timing of trampling (i.e., spring) is an important factor. Effects from trampling will be greatest in areas where livestock concentrate, such as along trails, at salt licks, and at watering holes and troughs. Sheep congregate in bedding grounds and during herding or trailing. This behavior results in distinctive swaths of heavily trampled soil and vegetation.

Nutrient Deposition
Livestock introduce organic matter, nitrogen, and salts to plant communities through their feces and urine. These introductions are typically concentrated in areas that are heavily used, especially in bedding grounds and along trails, and at watering holes and salt licks. Soils amended with nitrogen may promote invasion by annual exotics, including *Bromus tectorum*, and inhibit growth of native or perennial grasses (Kay and Evans 1965; Wilson et al. 1966). Effects may be exacerbated in nutrient-low soils that are typically preferred by rare plants.

Seed Dispersal and Weed Invasion
The correlation between livestock grazing and invasion by exotic plant species is well documented, especially in semi-arid environments (Belsky and Gelbard 2000). Mechanisms include not only dispersal of propagules, but disturbance of soils and biological soil crusts, creation of nutrient-rich patches of soil, and preferential grazing of natives over exotics (Belnap 1995; Belsky and Gelbard 2000). Invasion by exotics has been shown to alter ecosystem processes, including nutrient cycling and fire regime (D'Antonio and Vitousek 1992; Ehrenfeld 2003). *Bromus tectorum*, which dominates disturbed sites throughout the action area, has been shown to decrease nitrogen availability to plants following invasion of undisturbed grassland on the Colorado Plateau (Evans et al. 2001) and to increase fire frequency (Knapp 1996; Whisenant 1992).

Livestock Grazing Operation Effects on Soils and Terrestrial Vegetation

The BLM livestock grazing program involves a number of operational activities secondary to grazing that have the potential to affect Colorado hookless cactus, clay-loving wild buckwheat, DeBeque phacelia, and critical habitat. These activities include the construction and maintenance of range improvements (fences, corrals, water developments, unimproved access routes, cattleguards, etc.), salting and supplementing, livestock trailing and bedding, livestock handling, rangeland treatments, and utilization and trend monitoring. Water developments may include detention dams and stock ponds, developed springs, troughs, and water pipelines. All of these activities have the potential to affect the three focal species and their habitat directly and indirectly.

Direct effects from operation and maintenance activities are possible and include killing or otherwise damaging plants by physical impact or potentially herbicide application and drift. Grazing infrastructure and concentrated use by livestock in occupied habitat have the potential to result in direct loss of habitat, including damage to PCEs within critical habitat. Concentrated livestock use during permitted and routine trailing, bedding (especially sheep), watering, and salting are the most difficult factors to control. Concentrated use has the potential to affect plants, soils, and other habitat features through trampling and nutrient deposition.

Indirect effects would be more varied and may include proliferation of weeds on disturbed surfaces, especially near water developments, and soil degradation, resulting in habitat alteration or loss through changes in vegetation community. Potential effects of soil degradation and invasion by exotic species into rare plant habitat are reviewed above. Indirect effects may also occur if herbicides impact pollinator service of individual plants, resulting in decreased reproductive output.

Unimproved access, livestock trails, and patchy habitat loss from other operational activities may result in fragmentation of habitat for the three focal species. It appears unlikely that the size of these features would interfere in gene dispersal for the three focal species, especially if permitted trailing occurs outside the reproductive period whenever possible. These features will create edge effects, the most significant of which would be an increase in weeds, and possibly episodic, short-term increased exposure to dust along access routes and trails.

Direct and Indirect Effects from the Proposed Action

Colorado Hookless Cactus

Review of Potential Effects

Physical damage to Colorado hookless cactus individuals from sheep bedding and moderate to heavy trampling by livestock have been observed (BLM 2002, 2009b, 2010a; FWS 2010). Even when direct mortality does not occur, trampling damage may make individual plants more susceptible to desiccation or herbivory from insects or small mammals. No evidence of browsing by livestock on this species has been reported.

The original listing rule for Colorado hookless cactus (at the time, Uinta Basin hookless cactus) stated that, “Limited grazing of its habitat appears to be beneficial for this species. Greatly

increased or decreased grazing could contribute to a decline of the species". The *Recovery Plan for Uinta Basin Hookless Cactus* questioned whether a decrease in grazing would affect habitat for this species (FWS 1990). However, the more recent *Recovery Outline* for Colorado hookless cactus identifies livestock grazing as a threat to the species (FWS 2010). No studies have addressed the possible relationship between livestock grazing impacts and habitat function for this species. Over the course of a 20-year study of another federally listed species of *Sclerocactus*, *S. wrightiae*, ~~Clark and Clark (2007)~~scientists observed a more rapid increase in density inside a cattle exclosure compared to a grazed area adjacent to the exclosure~~.~~ (Clark and Clark 2007). Without replication, it is difficult to make conclusions from the study.

The Escalante LHA report, completed in 2010, states that trampling and occasional mortality to cacti have been attributed to livestock and that grazing activities are likely impacting this species (BLM 2010a). The North Delta LHA, completed in 2002, specifically identifies sheep camps and bedding grounds as affecting local occurrences (BLM 2002). Within the North Fork LHA unit, assessed in 2006 and 2007, grazing contributed to 29 percent of the area not meeting or meeting with problems one or more of Standards 1, 3, and 4 (BLM 2007b). Overgrazing by livestock and wildlife was considered a threat to Colorado hookless cactus. In 2001, the Gunnison Gorge LHA was meeting Standard 4, and grazing was identified as a problem or threat to the species (BLM 2001).

In its northern range, Colorado hookless cactus occurs in two allotments inside the Rifle-West Watershed LHA unit. According to the most recent assessment of the unit in 2005, sheep grazing has degraded the plant community in the County Line Allotment to such an extent that the currently stable cactus population was considered at risk (BLM 2005a). Following monitoring that specifically identified grazing as a factor contributing to the degraded state of the vegetation community, the CRVFO suspended grazing indefinitely in the allotment (DeYoung 2012b, pers. comm.). No grazing-related mortality or trampling of individual cacti was found in the Colorado hookless cactus occurrences inside the Whitewater Common-North Fork Kannah Creek or Northern DENCA LHA units when last assessed between 2006 and 2009 (BLM 2010b, 2010c).

The *Recovery Outline* noted that individual cacti are likely to be directly affected by herbicide and pesticide use, or indirectly if applications impact pollinators. Likewise, weed treatments associated with livestock grazing programs may affect cacti.

Effects of the Proposed Action

Eighty of the 100 or so documented occurrences of Colorado hookless cactus occur fully or partially on land managed by BLM. Approximately 97 percent of the BLM land in the action area for Colorado hookless cactus is currently allocated to grazing (Table 1). The area is divided among 104 allotments, including use by cattle and sheep with varied use, timing, and rotations (see the BA for details).

Direct effects to plants will occur through trampling, especially during concentrated use from salting, watering, trailing, and bedding. Although trampling and uprooting of Colorado hookless cactus by livestock has been observed, there are no data to indicate that it occurs commonly or

has been responsible for detectable landscape-scale changes in abundance or distribution of the species. Not all trampled plants will die. Based on field observations, plants can survive some damage and partial uprooting, and non-lethal damage may be compensated for through budding. However, if damaged plants direct resources towards tissue repair and away from reproduction, and if damage makes them vulnerable to desiccation and/or disease, they may have reduced reproductive output for some length of time and increased mortality compared to undamaged plants.

