U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Sclerocactus brevispinus* (Heil and Porter 1994)

COMMON NAME: Pariette cactus, short spined sclerocactus

LEAD REGION: Region 6

DATE INFORMATION CURRENT AS OF: March 24, 2016

STATUS/ACTION:

___ Species assessment - determined either we do not have sufficient information on threats or the information on the threats does not support a proposal to list the species and, therefore, it was not elevated to Candidate status

_X__ Listed species petitioned for uplisting for which we have made a warranted-but-precluded finding for uplisting (this is part of the annual resubmitted petition finding)

___ Candidate that received funding for a proposed listing determination; assessment not updated
___ New candidate
___ Continuing candidate
___ Listing priority number change
Former LPN:___
New LPN:___
___ Candidate removal: Former LPN:___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

Date when the species first became a Candidate (as currently defined): **09/18/2007**

Petition Information:

___ Non-petitioned
__**X**_ Petitioned; Date petition received: **04/18/2005 (60-day NOI Sue received 07/23/2009)**
90-day substantial finding FR publication date: **71 FR 75215 on 12/14/2006**
12-month warranted but precluded finding FR publication date: **72 FR 53211 on 09/18/2007**

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? **YES**
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? **YES**
c. Why is listing precluded? Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

ANIMAL/PLANT GROUP AND FAMILY: Flowering Plants, Cactaceae (Cactus Family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Utah

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Duchesne and Uintah Counties, Utah

LAND OWNERSHIP: Land ownership for the species' habitat is a mosaic of Federal, Tribal, State of Utah, and private lands. In 2016, we refined and improved the potential habitat polygon for Pariette cactus by removing non-habitat areas that overestimated the amount of potential habitat. We removed the non-habitat areas by completing surveys, compiling expert knowledge, and ground-proofing the model. Based on the updated potential habitat polygon, approximately 29 percent of the Pariette cactus' potential habitat occurs on public lands managed by the Bureau of Land Management (BLM), 32 percent occurs on Uintah and Ouray Reservations of the Ute Indian Tribe, and the remaining 39 percent occurs on the State of Utah and private lands (Table 1).

Table 1. The amount of Pariette cactus potential habitat and distribution of individuals by landowner based on the potential habitat polygon that we updated in 2016. (Numbers may not add precisely due to rounding).

Landowner	Hectares (ha) (Acres (a)) of Potential Habitat	Percent of Potential Habitat Polygon	Number of individuals	Percent of total
Federal	13,091 (32,173)	29%	1,7331	8
Tribal	14,538 (35,926)	32%	8,658	85.2
Private	15,569 (38,474)	35%	1,174	5.3
State	1,828 (4,518)	4%	332	1.5
TOTAL	**44,957 (111,092)**	**100%**	21,897	100

LEAD REGION CONTACT: Craig Hansen, (303) 236-4749, Craig_Hansen@fws.gov

LEAD FIELD OFFICE CONTACT: Rita Reisor, (801) 975-3330, rita_reisor@fws.gov

BIOLOGICAL INFORMATION:

Species Description

Sclerocactus brevispinus (Pariette cactus) is a barrel-shaped, ribbed cactus that ranges from 2.5-8.5 centimeters (cm) (1.0-3.4 inches (in.)) tall and grows up to 5 cm (2.0 in.) in diameter (74 FR 47114, September 15, 2009). Spines are clustered on the tips of tubercles along the ribs of the plants' body. Each spine cluster is composed of two spine types: radial spines and central spines. The short descending central spine (2-5 millimeters (mm) or 0.08-0.2 in. long) is the key field characteristic, distinguishing this species from other *Sclerocactus* species within its range. The campanulate (bell-shaped) flowers are pink to purple and are about 1.5 cm (0.6 in.) high and 3 cm (1.2 in.) in diameter (74 FR 47115, September 15, 2009). The green ovary ripens into a brown, dry fruit with about 15-30 seeds in about 4-6 weeks. The seeds are 1.5 mm (0.06 in.) wide and 2.5 mm (0.1 in.) long.

Taxonomy

On October 11, 1979, we published a final rule (44 FR 58868) listing all hookless (straight central spines) *Sclerocactus* populations in western Colorado and northeastern Utah, and referred to them as *Sclerocactus glaucus* per L. Benson (1966, pp. 50-57; 1982, pp. 728-729). However, this taxonomic classification is no longer supported by the scientific results of genetic studies (Porter *et al*. 2000, pp. 14, 16; 2006, pp. 6, 7, 10; 2007, p. 8-15, 23, 26), common garden experiments (Hochstätter 1993, pp. 94, 98; Welsh *et al.* 2003, p. 79), and reevaluations of morphological characteristics (Heil and Porter 2004, pp. 200-201; Hochstätter 1993, pp. 93, 97, 99; Porter *et al.* 2007, pp. 13, 20-22, 24-25). Revisions to the taxonomy of *S. glaucus* began in 1989 (Hochstätter 1989 in 1993, pp. 91-92; Heil and Porter 1994, pp. 25-27; Porter *et al.* 2000, pp. 8-23; Welsh *et al.* 2003, p. 79). By 2004, the *Flora of North America* recognized 15 species in the genus *Sclerocactus* and the plant previously identified only as *S. glaucus* (listed in 1979) was recognized as three distinct species: *S. glaucus* (Uinta Basin hookless cactus), *S. wetlandicus* (no common name), and *S. brevispinus* (Pariette cactus) (Heil and Porter 2004, pp. 197-207).

We formally accepted this taxonomic classification in our September 15, 2009, revised rule (74 FR 47112), recognizing the following three species as threatened with the following scientific and revised common names and State ranges: *S. glaucus* (Colorado hookless cactus, found only in Colorado), *S. wetlandicus* (Uinta Basin hookless cactus, found only in Utah), and *S. brevispinus* (Pariette cactus, found only in Utah).

Sclerocactus brevispinus is a morphologically unique *Sclerocactus* population occurring only in the Pariette Draw in the central Uinta Basin in Utah. This cactus is much smaller than either *S. wetlandicus* or *S. glaucus*, and the flowering adults of this species retain the vegetative

characteristics of juvenile *S. wetlandicus*. At the time of listing in 1979, these smaller-statured individuals were thought to represent an ecotypic variation of *S. glaucus*. This unique cactus from Pariette Draw was variously named *S. wetlandicus* var. *ilseae* (Hochstätter 1993, pp. 95-97), *S. brevispinus* (Heil and Porter 1994, p. 26), and *S. whipplei* var. *ilseae* (Welsh *et al.* 2003, p. 79). We have adopted the taxonomic nomenclature accepted by the *Flora of North America* (Heil and Porter 2004, pp. 197-207). We use the common name Pariette cactus to refer to *S. brevispinus* hereafter in this document.

Recent taxonomic work investigated the geographic boundaries separating *S. wetlandicus* and Pariette cactus (McGlaughlin *et al.* 2014). These boundaries were previously drawn based on morphology of the species, with individuals along the species' boundaries showing defining characters of both species. New information indicates that Pariette cactus and cacti previously identified as hybrid *S. wetlandicus* west of the Green River are more closely related to each other than to *S. wetlandicus* individuals found on the east side of the Green River. Hence, the Green River may be acting as a barrier to gene flow, especially for chloroplast genes that are inherited maternally through seed dispersal. Thus, cacti west of the Green River may need to be re-classified based on their close relationship and genetic divergence from cacti found on the east side of the Green River. However, the morphology of Pariette cactus differs significantly from *S. wetlandicus* and the mechanisms controlling these differences remain unknown. A common garden study is needed to better help understand the mechanisms controlling morphology and the taxonomic status of Pariette cactus. Until taxonomic relationships can be clarified further and the findings peer-reviewed, it is uncertain whether Pariette cactus will ultimately be reclassified, and therefore we will continue recognize Pariette cactus as a species and a listable entity under the Act for the purposes of this species assessment.

