Lepidium barnebyanum
(Barneby ridge-cress)

5-Year Review:
Summary and Evaluation

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U.S. Fish and Wildlife Service
Utah Field Office – Ecological Services
West Valley City, Utah 84119

July 2011

5-YEAR REVIEW
***Lepidium barnebyanum* (Barneby ridge-cress)**

1. GENERAL INFORMATION

1.1 Purpose of 5-Year Reviews

The U.S. Fish and Wildlife Service (USFWS) is required by Section 4(c)(2) of the Endangered Species Act (ESA) to conduct a status review of each listed species at least once every 5 years. The purpose of the 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one for more of the five threat factors described in Section 4(a)(1) of the ESA, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the ESA that includes public review and comment.

1.2 Reviewers

Lead Regional Office: Mountain-Prairie Regional Office
Mike Thabault, Assistant Regional Director - Ecological Services, 303-236-4210
Bridget Fahey, Regional Endangered Species Chief, 303-236-4258
Seth Willey, Regional Recovery Coordinator, 303-236-4257

Lead Field Office: Utah Ecological Services Field Office
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1.3 Methodology Used to Compile the Review

We initiated a 5-year review of *Lepidium barnebyanum* on October 6, 2008 (73 FR 58261). We received one comment in response to the Federal Register (FR) notice. All substantive comments and issues raised were considered. This 5-year review was drafted by the species' lead botanist in the Utah Ecological Services Field Office (Utah ESFO). It summarizes and evaluates information provided in the 1993 Barneby Ridge-cress Recovery Plan (USFWS 1993), hereafter referred to as the "Recovery Plan," current scientific research, and surveys related to the species. All pertinent literature and documents on file at the Utah ESFO were used for this review. Interviews with individuals familiar with *L. barnebyanum* were conducted as needed to clarify or obtain specific information.

1.4 Background

1.4.1 FR Notice Citation Announcing Initiation of this Review

73 FR 58261, October 6, 2008

1.4.2 Listing History

Original Listing
FR notice: 55 FR 39864, September 28, 1990
Entity listed: Species
Classification: Endangered range-wide

1.4.3 Review History

In 1991, we conducted a 5-year review for species listed prior to that year (56 FR 56882, November 6, 1991). This notice summarized the listing status of these species, but did not further discuss species status nor did it propose or change the status of any species, including *Lepidium barnebyanum*. We also considered the species' status in the Recovery Plan in 1993.

1.4.4 Species' Recovery Priority Number at Start of 5-year Review

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic Genus	1	1C
		Species	2	2C
		Subspecies/DPS	3	3C
	Low	Monotypic Genus	4	4C
		Species	5	**5C***
		Subspecies/DPS	6	6C
Moderate	High	Monotypic Genus	7	7C
		Species	8	8C
		Subspecies/DPS	9	9C
	Low	Monotypic Genus	10	10C
		Species	11	11C
		Subspecies/DPS	12	12C
Low	High	Monotypic Genus	13	13C
		Species	14	14C
		Subspecies/DPS	15	15C
	Low	Monotypic Genus	16	16C
		Species	17	17C
		Subspecies/DPS	18	18C

At the start of this 5-year review, the recovery priority number for *Lepidium barnebyanum* was 5c. This ranking indicated: 1) the plants taxonomic standing as a full species; 2) a perceived high degree of threat from activities such as oil and gas exploration and field development, and OHV use within the species' habitat; inadequate regulatory mechanisms on Tribal land habitat; and its inherent vulnerability to extinction due to its low population numbers and limited range; 3) a relatively low potential for full recovery due to the species' limited population and limited potential habitat in an area with significant potential for oil and gas development throughout its entire range; and 4) a species whose conservation status is in conflict with existing land uses and management.

1.4.5 Recovery Plan

Name of plan: Barneby Ridge-cress *Lepidium barnebyanum* Recovery Plan
Date approved: July 23, 1993

2. REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment Policy

This section of the 5-year review is not applicable to this species because the ESA precludes listing Distinct Population Segments (DPSs) of plants. For more information, see our 1996 DPS policy (61 FR 4722, February 7, 1996).