Physical impacts to cacti from activities secondary to grazing, such as herbicide application or vehicle use for herding or maintenance of range improvements, may also kill or impair plants. Herbicide use may also indirectly affect reproduction if pollinator populations are impacted. Five of the nine herbicides approved for use by BLM in their *Final Vegetation Treatments Using Herbicides Programmatic Environmental Impact Statement* (PEIS) are typically used on rangelands (BLM 2007a). The risk evaluations for all five herbicides presented in the PEIS conclude that the chemicals pose threats to non-target terrestrial plants species, especially from direct spraying at typical application rates, but in some cases also from drift. It is expected that implementation of the conservation measures~~ in the BA~~ and in accordance with the IWMPs will minimize threats to Colorado hookless cactus from herbicide applications.

Indirect effects to Colorado hookless cactus from grazing program-related changes in habitat may occur. Observations indicate that Mancos shale soils are vulnerable to surface disturbance and, once disturbed, the vegetation community is slow to recover and often becomes dominated by annual weeds (BLM 2002). ~~As noted above in the *Environmental Baseline* section, BLM believes these kinds of community-level changes are the result of intensive historical grazing, and that current management of livestock grazing is not likely to cause such disturbance except in areas of concentrated use.~~ Mature Colorado hookless cacti do exist in areas with a high percent cover of weedy species such as *Bromus tectorum* and *Halogeton glomeratus.* However, within the CRVFO, no recruitment of cacti has been documented in areas where cheatgrass infestations are dense, possibly because seedlings are unable to compete with weeds for water and nutrients (DeYoung 2012b, pers. comm.).

The deposition of livestock feces and urine in Colorado hookless cactus habitat may result in additional indirect effects to the species from the BLM grazing program. This species is restricted to soils poor in nutrients, making it possible that the introduction of organic matter and nitrogen from livestock feces and urine, especially in concentrated use areas, could alter soil physical and chemical properties in ways that may negatively affect Colorado hookless cactus and its plant associates.

The conservation measures place limits on concentrated use by livestock within occupied habitat, restrict use of motorized vehicles to designated routes during operation and maintenance activities, regulate use of herbicides, and do not authorize rangeland infrastructure maintenance and construction activities that would affect the species without further consultation. Implementation of conservation measures ~~will minimize direct and indirect~~should reduce effects to Colorado hookless cactus from BLM-authorized grazing and ~~activities secondary to it~~operations. With successful implementation of these measures, it is unlikely that the BLM

livestock grazing program will noticeably affect the current range-wide abundance and distribution of the species. However, not all effects to individuals and subpopulations are avoidable, and these effects are likely to be measurable in localized areas.

Clay-loving Wild Buckwheat

Review of Potential Effects

The primary threat to clay-loving wild buckwheat cited in the listing rule was concentrated grazing from horses. It was reported that all vegetation within a series of corrals and fenced pastures adjacent to occupied habitat had been eliminated, and that half of the plants at the site had been extirpated by grazing (Patterson et al. 1983, cited in FWS 2009b). At that time, the species was known from only this one occurrence on private land, where grazing was managed differently than on BLM. Since the species was listed, livestock grazing and trampling on clay-loving wild buckwheat have been reported, especially from winter and early spring grazing and bedding by sheep, with contrasting opinions on how detrimental these activities might be to species' health and survival (BLM 2007c, 2008b; FWS 1988, 2009a, 2009b).

The 1988 *Recovery Plan* noted that livestock grazing is likely to have little effect except with "season-long grazing, year-long grazing, high-density stocking, and use of sheep bed grounds …", but qualified that statement by saying that long-term studies are needed (FWS 1988). Although such studies have begun at Wacker Ranch and Fairview South ACEC, data analyses are not yet available. In 2008 and 2009, all four transects set out in the Fairview South ACEC contained sheep scat, footprints, and/or evidence of browsing (BLM 2011). No sheep were grazed in the ACEC in 2010. ~~Observed~~In the last 5 years, observed browsing damage on buckwheat by sheep during monitoring eliminated the previous notion that domestic sheep find the specie unpalatable.~~ The observation during monitoring that sheep were browsing clay-loving wild buckwheat was the first of its kind by the BLM, and it eliminated the previous notion that sheep find the species unpalatable.~~ In the monitoring area, sheep were thought to preferentially browse clay-loving wild buckwheat compared to *Krascheninnikovia lanata* (Sharp 2012d, pers. comm.), although no quantitative data are available to support this idea. A preliminary review of the monitoring data suggests that a shift in size class from larger to smaller individuals may have occurred over the three-year period, although the data have not been analyzed. A comparison of data from grazed and ungrazed transects at Fairview South and Wacker Ranch (although trespass grazing has occurred in the past) may help determine whether the change in size class is statistically significant and whether grazing is the causative factor in any such change. In February 2009, the Service documented "extensive trampling and grazing of individual plants" by sheep near the South Canal in the Shinn Park (05534) allotment (FWS 2009a).

When the Colona LHA report was completed in 2008, BLM concluded that current grazing did not cause any upland portion of the unit to not meet Standard 4, and only 960 upland acres to meet it with problems. Monitoring of grazing in clay-loving wild buckwheat habitat was

recommended (BLM 2008b). When the Gunnison Gorge LHA unit was last assessed in 2001, the entire analysis area met Standard 4 for clay-loving wild buckwheat and current grazing was not known to be impacting the species or its habitat (BLM 2001). Observations by BLM and FWS personnel in 2011 documented significant herbivory and trampling damage by sheep within this LHA unit near the Montrose Model Airplane property. Some plants were dead, although there is no direct evidence to link plant mortality to livestock grazing.

Grazing effects on this species vary from no effect following light grazing, to a beneficial effect from competitive release and biological soil crust removal, to elimination of plants in grazed versus ungrazed areas (BLM 2007c; FWS 2009b and references therein). Reported effects of livestock grazing on clay-loving wild buckwheat habitat include soil erosion in a sheep bedding ground that caused pedestaling of plants (BLM 2007c) and terracing from livestock trailing (Neely and O'Kane 1985, cited in FWS 2009b). The Service documented extensive pock-marking by sheep hooves on moist soils in February (FWS 2009a), when the freeze-thaw cycle often occurs daily in the valley bottoms where this species occurs.

The *5-Year Review* considered livestock grazing to be a moderate to high threat to the species on public and private lands. The imminence of the threat was considered moderate or low due to lack of data documenting adverse effects from grazing (FWS 2009b). Although BLM has documented herbicide use as a potential threat to clay-loving wild buckwheat (BLM 2009a), the Service considers the imminence and magnitude of the threat to be low (FWS 2009b).

Effects of the Proposed Action

A little over half of known clay-loving wild buckwheat occurrences are on land managed by BLM. Approximately 98 percent of the BLM land in the action area for clay-loving wild buckwheat is currently allocated to grazing (Table 1). This area is divided among 11 allotments, 8 of which are grazed by sheep, two by cattle, and one by both sheep and cattle. Season of use is predominantly winter, with six of the allotments extending into spring by approximately 15 days. Two of the allotments are grazed in the fall. Shinn Park and Dry Cedar, winter allotments, are in a deferred rest rotation strategy and receive yearlong rest from grazing every fourth year. The Shinn Park Allotment contains the South Fairview ACEC, which supports the largest known occurrence of clay-loving wild buckwheat. Under current terms and conditions, the ACEC is only permitted for five nights of use per year. In the Sulphur Gulch allotment, the AUM's allocated are for trailing only in spring and fall so grazing impacts are ~~truly~~ minimal. For the remaining allotments that receive annual grazing in the spring, the use areas/pastures are limited to 15 days as a term and condition of the permit. For the Brush Point Allotment, which permits spring use, seasonal use is concentrated on the mid to upper elevations of the allotment not known to support buckwheat.