Habitat/Life History

Pariette cactus grows on fine soils in clay badlands derived from the Uinta Geologic Formation (U.S. Fish and Wildlife Service (USFWS) 1990, p. 7). It is found on gravelly hills (Hochstatter 1993, p. 97), and is frequently, although not always, associated with desert pavement (soil with a high percentage of thin rock fragments covering the surface). Rock fragments constitute the greatest cover in Pariette cactus habitat followed by biological soil crust, bare ground, shrubs and grasses (SWCA 2015: Figure 1). Pariette cactus habitat is a sparsely vegetated desert shrubland dominated by *Atriplex* (saltbush), *Chrysothamnus* (rabbitbrush), and *Tetradymia* (horsebrush) species (USFWS 1990, p. 7).

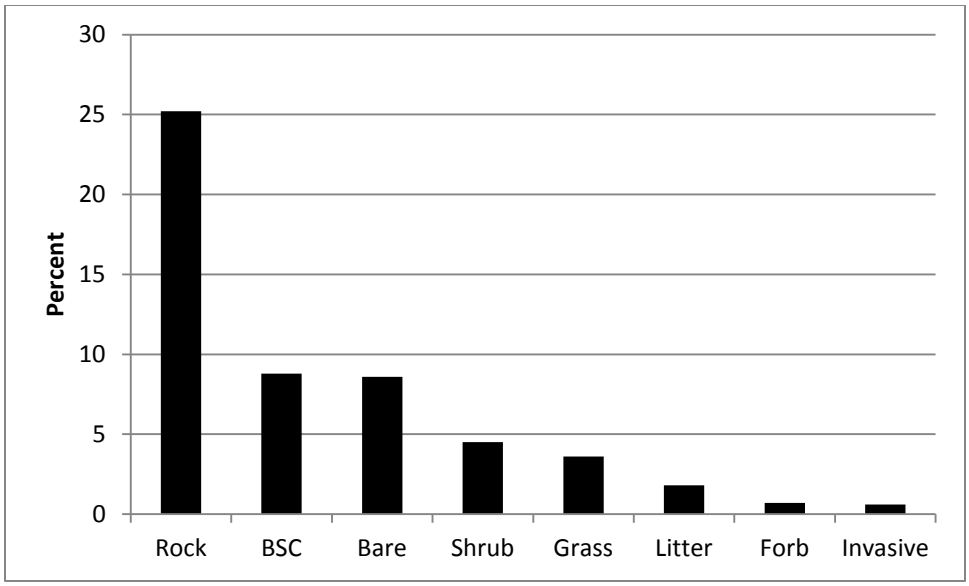

Figure 1. Percent cover near Pariette cactus by cover class (SWCA 2015)

Pariette cactus is an outcrossing species, meaning it requires pollen from the flower of a different plant to produce viable seed (Tepedino *et al.* 2010, p. 382-383). Flowers of Pariette cactus typically open in mid-day and close late in the afternoon for 3-5 days (Tepedino *et al.* 2010, p. 380). A broad assemblage of native, ground-nesting bees, mostly from the family Halictidae (Tepedino *et al.* 2010, p. 382), pollinate Pariette cactus. About 4-5 weeks after flowering, the fruits reach maturity, each containing approximately 20 seeds (Tepedino *et al.* 2010, pp. 378-380). The fruits open and fall away, leaving the seeds on the apex of the plant where they are washed to the ground and dispersed by rain (Tepedino *et al.* 2010, p. 380). Seeds also may be dispersed by ants (O'Hearn 2010, pers. comm.).

The life history and population dynamics of this species is poorly known, but it is thought to be a long-lived perennial, usually flowering after 3 or 4 years. During an ongoing demography study of the species, the distribution of flowering plants shifted so that the percentage of the stems that are flowering occur with increasing frequency in the larger size classes (SWCA 2015). The shift in flowering could indicate that more reserves are needed to withstand stressors in order to flower. Greater stem size correlates with increased chance of flowering, and stem diameter significantly influences survival with larger stems more likely to survive until the next sampling period (annually; Figure 2; SWCA 2015). Thus larger stem sizes are important to the persistence of the species because they contribute the most to reproduction, and individuals with larger stems are more likely to survive over a longer period of time.

Population growth rates for the four years of data from the ongoing demographic study are close to but less than 1.0, indicting a slowly declining population. Projections 10 years into the future predict a declining population, with populations declining more rapidly on BLM lands than on Tribal lands (SWCA 2015). We do not understand this discrepancy between population growth rates on BLM and Tribal lands, but it may correlate with density of oil and gas development, which has almost reached full field development on BLM lands and is just now starting to develop on Tribal lands. Additional stochastic models that incorporate the dynamic nature of the

desert climate are necessary in order develop accurate long-term projections for the species. We interpret these results with caution as these data represent only four years of study and additional years of data collection are needed to truly understand the demographic patterns of this long-lived species.

Historical Range/Distribution

The species was historically known as one population in an area about 27 kilometers (km) (17 miles (mi)) long and 13 km (8 mi) wide (O'Hearn 2009, entire), astride the Duchesne-Uintah County boundary on BLM, Ute Tribe, State of Utah, and private land.

Current Range/Distribution

Our knowledge of the distribution and abundance of Pariette cactus has changed over time, although it is unlikely that the actual species distribution has changed since it was originally listed as part of *S. glaucus* in 1979. Still, the boundaries of Pariette cactus' range remain unclear. In 2009, because previous range maps focused on suitable habitat (the more typical desert pavement) for Pariette cactus and failed to include more marginal but occupied habitats, we developed a potential habitat polygon in coordination with the BLM. This polygon is updated annually based on new survey information, and in 2013 we updated the polygon to include information from a habitat model developed by the University of Wyoming (Albeke 2012, entire). In 2016, we updated the potential habitat polygon by removing non-habitat areasbased on ground proofing of the model (Albeke 2012), species and habitat surveys, and botanist experience in the area. Following these improvements to the potential habitat polygon, the potential range for Pariette cactus covers an area approximately 22.5 by 32 km (14 by 20 mi), or 44,957 ha (111,092 ac, Table 1). Suitable habitat for Pariette cactus is not continuous across this area; it is irregularly distributed across the landscape within the area identified as potential habitat.

Our understanding of the range of Pariette cactus may change further based on recent genetics work (McGlaughlin *et al.* 2014). *Sclerocactus* found west of the Green River show characters that align more closely with Pariette cactus, whereas *Sclerocactus* found on the east side of the Green River align more closely with *S. wetlandicus*. However, further taxonomic work is needed to better define the species differentiation and range before any changes are made to species distribution boundaries.

Even though Tribal land represents 32 percent of the potential habitat, 85 percent of all known Pariette cactus plants occur on Tribal lands, while 8 percent occur on Federal lands, 5.3 percent occur on private lands, and 1.5 percent occurs on State lands (Table 1).