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved Recovery Plan containing objective, measurable criteria?

No. Section 4(F)(1)(B)(ii) indicates that recovery plans, to the maximum extent practicable, include recovery criteria which when achieved results in a species' removal from protection under the ESA. This Recovery Plan does not include recovery criteria that achieve delisting. Instead, the plan stated that it was unknown if the potential removal of *Lepidium barnebyanum* from the ESA's list of endangered and threatened species would be possible.

The primary objective of the Recovery Plan was to maintain a viable population of *Lepidium barnebyanum* at its only known location, which is on Tribal lands. We found that maintaining a viable population could be accomplished by: 1) ensuring the protection of the species' current known population and occupied habitat in all three of its known stands by enforcing the conservation provisions of Sections 7 and 9 of the ESA, and 2) establishing formal land designations to conserve and protect the habitats at each of the three stands to ensure their long term protection primarily from oil and gas development actions and OHV activities.

A secondary objective was to initiate conservation measures which may lead to downlisting of the species to threatened status.

2.2.2 Downlisting Criteria and Progress Toward Achieving Them

(1) Criterion: The abundance and distribution of *Lepidium barnebyanum* has increased by the discovery of additional stands or, if feasible, by the introduction of additional stands into suitable habitat proximal to the species' known range. The Recovery Plan sets this criterion at a total of five separate stands of at least 2,000 individuals each and an overall total of 20,000 *L. barnebyanum* individuals.

Status: This criterion has not been met. Comprehensive surveys of *Lepidium barnebyanum* were conducted in 2010 and 2011. Approximately b of known suitable habitat was surveyed, and 4,082 plants were counted. This is far fewer than the 20,000 plants needed to meet this criterion. We have not introduced additional stands into adjacent suitable habitats.

(2) Criterion: The above *Lepidium barnebyanum* stands, through population monitoring, have populations demonstrated at viable population levels for the long term.

Status: This criterion has not been met. We have not determined a minimum viable population size for *Lepidium barnebyanum.*

(3) Criterion: The habitat of the aforementioned *Lepidium barnebyanum* stands has formal land conservation designations in place to protect the species and its habitat.

Status: This criterion has not been met. There are no land conservation designations in place that afford long term protection to the species. However, we have started discussions with the Ute Tribe and the Bureau of Indian Affairs (BIA) regarding conservation of this species. All of the species known occupied habitat occurs on Ute Tribal lands.

2.2.3 Recovery Plan Actions and Status of Each

(1) Regulate activities that affect *Lepidium barnebyanum* stands and habitats through Sections 7 and 9 of the ESA and other relevant laws and regulations. Oil and gas leasing on the Uintah and Ouray Reservation is permitted and regulated by the Bureau of Land Management (BLM) and the BIA. Since 2006, we have conducted two Section 7 consultations with the BIA for energy projects potentially affecting *Lepidium barnebyanum* and its habitat. These consultations resulted in the development and implementation of conservation measures, including a measure to survey and adhere to a 100-foot buffer between surface disturbances and individual plants. However, development continues in unoccupied suitable habitat thereby limiting potential expansion and recovery of the species. It is unknown if dust and erosion from oil and gas development is adversely impacting the viability of *L. barnebyanum* populations.

(2) Inventory suitable habitat for *Lepidium barnebyanum* and determine its population and distribution. Comprehensive surveys of *Lepidium barnebyanum* were conducted in 2010 and 2011. Approximately b of known suitable habitat was surveyed, and 4,082 plants were counted. The remaining known suitable habitat should be surveyed, and additional potential habitat in the nearby area should continue to be checked for species presence or absence.

(3) Establish and conduct population viability studies on each of the three known *Lepidium barnebyanum* stands. Population viability studies have not been initiated.

(4) Establish formal land conservation designations for the habitat of each of the three known *Lepidium barnebyanum* stands. Although we have discussed establishing formal land conservation designations for *Lepidium barnebyanum* (field visit between the BIA and ourselves, summer 2008) there have not been any conservation areas established yet.