Direct effects to plants will occur through browsing and trampling, especially during concentrated use from salting, watering, trailing, and bedding. Although browsing and trampling by BLM-authorized livestock have been observed more frequently in clay-loving wild buckwheat compared to Colorado hookless cactus, there are no data to indicate how commonly these activities affect individuals or whether they are responsible for landscape-scale changes in abundance or distribution of the species. A limited amount of browsing may stimulate new

growth, although there are no data to support this idea. It is possible, but remains untested, that most damaged plants would have reduced reproductive output for some length of time and increased mortality compared to undamaged plants. Allotments ~~that this~~where the species occurs ~~in~~ are generally grazed in the winter, when livestock are moved to lower elevations. Sheep often show seasonal preference for forage species, concentrating more on woody species in the winter if grasses are not available (Pollock et al. 2007; NRC 2008). It is possible, but remains unknown without further study, that sheep browse clay-loving wild buckwheat more readily in the winter than in other seasons when their preferred herbaceous forage is available. Preferential grazing of clay-loving wild buckwheat by sheep is thought to occur (Sharp 2012d, pers. comm.), but this has not been studied.

The effects of grazing on germinants and seedlings are more difficult to assess. Given some evidence of episodic recruitment events (DBG 2010a; BLM 2011), heavy trampling during a recruitment flush could have effects on population growth that would last for years. A decline in growth rate may reduce the resiliency of small occurrences to other forms of disturbance. Spring snowmelt makes it likely that soils will be wet and more vulnerable to compaction during germination. Compaction may indirectly affect germination or emergence rates. Without more study, these potential effects are difficult to evaluate.

Physical impacts to clay-loving wild buckwheat from grazing operations, such as herbicide application or vehicle use, may also kill or impair plants. Herbicide use may indirectly affect reproduction if pollinator populations are impacted. It is expected that implementation of the conservation measures, including conservation measures in the IWMPs, will minimize threats to clay-loving wild buckwheat from herbicide applications.

Indirect effects to clay-loving wild buckwheat from grazing program-related changes in habitat may occur. ~~As discussed above for the cactus, Mancos soils are vulnerable to disturbance, and the BLM believes that problem areas are the result of historic overgrazing. Current management of livestock grazing is not likely to cause such disturbance except in areas of concentrated use.~~ Concentrated use is likely to degrade clay-loving wild buckwheat habitat through soil compaction and surface modification. Trampling and bedding will break the surface crust common on Mancos shale soils and expose the subsurface to wind and water erosion, with ensuing soil and nutrient loss and changes in water infiltration rates (Belnap 1995; Jones 2000). In Mancos shale communities, soil compaction may stunt plant growth by restricting gas exchange between the roots and soil (Potter et al. 1985).

Of particular concern is the concentration of 90 percent of all known individuals (250,000 of 278,600) in one occurrence at Fairview South-Wacker Ranch. This skewed distribution makes the species especially vulnerable to stochastic disturbances and deleterious effects of all kinds, including BLM-authorized livestock grazing. Seventy-percent of the occurrence is currently allotted to livestock grazing. Protecting ~~the occurrence that is the center of distribution of the species~~core populations is especially important given that ~~in plants,~~ larger populations are positively correlated with individual fitness and genetic diversity (Leimu et al. 2006 and references therein), which ~~likely~~ makes larger populations more resilient to disturbance and

environmental variation. As described above, there are grazing restrictions designed to reduce impacts on these populations.

Protecting outlying smaller occurrences from negative influences due to BLM-authorized grazing is also important for maintaining the species range and genetic diversity. Further, peripheral populations are important for species' ability to "migrate" in the face of climate change or other stochastic perturbations.

Proposed conservation measures place limits on concentrated use by livestock within occupied habitat, restrict use of motorized vehicles to designated routes during operation and maintenance activities, restrict use of herbicides, and do not authorize -rangeland infrastructure maintenance and construction activities that would affect the species without further consultation. The implementation of these measures will minimize direct and indirect effects to clay-loving wild buckwheat from BLM-authorized grazing and operations. However, effects to the species and its habitat from the grazing program are unavoidable. Effects are expected to be measurable in localized areas where concentrated livestock use cannot be fully avoided and less detectable in areas where dispersed livestock use occurs.

Clay-loving Wild Buckwheat Critical Habitat

Review of Potential Effects

Effects to critical habitat from a domestic livestock operations were reported ~~by the Service~~ in the listing rule (49 FR 28562), but apply to a private ranching operation only. Critical habitat is currently affected by livestock operations that are interdependent with the BLM grazing program. A BLM trailing permittee currently runs cattle across critical habitat en route to designated trails on the nearby Shamrock Allotment (05024). The edge of the allotment is within approximately 1,500 feet of the eastern edge of critical habitat. However, the allotment fenceline deviates from the public land boundary, passing through critical habitat, making it possible that sheep permitted on the allotment during a one-month period in the spring stray into critical habitat (Holsinger 2012, in litt.).

The Service visited critical habitat in the summer of 2009 and 2010, but didn't observe any evidence of grazing (Glenne 2012, in litt.). During those visits, the Service observed that although occupied habitat appeared somewhat weedy, with little biological soil crust, the Mancos shale soils that comprise a PCE of critical habitat appeared to be in reasonable condition. The presence of weeds may mean that the various activities that occur on private land inside critical habitat may be affecting the PCE for vegetation community, which consists of sparsely vegetated shale badlands.

Effects of the Proposed Action

Potential effects to clay-loving wild buckwheat critical habitat from BLM-authorized grazing and attendant activities would be similar to effects to occupied habitat, as described above. Of the two PCEs identified in the final rule, effects would most likely be focused on the sparsely vegetated shale badlands rather than the Mancos shale soils themselves, unless the PCE for soils is expanded to include attributes of surface texture and compaction. Implementation of

conservation measures will minimize the potential for direct and indirect effects to clay-loving wild buckwheat critical habitat from BLM-authorized grazing and operational activities. However, some effects to the PCEs from the grazing program will likely be unavoidable. Effects are expected to be measurable in localized areas where concentrated livestock use cannot be fully avoided and less detectable in areas where dispersed livestock use occurs.

DeBeque Phacelia

Review of Potential Effects

Trampling of habitat by cattle has been recorded in element occurrence reports for 14 of the 22 DeBeque phacelia occurrences (CNHP 2010, cited in 76 FR 45054). ~~In the~~The final listing rule~~, the Service observed~~ states that heavy trampling compacts the soil, increases potential for erosion, and alters the surface cracking thought to be important for seedbank longevity and recruitment of the species. No evidence of browsing by livestock on this species has been reported.

There have been no studies of grazing impacts to DeBeque phacelia or its habitat. The Service reviewed documented adverse effects of livestock grazing on another rare annual, *Lepidium papilliferum*, dependent on its seedbank for persistence, and surmised that effects of livestock grazing to DeBeque phacelia are likely to be similar. *Lepidium papilliferum* grows in clay soils in seasonally wet depressions in the sagebrush steppe of Idaho. During 11 years of monitoring, ~~Meyer et al. (2005) documented~~ the loss of a subpopulation was documented following intensive trampling by cattle when soils were wet in the spring~~.~~ (Meyer et al. 2005). The authors hypothesized that trampling and other forms of disturbance to wet soils damage or bury the seedbank (Meyer et al. 2005) and decrease germinant survival (Meyer et al. 2006). Using simulations, the authors found that even less severe trampling events may contribute to population decline. They hypothesized that trampling may permanently destroy soil structure important to the species' survival and that the long history of grazing inside the species' range may explain why so much potential habitat is unoccupied (Meyer et al. 2006).