Population Estimates/Status

Before it was recognized as a separate species, this taxa (at the time called the "short-spine" or "Pariette" population of *S. glaucus*) was estimated as one population of approximately 4,600 individuals in an area of about 6,000 ha (15,000 ac) centered on Pariette Draw on mostly BLM and some State and private lands (BLM 1985, pp. 2-4).

In 2006, we defined the boundary of Pariette cactus' distribution using a geographic information system (GIS), and the area within this boundary was roughly the same as that described by the BLM in 1985 (USFWS 2006, p. 1). In 2007, with new information regarding Pariette cactus' occurrence on Uintah and Ouray Reservation land, we expanded the total species count to about 8,000 individuals on approximately 7,200 ha (18,000 ac) (72 FR 53213, September 18, 2007). In 2009, we again expanded our population estimate to 12,000 plants to include more recent survey data (USFWS 2010, p. 4).

Further complicating our distribution and abundance estimates of Pariette cactus, hybridization occurs between Pariette cactus and *S. wetlandicus* along the limits of Pariette cactus' range. This morphological intergradation was first recognized along an east-west cline, with western-most individuals possessing traits that characterized Pariette cactus, and eastern-most individuals that more closely resembled *S. wetlandicus* (Heil and Porter 1994, p. 26). Recent surveys located individuals showing introgressed characteristics along the northern and southern limits of Pariette cactus' range. This makes it difficult to distinguish between Pariette cactus and *S. wetlandicus* in the field, as there is no distinct delineation of where the range of one begins and the other ends. Indeed, individuals of both species can exist in close proximity on different microhabitats, with intergradations between; Pariette cactus on fine clay soils and *S. wetlandicus* on coarse cobble and gravel hill tops (71 FR 75216, December 14, 2006; Tepedino *et al.* 2010, p. 384).

It is unclear how many Pariette cactus individuals exist. In 2007 and 2008, 2,857 individuals were documented within the Pariette Area of Critical Environmental Concern (ACEC) (Buys 2008, pp. 1-215). The Pariette ACEC was established to provide protection for portions of the Pariette cactus population, and the Resource Management Plan (RMP) includes a goal to "enhance and protect the wetlands community and associated habitat adjacent to Pariette and Castle Peak Washes…while meeting the management objectives of the final recovery plans for the special status species associated with the area" (BLM 1994, pp. 3-20; BLM 2008, Appendix G-2). The ACEC represents about 37 percent of the species' potential habitat on BLM land and about 10 percent of the total potential habitat.

As of May 2015, we were aware of 20,626 point locations representing 21,897 Pariette cactus individuals (Table 2). Many unidentified *Sclerocactus* species and *Sclerocactus* hybrids occur within the range of Pariette cactus, and these records account for an additional 5,813 plants. Although we do not have an accurate way to estimate how many of these points represent Pariette cactus (as opposed to other Sclerocactus species), it is likely that many of them do because they are located near or within known Pariette cactus habitat.

Our point location and cactus numbers are lower than in our 2015 CNOR because we removed 2,832 known dead individuals from the dataset. Previous years' data summaries included both living and dead individuals because not all surveyors distinguished between the two.

Overall, range-wide surveys for this species are incomplete, especially on State and private lands where surveys are not always required for proposed projects. Additionally, since most surveys are conducted as a result of energy development, the current data is biased toward areas high in mineral resources rather than range-wide surveys across the entirety of the species suitable habitat.

We believe a conservative minimum estimate for the total population of Pariette cactus is 35,000 – 40,000 plants, but this estimate will be refined in the future as we receive new and better information. Although this number is substantially larger than historical population estimates, the difference is due to increasingly better information and more complete surveys within the known range over time, and not necessarily due to an increase in the population size. We do not have long-term status or trend population data for Pariette cactus.

THREATS

A. <u>The present or threatened destruction, modification, or curtailment of its habitat or range</u>.

Energy development remains one of the largest threats to this species through direct loss of habitat, and it is occurring across the range of *Sclerocactus brevispius* at a rate much greater than existed at the time of the 1979 listing. We recently determined that reclassifying Pariette cactus as endangered was warranted but precluded due to the extent of current and pending energy development across the cactus' entire range (72 FR 53211, September 18, 2007). Other factors currently impacting the habitat or range of Pariette cactus include livestock grazing and trampling, nonative invasive plants, climate change, illegal collection, and drought.

<u>Oil and Gas Development and Associated Impacts</u>

Of the potential Pariette cactus habitat on BLM land, 100 percent is leased for oil and gas development by Newfield Exploration Company and Gasco Energy. On Uintah and Ouray Reservation land, at least 62 percent of Pariette cactus habitat is leased for oil and gas development, and the entire potential habitat for this species is likely to be developed.

Approximately 1,929 wells have been drilled and developed in Pariette cactus potential habitat across all landownerships. Some of these wells are plugged and abandoned or shut-in, but they may be reopened for future development. For the 2016 CNOR, the well numbers are lower than in the 2015 CNOR because the “location abandoned” wells have been excluded from the analysis due to the temporary nature of the disturbance.

We know of several additional energy development projects within the species range. For example, in 2014, we consulted on and an energy company completed a seismic project in the

Altamont and Bluebell fields which overlap 38,271 acres of potential habitat and 32,032 individuals of Pariette cactus and/or Pariette cactus hybrids. This project occurred mostly on tribal lands (Jun 3, 2014; 2014-F-0064) and in habitat that constitutes the majority of the population of Pariette cactus. This project is moving forward and the BLM is currently conducting the EIS/NEPA analysis for the field development of 3,925 wells in this development area.

We consulted on another project in 2014 on tribal lands that includes up to 500 new wells on 47,551 acres of potential habitat (Mar 27, 2014; 2013-F-0104). The BLM is conducting an EIS/ NEPA analysis for another project with 5,750 new wells of which 376 wellpads and an unknown number of wellpad extensions are estimated to be located within potential habitat. We estimate that each constructed single-well wellpad disturbs approximately 2 ha (5 ac) of habitat for the well pad and associated infrastructure (for example, roads and pipelines). For multi-well pads we add an addition 0.25 acres of disturbance for each additional well.

Overall, the exsting 1,929 wells across Pariette cactus potential habitat have resulted in at least 2,649 ha (6,546 ac) of surface disturbance, or 5.9 percent of the potential habitat polygon, and additional disturbances are expected given the ongoing oil and gas interest in this area. Ongoing and expected increasing energy development overlaps almost the entire range of Pariette cactus and this activity presents an imminent and intense threat that puts Pariette cactus in danger of extinction.

Increased surface disturbance from wells, roads, and pipelines can result in the following impacts to Pariette cactus and its habitat:

- Oil and gas drilling fragments and destroys Pariette cactus habitat and can affect the genetic composition of local populations (BLM 2005b, pp. 4.1-26, 4.2-22, 4.3-14, 5-18, 5-27; BLM 2008 Appendix L 6-8, Appendix N 58-68; Debinski and Holt 2002, p. 353). Low population numbers, combined with habitat fragmentation, pose a threat to rare plant species' ability to adapt genetically to changing environmental conditions (Lienert 2004, pp. 62, 63, 66; Matthies *et al.* 2004, pp. 481, 486).