(5) Conduct *Lepidium barnebyanum* life history research. Life history research has not been conducted.

(6) Propagate *Lepidium barnebyanum* individuals in horticultural facilities. Propagation has not occurred.

(7) Establish new *Lepidium barnebyanum* stands. We have not established new *Lepidium barnebyanum* stands.

(8) Develop public awareness, appreciation, and support for the conservation of *Lepidium barnebyanum*. The Uinta Basin Rare Plant Forum (Forum)—a group of private, government, and nonprofit biologists—has ranked *Lepidium barnebyanum* as one of the highest priority species for the Uinta Basin (Forum 2009). Because of the Forum's efforts, surveys for this species were conducted in 2010 and 2011. The participation of private and nonprofit individuals in the Forum and for survey efforts helps to develop public awareness and appreciation for this species. The Forum also has increased interagency awareness of the need to conserve this species, and as a result we have started discussions regarding monitoring and establishing conservation areas. We should continue to develop support for recovery of this species, particularly with the Ute Tribe and its members.

2.3 Updated Information and Current Species Status

2.3.1 Background on the Species

2.3.1.1 Biology and Life History

No new information concerning the biology and life history of *Lepidium barnebyanum* is available since we listed the species in 1990 and developed the Recovery Plan in 1993. The species is a rare local endemic occurring solely on Tribal lands and access to the species and its habitat is limited.

The species' plant community is comprised of small statured shrubs and semi-woody cushion plants on infrequently occurring limestone barrens within broader woodlands dominated by Utah juniper (*Juniperus osteosperma*) and piñon pine (*Pinus edulis*). The limestone substrate

where *Lepidium barnebyanum* grows has the appearance of highly weathered concrete. This particular limestone barren is an unnamed geological stratum of the geologic Uinta Formation. The species is restricted to that stratum. *Lepidium barnebyanum* is an edaphically (soil related) controlled endemic of the Uinta Basin (Welsh et al. 2003).

2.3.1.2 Distribution, Abundance, and Trends

The known spatial distribution of *Lepidium barnebyanum* has not changed since completion of the 1993 Recovery Plan. *L.* b*arnebyanum* is known from one population with three separate stands endemic to thin limestone caps on ridge lines near Indian Canyon approximately 3 miles south and southwest of the town of Duchesne, Utah (FIGURE 1):

- One stand is west of Indian Canyon Creek on the north ridge of Skitzy Canyon, a tributary to Indian Canyon, on the divide south of the Strawberry River.
- The second stand is on the ridge east of Indian Canyon Creek approximately 2 miles (5 kilometers) south east of the western-most stand.
- The third stand is on a ridge approximately 0.5 mile (0.8 kilometer) east of the second stand.

No new information concerning the demography of *Lepidium barnebyanum* is available since we listed the species in 1990 and developed the Recovery Plan in 1993. In the Recovery Plan, we estimated the species' population at 5,000 individuals on about 500 acres of suitable habitat occurring entirely on the Ute Indian Tribe's Uintah and Ouray Reservation. Comprehensive surveys of *L. barnebyanum* were conducted in 2010 and 2011. Approximately $^{2}/_{3}$ of known suitable habitat was surveyed, and 4,082 plants were counted. By extrapolating out to the rest of the known suitable habitat, we estimate the total population for this species to be approximately 6,000 individuals across approximately 500 acres of suitable habitat.

Access to the population is closely controlled by the Ute Tribe. In addition to our latest survey efforts, we are coordinating with the Tribe and BIA to establish monitoring plots for this species. We have not yet had the opportunity to closely monitor the species' known population or survey for additional populations in potential habitat. Recent (October 2008) interest in oil and gas development has enabled us to access the occupied habitat through coordination with the BIA and the Tribe. Anecdotal observations indicate the population and habitat of *L. barnebyanum* has changed little since the early 1990s (England pers. comm. 2008), and our recent survey work supports these observations.