~~Although the Service has suggested that impacts~~Impacts from cattle trampling to DeBeque phacelia may be similar to those observed in *Lepidium papilliferum*, although it has not been studied. If impacts were, in fact, similar, they may not be comparable in terms of intensity. *Lepidium papilliferum* occurs in seasonally wet depressions that attract concentrated use by cattle, whereas DeBeque phacelia occurs on barren slopes that do generally not attract livestock (although more than half of the known occurrences have reported livestock trampling), unless the sites support infestations of the palatable *Bromus tectorum* and *Eremopyrum tritecium* or are near water developments. Cattle use of occupied habitat is reported to be more frequent at sites that support such infestations (Langton 2011, in litt.). Cattle trampling has been documented in 64 percent of the known occurrences of DeBeque phacelia, but the extent of trampling within each occurrence is unknown unless the CNHP element occurrence reports specifically address this issue. The Service identified soil modification and seedbank impacts from livestock trampling as a moderate threat to the species (76 FR 45054).

Effects of the Proposed Action

Approximately 81 percent of known occupied habitat for DeBeque phacelia is on lands managed by BLM. Of this, 99 percent is currently allocated to grazing (Table 1). This area is divided among 14 allotments that are currently grazed by cattle predominantly in the winter and spring; two are also grazed in the fall.

Direct effects to DeBeque phacelia plants from trampling by BLM-authorized livestock have not been recorded, but may occur given that occupied habitat is grazed in the spring, during the above-ground portion of the life cycle for the species. Direct effects from browsing are probably minor, given the small size of the plants and their prostrate nature. Based on study results ~~from Meyer et al. (2005, 2006),~~, it is possible that damage and destruction of seeds, germinants, and seedlings occur from trampling, especially when soils are wet during the freeze-thaw cycle in the winter and during snow melt in the spring~~.~~ (Meyer et al. 2005, 2006). Effects would be most pronounced in areas of concentrated use~~, which are likely to be limited on the barren slopes where DeBeque phacelia is typically found~~.

Physical impacts to DeBeque phacelia from grazing operations, such as herbicide application or vehicle use, may also kill or impair plants, although there has been no documentation of such effects and ~~the Service does~~they were not ~~consider them to be threats~~identified as to the species in our listing rule (76 FR 45054). Although DeBeque phacelia is known to co-occur with several species of invasives, it is unlikely ~~that~~ permittees would be concerned about treating infestations that occur in the barrens where DeBeque phacelia occurs. It is expected that implementation of the conservation measures will minimize threats to DeBeque phacelia from herbicide applications.

Indirect effects to DeBeque phacelia from grazing program-related changes in habitat may occur, especially due to impacts to soils from trampling, although no research exists to confirm such effects. If surface cracking does provide microsites necessary for survival and germination of the seedbank, trampling might modify this habitat feature, indirectly affecting the species. Allotments containing occupied habitat for DeBeque phacelia are grazed by cattle during the spring and winter when soils may be wet and susceptible to compaction, increasing the potential for deleterious effects to soil properties or seedbanks where trampling ~~is occurring~~occurs. Effects would be most pronounced in other areas where use is concentrated. As stated above, concentrated livestock use of DeBeque phacelia habitat is uncommon on the barren slopes occupied by the species. Activities secondary to grazing, such as vehicle use to maintain allotment infrastructure, may also result in soil surface modification and compaction.

Other effects to DeBeque phacelia habitat from livestock grazing include erosion and changes in soil nutrient status~~, although no research exists to confirm such effects and they are likely to be limited on barren slopes.~~. Trampling would break the surface crust common on the clay soils DeBeque phacelia grows in and expose the subsurface to wind and water erosion, with ensuing soil and nutrient loss. Increased contributions of organic matter and nitrogen from livestock feces and urine, especially in concentrated use areas, may alter soil chemistry and hydrology in ways that may affect DeBeque phacelia and its plant associates, especially given the highly alkaline soils preferred by the species.

Livestock grazing may increase cover of invasive exotics due to surface disturbance and transport of propagules. *Bromus tectorum*, *Halogeton glomeratus*, and *Eremopyrum tritecium* are potential threats in a number of DeBeque phacelia occurrences (76 FR 45054; Langton 2011, in litt.). An increase in percent vegetative cover due to an increase in annual exotics may alter habitat suitability for this species that is typically confined to barrens with less than 10 to 20 percent cover.

The highly restricted habitat requirements of DeBeque phacelia increase its sensitivity to grazing disturbance. The species is confined to small patches of suitable habitat over a very small geographic range. The small patch size of many occurrences increases their vulnerability to habitat modification, as does the fact that occurrences may remain dormant underground during drought years, making them difficult to detect by BLM and permittees.
~~The~~
Proposed conservation measures place limits on concentrated use by livestock within occupied habitat, restrict use of motorized vehicles to designated routes during operation and maintenance activities, restrict use of herbicides, and do not authorize ~~-~~rangeland infrastructure maintenance and construction activities that would affect the species without further consultation. Implementation of conservation measures will minimize the potential for direct and indirect effects to DeBeque phacelia from BLM-authorized grazing and operations. However, some effects to the species and its habitat from the grazing program will be unavoidable. Effects are expected to be measurable in localized areas where concentrated livestock use cannot be fully avoided and less detectable in areas where dispersed livestock use occurs.

DeBeque Phacelia Critical Habitat

Review of Potential Effects
Livestock grazing is a potential threat to critical habitat for DeBeque phacelia. Trampling may affect the PCEs of critical habitat by compacting soils, increasing erosion potential, and altering surface cracking thought to be important for seedbank longevity and recruitment (76 FR 45054). BLM data related to effects of livestock grazing to PCEs is limited. The DeBeque-Roan Creek LHA report notes that spring grazing by cattle inside critical habitat may contribute to small areas of upland soils not meeting Public Land Health Standard 1 for Soils (BLM 2008c), but does not directly address potential effects to soil texture. The most recent Rifle-West Watershed LHA report found that the County Line Allotment, which supports two occurrences of DeBeque phacelia, did not meet Standard 3 for healthy plant communities (BLM 2005a). An increase in cover by *Bromus tectorum* was noted and may be affecting the plant community PCE for critical habitat.

The critical habitat Final Rule (77 FR 48368) designating critical habitat for DeBeque phacelia determined that special management practices would be required within all nine units to adequately address threats (including livestock grazing) to the PCEs. The Service has not characterized the magnitude of the threat to critical habitat from livestock grazing, but recommends ~~"~~minimization of livestock use or other human disturbances that disturb the soil or seeds~~."~~.

Effects from the Proposed Action

Approximately 85 percent of DeBeque phacelia critical habitat occurs in BLM grazing allotments (14 total allotments). Livestock grazing and operations have the potential to affect the following PCEs: (1) suitable soils and geology, including surface cracks resulting from shrink-swell processes; (2) maintenance of the seed bank and appropriate disturbance levels, which is defined as undisturbed areas with undamaged seed banks, and areas with light disturbance when dry and no disturbance when wet, within suitable soils and geology; and (3) plant community, which is defined as barrens 1 to 100 m^2 in size with less than 20 percent plant cover in the least vegetated portions of the site.

Implementation of conservation measures will minimize the potential for direct and indirect effects to DeBeque phacelia critical habitat from BLM-authorized grazing and activities. However, some effects to the PCEs from the grazing program are unavoidable. Effects are expected to be measurable in localized areas where concentrated livestock use cannot be fully avoided and less detectable in areas where dispersed livestock use occurs.