- Increased erosion, soil compaction, and sedimentation can kill cacti (BLM 2005b, pp. 4.1-26, 4.2-22, 4.3-14, 5-27), decreasing the ability of Pariette cactus to reproduce, maintain genetic viability, and persist as a species. For example, mortality of mature plants was observed when erosion of road sediments buried plants (BLM 2005b, pp. 4.1-28). Seeds also have been buried and lost due to erosion runoff from well field facilities (BLM 2005b, pp. 4.1-28).

- Construction and operation of roads and well pads substantially increase dust (BLM 2005b, pp. 2-4, 2-5, 4.1-8). Direct effects to individual plants are most likely when surface disturbance occurs within 300 meters (m) (984 feet (ft)) of a plant, as fugitive dust and erosion are highest in these close proximities (Walker and Everett 1987, pp. 482-485; USFWS 2014, entire). Dust particles increase leaf temperature and reduce photosynthesis (Farmer 1993, pp. 63-75; Sharifi *et al.* 1997, pp. 842-843).

- Increased surface disturbance facilitates the proliferation of noxious weeds (BLM 2005b, pp. 4.1-9 to 4.1-11, 5-18). Noxious weeds can alter the ecological characteristics of hookless cactus habitat, making it less suitable (USFWS 1990, pp. 9, 11; BLM 2005a, pp. 3-112; BLM 2008 pp. 44, 67, 129-132, 135-136). Noxious weeds are difficult to eradicate and tend to out-compete native vegetation (see Nonnative Invasive Species below).

Energy development requires the addition of access roads in previously undeveloped areas. In most cases, these access roads can be used by the public. Increased road access results in direct loss of individual plants due to increased illegal collection of the species or through off-road vehicle (ORV) access (BLM 2005b, pp. 5-18; USFWS 1990, p .9). Illegal collection is an ongoing threat to Pariette cactus (see Factor B). The ORV use also can result in crushing of individual cacti, increased erosion, soil compaction, and sedimentation (BLM 2005a, pp. 4-246, 4-265 to 4-271; USFWS 1990, pp. 8, 10). We have documented at least 6 incidents where vehicles were used off road in areas that had not been properly surveyed, and this off road travel resulted in mortality to at least 15 Pariette cactus and *S. wetlandicus* individuals since July 2008 (USFWS 2009, entire). Two additional incidents were reported in 2013 and 2014 impacting 7 and 11 cacti respectively (Brunson 2013, Grasslands 2013, Gordon 2014). Although we do not know the extent of *Sclerocactus* impacted by ORV activities, these examples indicate that significant impacts can occur to individuals as a result of this activity.

We consider any disturbance in Pariette cactus habitat a loss of habitat because we are not aware of effective reclamation techniques in this species' habitat. Revegetation with native species is difficult due to the harsh environment of the lowest elevations of the Uinta Basin, which receive less than 15 cm (6 in.) of rainfall per year, and reach extreme hot and cold temperatures (BLM 2005a, pp. 3-112; BLM 2005b, pp. 3.5-1, 3.5-5, 4.1-11; USFWS 1990, p. 11). Successful revegetation in this area is expected to occur, but only over the long term (up to 50 years) in desert shrub and sagebrush communities (BLM 2005b, pp. 4.3-7, 4.2-12). Drought conditions could further extend the recovery period, and noxious weeds would persist regardless of control efforts (BLM 2005b, pp. 4.3-7). To our knowledge, successful reclamation has not occurred within Pariette cactus potential habitat.

Livestock Grazing and Trampling

Livestock grazing and trampling impacts cacti through direct trampling of individuals and habitat alteration. Livestock grazing can degrade ecosystem function and structure (Fleischner 1994, entire) through trampling, soil compaction, increased erosion, invasion of noxious weeds, and disturbance to pollinators (Kauffman *et al.* 1983, p. 684; Fleischner 1994, entire; Kearns *et al.* 1998, p. 90; DiTomaso 2000, p. 257). Grazing can facilitate the establishment of invasive species like *Bromus tectorum* (cheatgrass) (Masters and Sheley 2001, entire), which are difficult to eradicate and tend to outcompete native vegetation, including cacti. Invasive weeds including *B. tectorum* and *Halogeton glomeratus* (halogeton) are prevalent on BLM land in the range of Pariette cactus and less so on Uintah and Ouray Reservation land where grazing has been concentrated in areas outside of suitable cactus habitat (72 FR 53214, September 18, 2007).

Livestock trampling destroys individual Pariette cactus plants (Utah Natural Heritage Program 2006, p. 3; BLM 2005a, pp. 4-231 to 4-235, 4-238; USFWS 1990, p. 11; Brunson 2013; BLM

2015). Trampling is likely to result in reduced Pariette cactus plant densities (O'Hearn 2007, pers. comm.). Cattle grazing within occupied habitat of a closely related species, *S. wrightiae,* results in reduced cactus survival, lower flower density, and fewer large cacti (Clark 2010, p. 2). *S. wrightiae* and Pariette cactus are comparable in growth form and reproductive traits, and thus we would expect Pariette cactus to react similarly to grazing impacts. Loss of large individuals greatly reduces the reproductive capabilities of a population.

Nearly all Pariette cactus potential habitat on BLM land is leased for grazing under four BLM grazing allotments. Most of the area is grazed by sheep, either continuously or on a deferred rotation, with some cattle grazing on the western and eastern edges of Pariette cactus potential habitat. Livestock grazing occurs on Uintah and Ouray Reservation land, and although we do not know the extent, we are unaware of any measures to minimize the negative effects on Pariette cactus.

Private lands consitute more than one-third of the potential suitable habitat for Pariette cactus, yet we do not know the abundance of cacti that occur there due to lack of surveys on private lands. However, in 2006, livestock production contributed 67 percent to total agricultural reciepts in Uintah County (Godfrey 2008, pg 12), indicating that significant grazing activity is likely occurring on private agricultural lands. We assume that livestock grazing combined with energy development on these private lands is having a negative effect on Pariette cactus, similar to the effects of these activities on other lands. Given the widespread grazing-related impacts on BLM, tribal, and likely private lands across the range of Pariette cactus the species, we consider livestock grazing to be a low to moderate threat to Pariette cactus.

Nonnative Invasive Species

The spread of nonnative invasive species is considered the second largest threat to imperiled plants in the United States (Wilcove *et al.* 1998, p. 608). One of the most substantial negative effects invasives have on native ecosystems is the change in vegetation fuel properties which, in turn, alters the frequency, intensity, extent, type, and seasonality of fire (Menakis *et al.* 2003, pp. 282–283; Brooks *et al.* 2004, p. 677; McKenzie *et al.* 2004, p. 898). Shortened fire return intervals make it difficult for native plants to reestablish or compete with invasive plants (D'Antonio and Vitousek 1992, p. 73). Invasive plants can exclude native plants and alter pollinator behaviors (D'Antonio and Vitousek 1992, pp. 74–75; DiTomaso 2000, p. 257; Mooney and Cleland 2001, p. 5449; Levine *et al.* 2003, p. 776; Traveset and Richardson 2006, pp. 211–213). For example, *Bromus tectorum* outcompetes native species for soil nutrients and water (Melgoza *et al.* 1990, pp. 9–10; Aguirre and Johnson 1991, pp. 352–353).