Effects from Interrelated and Interdependent Actions

Interrelated and interdependent actions include grazing, trailing, bedding, and other operational activities on non-BLM lands that would not occur if BLM did not authorize grazing or trailing in their allotments. Effects from these interdependent actions to Colorado hookless cactus, clay-loving wild buckwheat, DeBeque phacelia, and associated critical habitat would be the same as effects from the proposed action on BLM.

Summary of Effects to the Three Species

Greater than 95 percent of occupied habitat for Colorado hookless cactus, clay-loving wild buckwheat, and DeBeque phacelia is allocated to BLM-authorized grazing (Table 1), including approximately 85 percent of critical habitat for DeBeque phacelia. A portion of designated critical habitat for clay-loving wild buckwheat is currently affected by BLM-authorized trailing and possibly grazing. BLM livestock grazing programs, therefore, have the potential to affect these species and their critical habitat. The Service has identified livestock grazing as a threat to all three species and associated critical habitat. There is evidence of impacts from grazing and grazing activities to Colorado hookless cactus and clay-loving wild buckwheat. Trampling of habitat by livestock has been observed in DeBeque phacelia habitat. ~~However, BLM feels that those activities do not affect the species, either individually or at a population level.~~

Since FLPMA was enacted, BLM has drastically reduced grazing intensity from historic levels and implemented a program for systematically evaluating permits and carrying capacity. Regular monitoring of rangeland heath is integral with the livestock grazing program and includes monitoring of threatened and endangered species and their habitats. Although a large proportion of occupied and critical habitat is open to livestock grazing, utilization is closely managed to maintain or remediate rangeland health. With the implementation of proposed conservation measures, effects from the grazing program to the three focal species will be minimized. Despite a long history of grazing on public lands, Colorado hookless cactus, clay-loving wild buckwheat, and DeBeque phacelia still persist~~. Under the current system of grazing management, BLM does not expect livestock grazing to cause a downward trend in regional~~

~~populations or alter the regional distribution of any of the three species; or impact designated critical habitat to an extent that would affect the survival and recovery of clay-loving wild buckwheat or DeBeque phacelia.~~, although we do not know how numbers today compare to those before livestock grazing was prevalent on the landscape.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological assessment (50 FR § 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.
In the action area, BLM lands occur in a mixture of private, local, State, and other federal lands, with private lands dominating. No tribal lands occur inside the action area.

Activities that occur on non-BLM lands within the action area include agriculture ~~including~~ and ranching; residential development; oil, gas, and utility line development; road development; and recreation, including hunting, fishing, ORV use, hiking, and mountain biking. The human population in the area has grown tremendously since 1990. This growth is likely to continue at near current rates for the foreseeable future, which will result in increased pressure from development and recreation on private, local, and State lands.

The Grand and Uncompahgre Valleys support a major agricultural industry and growing residential development. These activities will continue to affect the three species through direct loss of plants and habitat, and through habitat modification. New construction, development and maintenance of irrigation systems, use of herbicides, and increased pressure from recreation associated with residential development may affect the species and their critical habitat. Effects are likely to be greater for clay-loving wild buckwheat, which occurs on the Uncompahgre Valley floor within and around the communities of Delta and Montrose. Between 1990 and 2009, these cities grew approximately 144 and 108 percent, respectively (U.S. Census Bureau 2012). Development has been particularly rapid in this region and is expected to expand as ~~the populations of Montrose and Delta~~area cities continue ~~to grow~~growing. The Service estimates that about 40 percent of clay-loving wild buckwheat habitat has already been impacted by construction or agriculture (FWS 2009b). As development continues within the action area, recreational activities (e.g., OHVs) are likely to increase on private lands.

Future livestock grazing on private lands will affect the three species. Many of the BLM allotments in the action area include both BLM and private surface. The BLM does not have discretion over grazing or trailing on private land, and this use will continue to occur regardless of BLM's grazing program. Unpermitted trailing across BLM lands is likely occurring along State and county road ROWs. Effects to the three species and their critical habitat from grazing and related activities on private, local, or State lands or ROW would be similar to those described for the proposed action.

Energy development is expected to continue in Colorado hookless cactus and DeBeque phacelia habitat. Although the development of private mineral rights is regulated by the Colorado Oil and Gas Conservation Commission, the Commission has no leverage when it comes to conservation

of federally listed plants. Effects to clay-loving wild buckwheat are expected to increase due to energy transmission projects. For instance, the projected extension of the East Montrose Transmission Improvement Line south from the planned Miguel Road Substation may be routed through or near clay-loving wild buckwheat populations on private land. Effects from oil and gas development and utility line projects to the three focal species and their habitats on non-federal lands would be similar to those described for the proposed action.

CONCLUSION

Based on a review of the current status of the affected species, the environmental baseline for the action area, effects of the proposed action, ~~and~~ cumulative effects, and proposed conservation measures, it the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the Colorado hookless cactus, clay-loving wild buckwheat, or DeBeque phacelia. Further, we find that the proposed action will not result in the destruction or adverse modification of critical habitat for clay-loving wild buckwheat or DeBeque phacelia.

We have reached these conclusions because the BLM has committed to a series of conservation measures designed to avoid or minimize impacts from grazing programs and activities on these species, such that effects would not be expected to reduce, directly or indirectly, the survival or recovery of the species or adversely modify or destroy critical habitat. Conservation measures proposed by the BLM include clearance surveys, coordination with grazing permittees, herbicide use restrictions, forage utilization standards, livestock trailing restrictions, monitoring, annual reporting, and similar practices.

INCIDENTAL TAKE STATEMENT

Section ~~9~~7(b)(4) and 7(0)(2) of the Act ~~does~~do not ~~address the incidental take of~~ apply to listed plant species. ~~Consequently, this biological opinion does not include an incidental take statement, reasonable and prudent measures, or terms and conditions.~~ However, limited protection of listed plants is provided ~~in~~ to the extent that the ~~ESA requires a Federal permit for~~Act prohibits the removal ~~or~~and reduction ~~to~~of possession of federally listed endangered ~~or threatened~~ plants ~~from Federal lands. Furthermore, it is unlawful for any person to remove, cut, dig up,~~ or the malicious damage ~~or destroy a listed plant species in knowing~~ of such plants on areas under Federal jurisdiction, or the destruction of listed plants on non-Federal areas in violation of ~~any~~State law or regulation ~~of any State or in the course of any violation of a State criminal trespass law [section 9(a)(2)(B) of the ESA].~~.

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We are providing the following conservation recommendations to the BLM for the project, and we strongly encourage implementation of these measures in furtherance of Section 7(a) (1) of the ESA.

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To ensure the conservation of the three listed species, BLM will coordinate with FWS to develop a plant conservation strategy. This conservation strategy will identify grazing impact thresholds (or triggers) to guide necessary actions and adjustments to livestock grazing management. By overlaying pastures, plant locations, LHA information, water developments, and other information, the strategy will identify potential problem areas for livestock grazing impacts on listed plants and important areas for conservation. Coordination and the plant conservation strategy should result in actions to improve species conservation, initiate adaptive management strategies, or place greater management emphasis through BLMs planning and decision process. Following are required components of the plant conservation strategy.

1. Develop a specific long-term monitoring strategy to evaluate the effects of livestock grazing on these species and their habitats.
2. to supplement LHA monitoring. Incorporate paired-plot, or treatment-control, designs in your studies to detect and quantify the effects of livestock grazing on listed plants and their habitats.
3. Identify Based on the long-term monitoring strategy, identify species' population triggers to guide and inform adaptive management such that livestock grazing impacts to listed plants are avoided or minimized with the goal of advancing the long-term survival and recovery of the species.
4. Identify key conservation areas where special management and monitoring are needed to ensure the long-term survival and recovery of the species. Key conservation areas may include relatively intact and large patches of habitat where native plants comprise a majority of the vegetative community, with habitat qualities and quantities sufficient to support relatively large numbers of reproducing Colorado hookless, clay-loving wild buckwheat, or DeBeque phacelia plants.
5. Identify problem or high-impact areas where grazing management changes are necessary to ensure the long-term survival and recovery of the species.
6. Expand species inventory efforts to improve baseline knowledge of the species and their distribution and adjust management accordingly.
7. At least once every 5 years, reevaluate the status of the three species and BLM livestock grazing and operations and determine whether changes in management or reinitiation of section 7 consultation should occur (see following section for reinitiation criteria).

7. Retire livestock grazing allotments, such as those in the Colona LHA unit, to remove unavoidable adverse effects on significant populations known to be important to the long-term survival and recovery of the species.
8.

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REINITIATION NOTICE

This concludes formal consultation under section 7 of the Endangered Species Act for the proposed project. Reinitiation of formal consultation is required if: (1) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (2) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not

considered in this biological opinion; and (3) a new species is listed or any new critical habitat is proposed or designated that may be affected by this action (50 CFR 402.16).

~~Furthermore, reinitiation of formal consultation is required under the following conditions:~~

In this biological opinion the positive and negative effects of the proposed action are anticipated and considered in the "Effects of the Action" section. The Service anticipates implementation of the conservation measures will result in stable plant populations and habitat conditions. It would be considered new information if there is a significant decline in plant populations or habitat conditions. Significant decline shall be defined as follows:

1. Plant populations ~~at key conservation areas (see Conservation Recommendations above)~~ exhibit a 10% or greater decline after 10 years of monitoring. Study methods and design ~~to verify this~~would be flexible, but must have a power of 90% (Type II error rate $\beta = 0.10$) to detect a 10% or greater decline with a Type I error rate (α) of 0.10. Studies should focus on species demographics, reproduction, and livestock grazing effects.

2. Habitat conditions ~~at~~in key conservation areas (see Conservation Recommendations above) exhibit a 20% or greater decline after 10 years of monitoring, based on vegetation community composition and cover attributes. Study methods and design ~~to verify this~~would be flexible, but must have a power of 90% (Type II error rate $\beta = 0.10$) to detect a 20% or greater decline with a Type I error rate (α) of 0.10. Studies should focus on effects from livestock grazing.

Since the BA only addressed the three listed plants and their critical habitat, separate section 7 consultation is required for BLM livestock grazing program effects on other listed species and critical habitat not addressed in this consultation (see *Species Addressed* section). Also please note that for the purposes of BLM's national planning effort for livestock trailing, this consultation only covers the three listed plants and their critical habitat. Consequently, separate section 7 consultation is required for livestock trailing and activities that may affect other listed species and their critical habitat.

If you have any comments or questions, please contact Gina Glenne of my staff at (970) 243-2778, extension 20. Do not bother calling Charlie. Call Gina all you want. Here is her home phone number and address:

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LITERATURE CITED

Ågren, J. 1996. Population size, pollinator limitation, and seed set in the self-incompatible herb *Lythrum salicaria*. *Ecology* 77:1779-90.

Bartlett, O. 2012. Personal communication from Olivia Bartlett (Black Canyon Regional Land Trust) to Alison Graff (BIO-Logic) regarding conservation easements protecting the Lawhead Gulch occurrence of clay-loving wild buckwheat.

Bhattacharyam, M., Primack, R.B., and J. Gerwein. 2003. Are roads and railroads barriers to bumblebee movement in a temperate suburban conservation area? *Biological Conservation* 109:37-45.

Belnap, J. 1995. Surface disturbances: Their role in accelerating desertification. *Environmental Monitoring and Assessment* 37:39-57.

Belnap, J. 2001. Biological soil crusts and wind erosion. In: J. Belnap and O.L. Lange, editors. Biological Soil Crusts: Structure, Function, and Management. Ecological Studies, Vol. 150. Berlin Heidelberg: Springer-Verlag.

Belnap, J. 2002. Nitrogen fixation in biological soil crusts from southeast Utah, USA. *Biology and Fertility of Soils* 35:128-135.

Belnap, J., Reynolds, R.L., Reheis, M.C., Phillips, S.L., Urban, F.E., and H.L. Goldstein. 2009. Sediment losses and gains across a gradient of livestock grazing and plant invasion in a cool, semi-arid grassland, Colorado Plateau, USA. *Aeolian Research* 1:27-43.

Belsky, A.J. and J.L. Gelbard. 2000. Livestock Grazing and Weed Invasions in the Arid West. Oregon Natural Desert Association (April 2000). Bend and Portland, OR.

BIO-Logic, Inc. 2008. Tri-State Generation and Transmission Association. Delta County Transmission Improvement Project Colorado Hookless Cactus Conservation Plan. November 25, 2008. Montrose, CO.

BIO-Logic, Inc. 2009. Wells Gulch Evap, Inc. Wells Gulch Water Treatment and Impoundment System Project. Survey for the Federally Threatened Colorado Hookless Cactus. September 21, 2009. Montrose, CO.

BIO-Logic, Inc. 2011. Biological Assessment East Montrose Electric System Improvement Project. July 21, 2011. Montrose, CO.

Bowlin, W. R., Tepedino, V.J., and T.L. Griswold. 1993. The reproductive biology of *Eriogonum pelinophilum* (Polygaonaceae). Proc. Southwestern Rare and Endangered Plant Conference, R. Sivinski and K. Lightfoot, editors. New Mexico Forestry & Resources Conservation Division, Misc. Publ. #2, Santa Fe, NM.

Brown, W.E. 2009. Impacts of dirt and gravel road dust on roadside organic forest soils and roadside vegetation. Masters Thesis. School of Forest Resources. Pennsylvania State University.

Bureau of Land Management, Uncompahgre Field Office (BLM). 1999a. Escalante Area Land Health Assessment. November 22, 1999. Montrose, CO. 28 pp.

Bureau of Land Management National Applied Resource Sciences Center, ed. (BLM). 1999b. Sampling Vegetation Attributes. Interagency Technical Reference 1734-4 (Cooperative Extension Service, USDA Forest Service, and USDI Bureau of Land Management). Denver, CO.

Bureau of Land Management National Applied Resource Sciences Center, ed. (BLM). 1999c. Utilization Studies and Residual Measurements. Interagency Technical Reference 1734-3 (Cooperative Extension Service, USDA Forest Service, and USDI Bureau of Land Management). Denver, CO.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2001. Land Health Assessment Gunnison Gorge Area. 2001. Montrose, CO. 96 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2002. North Delta Land Health Assessment. 2001-2002. Montrose, CO. 110 pp.

Bureau of Land Management, Gunnison Gorge NCA Office (BLM). 2004. Gunnison Gorge National Conservation Area Approved Resource Management Plan and Record of Decision. November 2004. Montrose, CO. 380 pp.

Bureau of Land Management, Glenwood Springs Field Office (BLM). 2005a. Land Health Assessment Report Rifle-West Watershed. Glenwood Springs, CO. 34 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2005b. Roubideau Land Health Assessment 2004-2005. Montrose, CO. 97 pp.