Bromus tectorum is a particularly problematic nonnative invasive annual grass in the Intermountain West. If already present in the vegetative community, *B. tectorum* increases in abundance after a wildfire, increasing the chance for more frequent fires (D'Antonio and Vitousek 1992, pp. 74–75). In addition, *B. tectorum* invades areas in response to surface disturbances (Hobbs 1989, pp. 389, 393, 395, 398; Rejmanek 1989, pp. 381–383; Hobbs and Huenneke 1992, pp. 324–325, 329, 330; Evans *et al.* 2001, p. 1308). Anthropogenic increases in carbon dioxide in the atmosphere (which is leading to global climate change) are likely to also

increase *B. tectorum*. Invasive annuals increase biomass and seed production at elevated levels of carbon dioxide (Mayeux *et al.* 1994, p. 98; Smith *et al.* 2000, pp. 80–81; Ziska *et al.* 2005, p. 1328). *Bromus tectorum*, as well as the invasives *Halogeton glomeratus* and *Salsola tragus* (prickly Russian thistle), are known to occur across Pariette cactus' range (SWCA 2009, p. 11; SWCA 2015, entire). Of all invasives, *Bromus tectorum* was documented the most frequently in Pariette cactus' range, occuring in 17.2 percent of monitored plots, and *Halogeton glomeratus* was the second most frequent, occuring in 11.5 percent of plots (SWCA 2015). Although we do not know the exact extent and amount of these invasives across *S. brevispius*' range, given the fact that invasives tend to increase in density and the high level of energy and grazing-related disturbance in Pariette cactus' range, we expect the threat from *B. tectorum* and other invasives will only increase over time. Thus, we believe invasive species present a threat to Pariette cactus for the foreseeable future.

Climate Change and Drought

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Climate change is potentially impacting Pariette cactus now, and could continue to impact this species into the future. Over the last 50 years, average temperatures have increased in the Northern Hemisphere and extreme weather events have changed in frequency or intensity, including fewer cold days and nights, fewer frosts, more heat waves, and more hot days and nights (IPCC 2007, p. 30). In the southwestern United States, average temperatures increased approximately 1.5 degrees Fahrenheit (°F) compared to a 1960 to 1979 baseline (Karl 2009, p. 129). Climate modeling is not currently to the level of detail at which we can predict the amount of temperature and precipitation change precisely within the limited range of this species. Therefore, we generally address what could happen under current climate predictions.

Climate changes will continue as hot extremes, heat waves, and heavy precipitation will increase in frequency, with the Southwest experiencing the greatest temperature increase in the continental United States (Karl 2009, p. 129). Annual mean precipitation levels are expected to decrease in western North America and especially the southwestern States by mid-century (IPCC 2007, p. 8; Seager *et al.* 2007, p. 1,181), with a predicted 10- to 30-percent decrease in precipitation in mid-latitude western North America by the year 2050 (Milly *et al.* 2005, p. 1). These changes are likely to increase drought intensity and frequency where Pariette cactus

grows.

We do not have a clear understanding of how Pariette cactus responds to changes in precipitation, although generally plant numbers decrease during drought years and recover in subsequent seasons that are less dry. For *S. mesae-verdae*, a closely-related species with similar demographic characteristics as Pariette cactus, seedling recruitment and survival is strongly correlated with April precipitation (Coles *et al.* 2010, p. 5). It is likely that Pariette cactus, like *S. mesae-verdae*, depends on periodic high precipitation events in the spring for successful recruitment. Thus, with reduced spring precipitation, Pariette cactus is likely to experience reduced recruitment over time.

Accelerating rates of climate change over the past two or three decades indicate that the extension of species' geographic range boundaries toward the poles or to higher elevations by progressive establishment of new local populations will become increasingly apparent in the relatively short term (Hughes 2005, p. 60). However, the limited range of habitat that Pariette cactus inhabits could limit the ability of this species to adapt to changes in climactic conditions by progressive establishment of new populations. In fact, recent climate change research indicates that under a hot and dry scenario, no suitable Pariette cactus habitat would remain by the year 2099, and it is not possible for Pariette cactus to move into a more suitable climate (Krause 2010, pers. comm.).

Although Pariette cactus is adapted to hot and dry conditions, slight changes in environmental factors, especially precipitation, are a major influence in plant survival in arid regions (Herbel *et al.* 1972, p. 1,084). Global climate change exacerbates the risk of extinction for species that are already vulnerable due to low population numbers and restricted habitat requirements. Persistent or prolonged drought conditions are likely to reduce the frequency and duration of flowering and germination events, lower the recruitment of individual plants, compromise the viability of populations, and impact pollinator availability (Tilman and El Haddi 1992, p. 263; Harrison 2001, p. 78). For example, drought conditions led to a noticeable decline in survival, vigor, and reproductive output of other rare and endangered plants in the Southwest during the drought years of 2001 through 2004 (Anderton 2002, p. 1; Van Buren and Harper 2002, p. 3; Van Buren and Harper 2004, entire; Hughes 2005, entire; Clark and Clark 2007, p. 6; Roth 2008a, entire; Roth 2008b, pp. 3–4).

In summary, climate change is affecting and will continue to affect temperature and precipitation events in the future. Naturally occurring droughts are not likely to impact the long-term persistence of Pariette cactus, but an increase in periodic prolonged droughts due to climate change are likely to lead to a decline of the species across its entire range. Although we believe climate change will impact this species plants in the future, current data are not reliable enough at the local level for us to draw conclusions regarding the imminence of climate change threats to Pariette cactus.

<u>Summary of Factor A</u>

We find that Pariette cactus is in danger of extinction throughout all of its range due to the threats of energy development and climate change. These threats alone endanger the species

now and in the foreseeable future. Energy development is occurring in the habitat of Pariette cactus at a rate much greater than existed at the time we originally listed *S. glaucus* in 1979. The extent of current and pending energy development across the entire range of Pariette cactus is a threat to the species (USFWS 1990, pp. 8-10; BLM 2005a pp. 4-246, 4-265 to 4-271; BLM 2005b, pp. 4.1-26, 4.2-22, 4.3-14, 5-18; BLM 2008, ROD p. 49). Threats from oil and gas development, existing and planned, occur within the entire known range of Pariette cactus. These threats include erosion, soil compaction, sedimentation, increased road access, ORV use, surface disturbance, habitat fragmentation, and illegal plant collection. Combined effects of these threats could decrease the ability of Pariette cactus to reproduce and sustain viable populations. Rehabilitation of disturbed habitat areas following oil and gas projects is especially difficult in the dry, desert plant community, and is expected to be met with limited success. Although conservation measures minimize the loss of individual cacti due to oil and gas activities, the integrity of the species' populations may be impaired.

Climate change and drought are likely impacting the species now, and we expect the species' habitat may be severely limited so that the species can no longer survive within the next 100 years. Although the state of knowledge concerning the localized effects of climate change within the habitat occupied by Pariette cactus is somewhat speculative, the best available science indicates that climate change alone is a threat to this species in the foreseeable future.

We do not believe that the threats of livestock grazing and nonnative invasive weeds, while severe, would alone lead to the extinction of Pariette cactus across its entire range now or in the foreseeable future. However, these factors, combined with the existing threats of energy development and climate change, contribute to the endangerment of this species. Livestock grazing in particular occurs across the range of Pariette cactus, and negatively affects the species through trampling and habitat alteration. We do not currently have conservation measures in place to protect this species from livestock grazing, and we do not know the magnitude of grazing impact on this species. Invasive species also are known to occur throughout Pariette cactus' range and are known to outcompete native plants, but we do not know the magnitude of the impact of invasive weeds on Pariette cactus.

B. <u>Overutilization for commercial, recreational, scientific, or educational purposes</u>.

The original listing of *Sclerocactus glaucus* (Uinta Basin hookless cactus) concluded that the cactus is prized by collectors and, therefore, is threatened by unregulated commercial trade (44 FR 58869, October 11, 1979). Illegal collecting continues, is often documented, and negatively affects the species (USFWS 1990, p. 9; Ulloa 2006, p. 1). Roads associated with increased energy development (see Factor A) allow increased human access to Pariette cactus habitat with an increased potential for illegal collecting (BLM 2005b, p. 4.1-26). In 2006, the BLM documented that at least 60 Pariette cactus plants were illegally collected, many from existing monitoring plots within the Castle Peak/Eight Mile Flat Project area. Illegal collection areas were all within 100 m (382 ft) of roads associated with oil and gas development (Ulloa 2006, p. 1). Additional plants were lost in 2007 and 2008, but we do not know how many. No collecting losses have been reported to the Service since 2009. We conclude that illegal collection is a threat to Pariette cactus across its range and, combined with other threats to the species, contributes to its likelihood of becoming extirpated. However, collection alone may not cause

the species to become in danger of extinction throughout all of its range now or in the foreseeable future.

C. Disease or predation

Parasitism by the cactus-borer beetle (*Moneilema semipunctatum*) is a significant source of mortality to all *Sclerocactus* species on the Colorado Plateau, especially in larger, mature reproducing individuals (USFWS 1990, p. 11; Woodruff 2010, pp. 8-10). More studies are needed in order to determine the long-term population level effects of the cactus borer beetle to Pariette cactus.

D. The inadequacy of existing regulatory mechanisms

About 28 percent of Pariette cactus potential habitat is found on BLM land. Federal laws protecting this species on Federal land include the Federal Land Policy and Management Act (FLPMA), the National Environmental Policy Act (NEPA), and the Endangered Species Act (hereafter "Act").

The FLPMA requires BLM to develop and revise land-use plans when appropriate (43 U.S.C. 1712 [a]). The BLM developed a RMP for the Vernal Field Office to consolidate existing land-use plans and to balance use and protection of resources (BLM 2008, pp. 1–2). The RMP included conservation measures for listed species specific to oil and gas development, and these measures are included in projects through Section 7 consultation under the ESA. Conservation measures include moving well pad and pipeline locations to avoid direct impacts to the species and maintaining a 300-foot buffer between occupied habitat and surface disturbance. Despite employing these conservation measures, some projects can and do proceed within occupied Pariette cactus habitat and harm the species by, for example, increasing habitat fragmentation.

To address the lack of protection for Pariette cactus and its pollinators at the landscape level, we developed core conservation areas (USFWS 2013). If a pollinator can fly long distances, pollen transfer is also possible across these distances. To protect pollinators of Pariette cactus and thus successful reproduction and gene flow for Pariette cactus (an obligate outcrossing species), we identified a 400- to 1,000-m (984- to 3,281-ft) area beyond occupied habitat to conserve the pollinators essential for plant reproduction. The core conservation areas also provide more habitat for Pariette cactus to expand into and add protection against encroachment by invasive weeds or other disturbance effects.

Level 1 core conservation area polygons include the densest known populations of Pariette cactus and thus are of the greatest conservation importance. These areas were delineated using a 400-m pollinator habitat area around plants to allow for pollinator travel and include the densest concentrations of cactus locations and the most restrictive management recommendations. Level 2 core conservation area polygons include areas of medium to low plant density adjacent to Level 1 areas. Level 2 core conservation areas were developed using a 1,000-m pollinator habitat area around plants and require less restrictive management recommendations. These conservation areas are being implemented by the BLM through

consultation with the Service on a project by project basis, and they will be included as a recovery objective in the updated recovery plan. Implementation of core conservation areas will help protect remaining habitat for Pariette cactus and its pollinators.

Although core conservation areas and existing conservation measures will help protect Pariette cactus, we expect that these protections will not be followed on private or state lands. Protections on Ute Indian Tribe lands are now following the Ute Indian Tribe's Sclerocactus Management Plan for the Uintah and Ouray Indian Reservation, Uinta Basin, Utah, that was finalized in 2015 (Ute Indian Tribe 2015). This plan implements a 100-foot avoidance buffer for Pariette cactus (Ute Indian Tribe 2015), and therefore provides the Pariette cactus less protection from energy development across 85 percent of the species' population, as compared to 300-foot buffers that are used on Federal lands.

Substantial development has already occurred within occupied Pariette cactus habitat, regardless of landownership. Therefore, we conclude that even with implementation of the existing conservation measures, increased energy development in Pariette cactus habitat on non-federal lands will increase direct loss of individual plants and habitat, and decrease the likelihood of establishing relatively undisturbed conservation areas to preserve long-term integrity of the species.

The Vernal Field Office RMP includes management prescriptions for the Pariette Wetlands ACEC (BLM 2008, p. 121). The Pariette Wetlands ACEC management prescriptions state that the BLM will not authorize actions in suitable habitat for threatened and endangered species if those actions jeopardize the continued existence of the species or result in severe modification of the habitat (BLM 2008, Appendix G). Of BLM's 4,664 ha (10,437 ac) in the Pariette Wetlands ACEC, the 2008 Vernal Field Office RMP stipulates that the entire area will be open to oil and gas leasing subject to major constraints such as no surface occupancy stipulations (BLM 2008, p. 121). However, much of the ACEC was previously leased for oil and gas under the 1994 Diamond Mountain RMP (BLM 1994, p. 5), with much less restrictive management practices and absent no surface occupancy requirements within the Pariette Wetlands ACEC (BLM 1994, p. 5).

To date, the ACEC has provided little additional protection to Pariette cactus above and beyond conservation measures included in the RMP—for example, maintaining a 300-foot buffer between surface disturbance and occupied habitat. In fact, well density within the ACEC is slightly higher than well density within the range of Pariette cactus outside of the ACEC. As discussed above under "Oil and Gas Development and Associated Impacts," oil and gas development increases habitat fragmentation, soil erosion, sedimentation, dust, weed invasion, and public access across the landscape where this species grows. These effects occur despite a 300-ft buffer from surface disturbance, and full field development (a well every 40 acres) across the range of Pariette cactus is likely to be highly detrimental to the species. Therefore, we conclude that this ACEC is inadequate to protect Pariette cactus from the threat of habitat loss and modification due to oil and gas development.

The NEPA (42 U.S.C. 4371 et seq.) provides some protections for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to

implementation of such projects with a Federal nexus, NEPA requires an agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where the analysis reveals significant environmental effects, the Federal agency must discuss mitigation that could offset those effects (40 CFR 1502.16). These mitigations usually provide some protections for listed species. However, NEPA does not require that adverse impacts be mitigated, only that impacts be assessed and the analysis disclosed to the public. In the absence of the ESA's protections, it is unclear what level of consideration and protection Federal agencies would provide through the NEPA process and whether protection of Pariette cactus from the threats would be adequate.