Bureau of Land Management (BLM). 2007a. Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS). Volumes I-III. Washington Office, Washington, D.C.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2007b. North Fork Land Health Assessment. 2006-2007. Montrose, CO. 110 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2007c. Summer 2007 Clay-Loving Wild Buckwheat (*Eriogonum pelinophilum*) Field Surveys, Including an Assessment of the Potential Effects of Livestock Grazing on this Species within the Colona LHA. (Unpublished report prepared by J.R Ferguson for the Bureau of Land Management, Uncompahgre Field Office, October 30, 2007.) Montrose, CO. 22 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2008a. Biological Assessment for Clay-loving Wild Buckwheat (*Eriogonum pelinophilum* Reveal): Renewal of Grazing Permits Within the Colona Land Health Assessment Area. March 20, 2008. Montrose, CO. 28 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2008b. Colona Land Health Assessment. 2007-2008. Montrose, CO. 122 pp.

Bureau of Land Management, Grand Junction Field Office (BLM). 2008c. Land Health Assessment Report DeBeque-Roan Creek. 2008. Grand Junction, CO. 43 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2009a. Biological Assessment for Federally Protected Species and Designated Critical Habitat for an Amendment to the Uncompahgre Basin and San Juan-San Miguel Resource Management Plans: Limited Motorized and Mechanized Travel to Existing Routes. May 12, 2009. 41 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2009b. *Sclerocactus glaucus* Monitoring Projects and Trends in the BLM Uncompahgre Field Office, 1978-2009. (Unpublished report prepared by Charlie Sharp in support of the U.S. Fish and Wildlife Service's Revision of the Species Recovery Plan, December 15, 2009.) Montrose, CO. 13 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2010a. Escalante Land Health Assessment. 2009-2010. Montrose, CO. 47 pp.

Bureau of Land Management, Grand Junction Field Office (BLM). 2010b. Land Health Assessment Report for Whitewater Common and North Fork Kannah Creek Allotments and City of Grand Junction Property within the Allotments. Prepared 2006. Finalized 2010. Grand Junction, CO. 74 pp.

Bureau of Land Management, Grand Junction Field Office (BLM). 2010c. Land Health Assessment Report Northern Portion of the Dominguez-Escalante NCA Grand Junction. Grand Junction, CO. 58 pp.

Bureau of Land Management, Uncompahgre Field Office (BLM). 2011. Clay-loving wild buckwheat monitoring data from the Colona Land Health Assessment unit. Unpublished data provided by the Uncompahgre Field Office, Montrose, CO.

Center for Native Ecosystems and Colorado Native Plant Society and Uncompahgre Valley Asociation (CNE et al.). 2006. Petition to Amend the Critical Habitat Designation for the Clay-loving Wild Buckwheat

(*Eriogonum pelinophilum*) Made Under the Endangered Species Act (16 U.S.C. § 1531, *et. seq.*). July 17, 2006. 52 pp.

Christen, D.C. and G. R. Matlack. 2009. The habitat and conduit functions of roads in the spread of three invasive plant species. *Biological Invasions* 11:453-465.

Clark, T.O. and D.J. Clark. 2007. *Sclerocactus wrightiae* monitoring in Capitol Reef National Park. (Unpublished report submitted to Capitol Reef National Park, Nov. 1, 2007.) Torrey, UT. 23 pp.

Colorado Natural Areas Program (CNAP). 1997. Monitoring Plan Badger Wash, Pyramid Rock, and Rough Canyon ACECs. May 1997. Denver, CO. 5 pp.

Colorado Natural Areas Program (CNAP). 1999. Monitoring Update Areas of Critical Environmental Concern in the Grand Junction Resource Area: Badger Wash, Pyramid Rock, and Rough Canyon. January 1999. Denver, CO. 5 pp.

Colorado Natural Areas Program (CNAP). 2000. Monitoring Update Areas of Critical Environmental Concern in the Grand Junction Resource Area: Badger Wash, Pyramid Rock, and Rough Canyon. May 2000. Denver, CO. 4 pp.

Conner, S. 2011. Personal communication from Shawn Conner (BIO-Logic) to Alison Graff (BIO-Logic) regarding vegetative budding in Colorado hookless cactus and dramatic shifts in population sizes.

Conner, S. 2012. Personal communication from Shawn Conner (BIO-Logic) to Alison Graff (BIO-Logic) regarding cattle browsing on *Sarcobatus vermiculatus*.

D'Antonio, C.M., and P.M.Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. *Annual Review of Ecology and Systematics* 13:63-87.

Denver Botanical Gardens (DBG). 2007. *Sclerocactus glaucus* Monitoring. Denver, CO. 6 pp.

Denver Botanic Gardens (DBG). 2008. Demographic Monitoring of *Sclerocactus glaucus*, an Endemic Species of Western Colorado. Population Monitoring 2007-2008. (Unpublished Technical Report prepared for the Bureau of Land Management, U.S. Dept. of Interior, November 2008.) Denver, CO. 17 pp.

Denver Botanic Gardens (DBG). 2010a. Denver Botanic Gardens Monitoring Review – 2010. Review of *Eriogonum pelinophilum*, Fairview South and Wacker Ranch. Denver, CO. 7 pp.

Denver Botanic Gardens. 2010b. Research Report 2010 to Black Hills Exploration & Production. Denver, CO. 4 pp.

DeYoung, C. 2012a. Personal communication from Carla De Young (BLM) to Collin Ewing (BLM) regarding Colorado hookless cactus monitoring conducted by CRVFO.

DeYoung, C. 2012b. Personal communication from Carla De Young (BLM) to Collin Ewing (BLM) regarding impacts from elk trampling and livestock grazing to Colorado hookless cactus.

Doak, D.F., Thomson, D., and E.S. Jules. 2002. PVA for plants: understanding the demographic consequences of seed banks for population persistence and management. In: S.R. Beissinger and D.R. McCullough, editors. Population Viability Analysis. Chicago: University of Chicago Press.

Ehrenfeld, J.G. 2003. Effects of exotic plant invasions on soil nutrient cycling processes. *Ecosystems* 6:503-523.

Evans, R.D., Rimer, R., Sperry, L., and J. Belnap. 2001. Exotic plant invasion alters nitrogen dynamics in an arid grassland. *Ecological Applications* 11:1301-1310.

Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. *Conservation Biology* 8:629-644.

Hansen, M.J. and A.P. Clevenger. 2005. The influence of disturbance and habitat on the presence of non-native plant species along transportation corridors. *Biological Conservation* 125:249-59.

Heil, K.D. and J.M. Porter. 1994. *Sclerocactus* (Cactaceae): A revision. *Haseltonia* 2:20-46.

Heil, K.D. and J.M. Porter. 2004. Sclerocactus in Flora of North America. Online at: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=129764. Accessed Dec. 6, 2011.

Honnay, O. and H. Jacquemyn. 2007. Susceptibility of common and rare plant species to the genetic consequences of habitat fragmentation. *Conservation Biology* 21:823-31.

Jones, A. 2000. Effects of cattle grazing on North American arid ecosystems: A quantitative review. *Western North American Naturalist* 60:155-164.

Kay, B.L., and R.A. Evans. 1965. Effects of fertilization on a mixed stand of cheatgrass and intermediate wheatgrass. *Journal of Range Management* 18:7-11.

Knapp, P.A. 1996. Cheatgrass (*Bromus tectorum* L.) dominance in the Great Basin Desert – history, persistence, and influences to human activities. *Global Environmental Change* 6:37-52.

Leimu, R., Mutikainen, P., Koricheva J., and M. Fischer. 2006. How general are positive relationships between plant population size, fitness and genetic variation. *Journal of Ecology* 94:942-952.

Levine, J.M., McEachern, A.K., and C. Cowan. 2008. Rainfall effects on rare annual plants. *Journal of Ecology* 96:795-806.

Lyon, P. 2008. Monitoring of *Eriogonum pelinophilum* at the Wacker Ranch, Montrose, Colorado, June 2008. (Unpublished report prepared for The Nature Conservancy.) Fort Collins, CO. 49 pp.