The Endangered Species Act is the primary Federal law that protects Pariette cactus since its listing. Section 7(a)(1) states that all Federal agencies, in consultation with the USFWS, shall use their authorities in the furtherance of the purposes of the Act by carrying out programs for the conservation of endangered and threatened species. Section 7(a)(2) requires Federal agencies to consult with the USFWS to ensure any action they fund, authorize, or carry out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Section 9(a)(2) of the Act prohibits the following activities: (1) the removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction; (2) the malicious damage or destruction on lands under Federal jurisdiction, and; (3) the removal, cutting digging, damaging, or destruction of endangered plants on any other area in knowing violation of a State law or regulation, or in the course of any violation of a State criminal trespass law. Section 9 also makes illegal the international and interstate transport, import, export, and sale or offer for sale of endangered plants and animals.

The BLM policy regarding federally listed species includes measures to implement management plans and programs that will conserve listed species and their habitats (BLM 2001, p. 6). However, implementation of conservation recommendations are completed only if they are consistent with BLM land use planning and policy, are consistent with existing lease rights, and are technologically and economically feasible.

Additionally, the BLM lists Pariette cactus as a BLM-sensitive plant. Through the RMP, the Vernal Field Office is directed to conserve and recover all special status species, including listed species (BLM 2008, p. 129). Thus, limited policy-level protection by the BLM is afforded through the Special Status Species Management Policy Manual # 6840 which forms the basis for special status species management on BLM land (BLM 2008, entire). Even without protection under the Act, Pariette cactus would retain a 150-foot protection buffer from surface disturbance (Roe 2011, pers. comm.), although we do not consider this buffer sufficient to effectively prevent negative impacts associated with surface-disturbing activities. Additionally, the 150-foot buffer for sensitive plant species is not official policy for the BLM and could potentially change with new management or under specific project scenarios.

We are not aware of any standard protections afforded Pariette cactus on Uintah and Ouray Reservation land. Oil and gas development on the Uintah and Ouray Reservation is regulated by the Bureau of Indian Affairs (BIA) and the BLM. There are no Tribal laws or regulations that provide protection to the species, but because there is a Federal nexus (in this case, the involvement of the BIA and BLM) protection is provided under the Act. We work with the BIA

to minimize impacts to the species through incorporation of best management practices and buffers between plants and oil and gas developments through Section 7 interagency consultation. Although we currently require a 300-foot buffer between listed plant species and surface disturbance, the Uintah and Ouray Tribal Business Committee passed a resolution in 2011 to maintain no more than a 100 foot buffer between Pariette cactus and surface disturbance (Business Committee 2011, entire). We are currently working with the tribe to resolve the difference between buffer distances. Since 2007, we are not aware of any direct mortality to the cactus as a result of oil and gas development on Tribal land, although plants occur in close proximity to roads and well pads and are affected by the same factors that affect cacti on BLM land (for example, road dust and increased invasive species; see Factor A).

There are no laws protecting plants on private or State lands in Utah. Approximately 40 percent of potential habitat for Pariette cactus occurs on State of Utah or private lands. State and private lands have no regulatory authority affording protection to federally listed plant species. Oil and gas activity is occurring within the immediate vicinity of known populations on private and State lands. These populations are not protected or monitored on a regular basis.

Summary of Factor D

Despite BLM laws, regulations, and policy regarding federally listed species, implementation of conservation recommendations is completed only if they are consistent with BLM land use planning and policy, are consistent with existing lease rights, and are technologically and economically feasible. Adherence to protection of core conservation areas is a major step forward in protecting Pariette cactus. Uintah and Ouray Reservation land does not carry regulations that take precedence over energy development, and the existing regulatory mechanisms offer no protection to occurrences of the species on non-Federal lands. Specifically, the regulations and policies of the BLM and Uintah and Ouray Reservation do not include “no surface occupancy” stipulations for currently existing leases, which we believe would be necessary to recover Pariette cactus. This situation allows for the ongoing and planned expansion of energy developments that threaten the continued existence of Pariette cactus and its habitat.

The BLM and BIA generally require oil and gas lease holders in their development activities and associated disturbances to avoid direct impact to the species and maintain a protective buffer around these developments to reduce indirect impacts, although the Uintah and Ouray Tribal Business Committee is not supportive of the USFWS designated core conservation areas. In addition, recognizing and conserving habitat within core conservation areas will provide sufficient protection for this species on a landscape level. However, Pariette cactus receives no protection on state or private lands. The extent and magnitude of energy development-related threats demonstrate that existing regulatory mechanisms are not adequate to protect remaining occupied and essential Pariette cactus habitat. Therefore, we find that Pariette cactus is in danger of extinction throughout all of its range now and in the foreseeable future, and that the existing regulatory mechanisms do not adequately address the threats to the species.

E. Other natural or manmade factors affecting its continued existence

Other potential threats to Pariette cactus include effects from genetic swamping, small population size, and pollinator limitation.

Genetic Swamping

A potential long-term threat to Pariette cactus is genetic swamping from *S. wetlandicus* (Porter *et al.* 2007, pp. 3, 5, 8-9) a process whereby a more rare species hybridizes with a more common species and the gene pool of the more rare species is gradually lost or "swamped" by the more common species (Hufford and Mazer 2003, p. 148; Tepedino *et al.* 2010, p. 384). Individuals in the eastern portion of Pariette cactus' range have morphological characteristics and genetic markers common to both Pariette cactus and *S. wetlandicus* (Porter *et al.* 2007, pp. 3, 8-9; Nitschke-Sinclear 1985, pp. 1-6, map; 1989, pp. 4). Although genetic swamping can impact a species, some consider hybridization a process that can genetically enrich a species. Thus far, evidence indicates that hybridization between Pariette cactus and *S. wetlandicus* is a natural evolutionary process (Heil and Porter 2004, p. 199; Tepedino *et al.* 2010, p. 384) and could take numerous generations and perhaps thousands of years to fully manifest itself. Therefore, we do not consider genetic swamping a threat to Pariette cactus.

Small Population Size

Pariette cactus may be vulnerable to stochastic events and reduced reproduction due to its small population size. Small populations and species with limited distributions are vulnerable to relatively minor environmental disturbances (Given 1994, pp. 66–67). Small populations also are at an increased risk of extinction due to the potential for inbreeding depression, loss of genetic diversity, and lower sexual reproduction rates (Ellstrand and Elam 1993, entire; Wilcock and Neiland 2002, p. 275). Lower genetic diversity may, in turn, lead to even smaller populations by decreasing the species' ability to adapt, thereby increasing the probability of population extinction (Barrett and Kohn 1991, pp. 4, 28; Newman and Pilson 1997, p. 360).

In the absence of information identifying threats to the species that are linked to the rarity of the species, we do not consider rarity alone to be a threat. A species that has always been rare, yet continues to survive, could be well-equipped to continue to exist into the future. Many naturally rare species have persisted for long periods within small geographic areas, and many naturally rare species exhibit traits that allow them to persist, despite their small population sizes. Consequently, the fact that a species is rare does not necessarily indicate that it may be in danger of extinction in the foreseeable future.

We have no evidence that Pariette cactus' range and population numbers were significantly larger historically than they are currently, except for recent documented losses due to oil and gas development and illegal collection. However, as a species that requires cross-pollination (see Habitat and Life History above) Pariette cactus could be subject to insufficient numbers of plants for effective cross-fertilization, and thus prone to reduced viable seed production.