Meyer, S.E., Quinney, D., and J. Weaver. 2005. A life history study of the Snake River plains endemic *Lepidium papilliferum* (Brassicaceae). *Western North American Naturalist* 65:11-23.

Meyer, S.E., Quinney, D., and J. Weaver. 2006. A stochastic population model for *Lepidium papilliferum* (Brassicaceae), a rare desert ephemeral with a persistent seed bank. *American Journal of Botany* 93:891-902.

National Research Council (NRC). 2008. Changes in the Sheep Industry in the United States: Making the Transition from Tradition. National Research Council (U.S.), Committee on the Economic Development and Current Status of the Sheep Industry in the United States. Washington, D.C.: National Academies Press. 347 pp.

Neff, J.C., Reynolds, R.L., Belnap, J., and P. Lamothe. 2005. Multi-decadal impacts of grazing on soil physical and biogeochemical properties in southeast Utah. *Ecological Applications* 15:87-95.

Ouren, D.S, Haas, C., Melcher, C.P., Stewart, S.C., Ponds, P.D., Sexton, N.R., Burris, L., Fancher, T., and Z.H. Bowen. 2007. Environmental Effects of Off-highway Vehicles on Bureau of Land Management Lands: A Literature Synthesis, Annotated Bibliographies, Extensive Bibliographies, and Internet Resources. U.S. Geological Survey, Open-File Report 2007-1353. 225 pp.

Pollock, M.L., Legg, C.J., Holland, J. P., and C. M. Theobald. 2007. Assessment of expert opinion: Seasonal sheep preference and plant response to grazing. *Rangeland Ecology and Management* 60:125-135.

Potter, L.D., Reynolds, R.S., and E.T. Louderbough. 1985. Mancos shale and plant community relationships: field observations. *Journal of Arid Environments* 9:137-145.

Rasoul Sharifi, M., Gibson, A.C., and P.W. Rundel. 1997. Surface dust impacts on gas exchange in Mojave Desert shrubs. *Journal of Applied Ecology* 34:837-46.

Reveal, J.L. 2006. On the Status of *Eriogonum pelinophilum* Reveal (*Polygonaceae* Juss.: subf. *Eriogonoideae* Arn.). Appendix B in: Center for Native Ecosystems and Colorado Native Plant Society and Uncompahgre Valley Association, Petitioners, Petition to Amend the Critical Habitat Designation for the Clay-loving Wild Buckwheat (*Eriogonum pelinophilum*) Made Under the Endangered Species Act (16 U.S.C. § 1531, *et. seq.*). pp 46-52.

Sharp, C. 2012a. Personal communication from Charles Sharp (FWS) to Collin Ewing (BLM) regarding ORV effects on Colorado hookless cactus.

Sharp, C. 2012b. Personal communication from Charles Sharp (FWS) to Collin Ewing (BLM) regarding utilization of clay-loving wild buckwheat by big game.

Sharp, C. 2012c. Personal communication from Charles Sharp (FWS) to Collin Ewing (BLM) regarding tent caterpillar effects on clay-loving wild buckwheat.

Sharp, C. 2012d. Personal communication from Charles Sharp (FWS) to Collin Ewing (BLM) regarding sheep browsing on clay-loving wild buckwheat.

Tepedino, V.J. 2009. Clay-loving Wild Buckwheat (*Eriogonum pelinophilum*) in Highly and Lightly Disturbed Surroundings: Comparative Diversity of Flower Visitors and Their Importance in Pollination. (Submitted to USDI Bureau of Land Management, March 30, 2009). Montrose, CO. 54 pp.

Census Bureau. 2012. Population Finder. Available online at: http://factfinder.census.gov/servlet/SAFFPopulation?_event=ChangeGeoContext&geo_id=05000US08085&_geoContext=&_street=&_county=montrose&_cityTown=montrose&_state=04000US08&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=010&_submenuId=population_0&ds_name=null&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=

Fish and Wildlife Service (FWS). 1988. Clay-loving Wild-buckwheat, *Eriogonum pelinophilum* Reveal, Recovery Plan. U.S. Fish and Wildlife Service (November 10, 1988), Denver, CO. 15 pp.

Fish and Wildlife Service (FWS). 1990. Uinta Basin Hookless Cactus, *Sclerocactus glaucus,* Recovery Plan. U.S. Fish and Wildlife Service (September 27, 1990), Denver, CO. 26 pp.

Fish and Wildlife Service (FWS). 2008. Letter of Concurrence on Proposed Colona Land Health Assessment Grazing Permit Renewals on the Endangered Clay-loving Wild Buckwheat (*Eriogonum pelinophilum*). June 19, 2008. Grand Junction, CO.

Fish and Wildlife Service (FWS). 2009a. Colorado Natural Heritage Program Field Forms, Maps, and Photos for Clay-loving Wild Buckwheat Element Occurrences. Unpublished forms from February 2009. Cited as Ewing and Glenne 2009 in *Eriogonum pelinophilum* (clay-loving wild buckwheat) 5-Year Review: Summary and Evaluation.

Fish and Wildlife Service (FWS). 2009b. *Eriogonum pelinophilum* (clay-loving wild buckwheat) 5-Year Review: Summary and Evaluation. September 2009. Grand Junction, CO. 48 pp.

Fish and Wildlife Service (FWS). 2010. Recovery Outline for the Colorado hookless cactus (*Sclerocactus glaucus*). Colorado Ecological Services Field Office (April 2010), Grand Junction, CO. 17 pp.

Vardaka, E., Cook, C.M., Lanaras, T., Sgardelis, S.P., and J.D. Pantis. 1995. Effects of dust from a limestone quarry on the photosynthesis of *Quercus coccifera*, an evergreen sclerophyllous shrub. *Bulletin of Environmental Contamination and Toxicology* 54:41419.

Westwater Engineering, Inc. (WWE). 2010. Enterprise Gas Processing, LLC Collbran Natural Gas Pipeline Special Status Plan Species 2010 Monitoring Report. (Unpublished report prepared for Enterprise

Gas Processing, LLC, October 2010.) Grand Junction, CO. 68 pp.

Whisenant, S.G. 1992. Changing fire frequencies on Idaho's Snake River plains: ecological and management implications. In: E.D. McArthur, E.U. Romney, S.D. Smith, and P.Y. Tueller, editors. Proceedings, Symposium on *Bromus* invasion. USDA GTR-INT-276.

Wilson, A.M., Harris, G.A., and D.H. Gates. 1966. Fertilization of mixed cheatgrass-bunchgrass wheatgrass stands. *Journal of Range Management* 19:134-137.

In Litteris

Glenne, G. 2012. Biologist, U.S. Fish and Wildlife Service, Western Colorado Ecological Services Field Office. Subject: Status of clay-loving wild buckwheat critical habitat. Email to Alison Graff, Charles Sharp, and Olivia Bartlett, dated March 28, 2012.

Holsinger, K. 2012. Biologist, Bureau of Land Management, Uncomphagre Field Office. Subject: Potential for the BLM livestock grazing program to affect designated critical habitat for clay-loving wild buckwheat. Email to Collin Ewing, Alison Graff, Anna Lincoln, and Carla DeYoung, dated March 23, 2012.

Langton, A. 2011. Biologist, U.S. Fish and Wildlife Service, Western Colorado Ecological Services Field Office, and graduate student researching the reproductive biology of DeBeque phacelia. Subject: Breeding system of DeBeque phacelia and impacts from cattle grazing to occupied habitat. Email to Alison Graff, dated November 28, 2011.