Pollinator Limitation

Recent insights into the pollination biology of Pariette cactus indicate weak evidence that bee

numbers may not be sufficient to pollinate Pariette cactus flowers (Tepedino *et al.* 2010, p. 383). Pariette cactus may be affected directly by use of herbicides in or directly adjacent to its populations, and indirectly by pesticides that affect its pollinators (USFWS 1990, pp. 10-11). More research is needed to determine whether bee numbers are sufficient to pollinate Pariette cactus.

Summary of Factor E

We consider genetic swamping of the Pariette cactus population by *S. wetlandicus* a natural, long-term process. For the foreseeable future (less than 1,000 years), this is not likely a threat to the species. The effects of small population size and its long-term effects on this species are unknown but are not expected to be appreciable. Thus far, the evidence for pollinator limitation for Pariette cactus is weak. Overall, we do not believe that any of these factors alone puts Pariette cactus in danger of extinction throughout all or a significant portion of its range now or in the foreseeable future. Further biological and ecological investigation of this species may provide evidence for additional conservation concerns in the future.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED:

Pariette cactus is currently listed as threatened. The protections afforded listed species from adverse effects of oil and gas development and specimen collection will continue through Sections 7 and 9 of the ESA. Conservation measures are in place to minimize the loss of individual cacti from oil and gas activities (BLM 2005a, pp. 1-14, 2-2, 2-29, 2-30; BLM 2005b, Record of Decision (ROD) pp. 5, 18-20; BLM 2008, appendix L, pp. 6-8). These measures include pre-construction cactus surveys and application of spatial avoidance buffers. Losses of individual plants have occurred despite conservation efforts implemented by the BLM and oil field operators.

We developed a recovery plan for *Sclerocactus glaucus* in 1990, which at that time included the population of Pariette cactus. We finalized a recovery outline for Pariette cactus on April 14, 2010. We plan to initiate a recovery plan in 2016.

In 2013, we developed draft management guidelines that identify core areas that are important to the resilience, redundancy, and representation of the species (USFWS 2013). These core areas were identified to help meet recovery objectives for the species and were based on pollinator travel distances and population connectivity. We are implementing these guidelines through our section 7 consultation process.

SUMMARY OF THREATS:

We determined that the main threats to Pariette cactus include: (1) the current and threatened destruction of the species' habitat through direct and indirect effects associated with energy development across the species' entire range; (2) livestock grazing and trampling; (3) nonnative invasive species; (4) climate change and drought; (5) illegal and unauthorized collection of the species for horticultural purposes; and (6) Federal, State, and Tribal regulations, which are not adequate to prevent or minimize the loss of occupied habitat. Two of these factors alone (energy

development and climate change), combined with the impacts from the remaining threats put Pariette cactus in danger of extinction throughout all or a significant portion of its range now and in the foreseeable future.

RECOMMENDED CONSERVATION MEASURES:

The BLM and BIA need to continue to protect Pariette cactus from direct and indirect impacts from energy and other development within the species' habitat. Undisturbed occupied habitat with the densest populations of Pariette cactus (which we call "core conservation areas") and open habitat connecting these areas should be designated as no surface occupancy areas, particularly because of the difficulty in restoring arid soils and vegetation. In core conservation areas with existing development, future development should be limited to existing disturbance. For plugged and abandoned wells and developed areas that are no longer in use within core conservation areas, effective reclamation of the species' habitat and native plant community needs to be prioritized.

Continued and expanded range-wide population monitoring are essential for the conservation of Pariette cactus. Additional surveys to delineate the species distribution are critical for environmental planning and management of Pariette cactus' habitat in relation to the intense oil and gas development of its habitat. New surveys should include GPS locations of all populations and accurate computer-based GIS mapping and analysis. Identification of pollinator nesting habitat and how to protect these areas would be beneficial to future management decisions. Protection of Pariette cactus from collection is needed and the precise location of individual plants should be kept confidential.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number: The uplisting of Pariette cactus has a listing priority number of 2. This priority number indicates the magnitude of threat is high and those threats are imminent. However, proposed rules to reclassify threatened species to endangered are a lower priority than listing currently unprotected species (i.e., candidate species), since species currently listed as threatened are already afforded the protection of the Act and implementing regulations.

Magnitude: **High**
Oil and gas development, grazing impacts, and illegal collection are current threats to Pariette cactus. Future oil and gas development in the range of this species could pose a major threat to the continued existence of this species due to its limited range. The species' entire population and range are within active and expanding oil and gas fields mostly on Federal and Uintah and Ouray Reservation lands administered by the BLM and Ute Tribe assisted by the BIA. Existing regulatory mechanisms including buffers and core conservation areas, where they are implemented, are adequate to protect remaining occupied and essential Pariette cactus habitat on a landscape level. However, these measures are not being implemented on all federal and tribal lands, as pre-existing leases allow development in a manner that conflicts with adequate protections for the species. We do not believe the species is being protected on private lands from energy development. Substantial disturbance has already occurred within occupied habitat and this disturbance is increasing with the permitted and proposed projects that overlap much of its range. The species also is subject to the trampling and habitat alteration from grazing, and specimen collection. Additional impacts from climate change and invasive species are highly likely to impact the species. Any one of these threats has the potential to severely impact Pariette cactus because of its highly limited range and distribution, and the combination of these factors contributes to a high magnitude of threats to Pariette cactus.

Imminence: **Imminent**
Threats to Pariette cactus are diverse, well documented, and ongoing. Threats associated with oil

and gas development are anticipated to continue into the foreseeable future. Based on the ongoing nature of threats to this species, we conclude that they are imminent.

Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? **Yes**

Is Emergency Listing Warranted? **No**, Species is already listed as threatened. Emergency uplisting to endangered is not warranted. Potential impacts to the species are not likely to destroy occupied habitat throughout all or a significant portion of the species' range within the immediate future. If oil and gas development increase substantially throughout a significant portion of the species' range, emergency listing would be reconsidered.

DESCRIPTION OF MONITORING:

In 2005, the BLM re-initiated demographic monitoring research on Pariette cactus, including revisits to historical monitoring plots. Research and monitoring is being conducted on 22 locations on BLM land. These data have not yet been analyzed for trends and are not representative across the entire range of the species.

In 2012, we implemented a range wide monitoring program. One-hundred and forty plots were established for Pariette cactus. Results after four years of monitoring show that there were very few significant differences in average percent cover of biotic habitat parameters between subpopulations of Pariette cactus. The average size of flowering stems of Pariette cactus is 45 mm. Only 20.5 percent of adults flowered in 2012 due to drought (SWCA 2013, entire) but 45 percent flowered in 2014 (SWCA 2015). We expect more complete demographic results after 5 years of data are collected. Also in 2012, the University of Wyoming completed a habitat model for Pariette cactus and the closely-related *S. wetlandicus*. This model was used to refine the potential habitat polygon for Pariette cactus and was ground-truthed in 2013 and 2014.

COORDINATION WITH STATES:

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: The Utah Natural Heritage Program based in Utah State University maintains an active database on the distribution and abundance of Pariette cactus. Information from this source was incorporated into this report.

Indicate which State(s) did not provide any information or comments: **None**

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ June 2, 2016
Regional Director, Fish and Wildlife Service Date

Concur: _____ 11/14/2016
Acting Director, Fish and Wildlife Service Date

Do not concur:_____ _____
Director, Fish and Wildlife Service Date

Director's Remarks:_____

_____

_____

Date of annual review:_____

Conducted by:_____