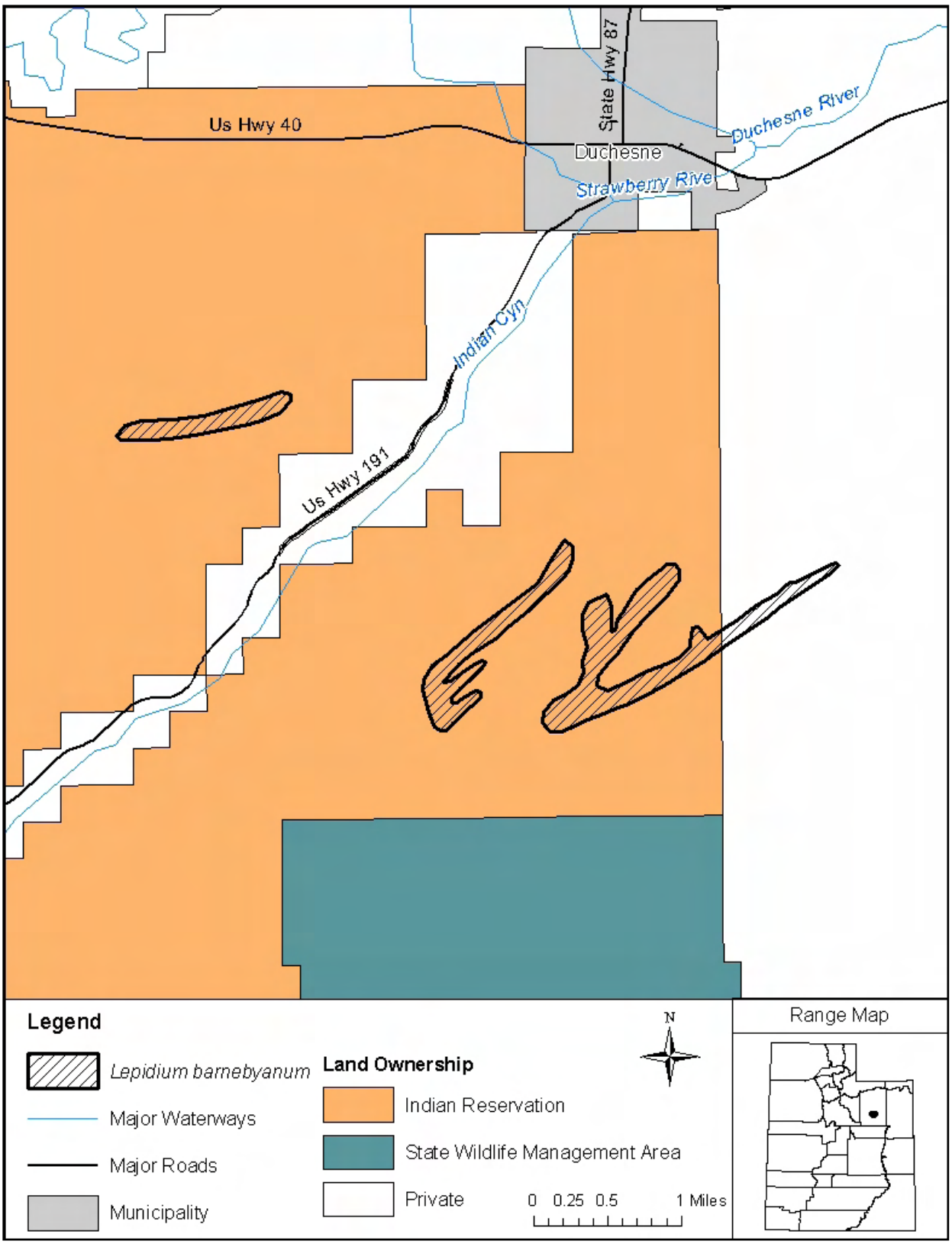

FIGURE 1. ***Lepidium barnebyanum*** **known sites within the range of the species.**

2.3.1.3 Genetics, Genetic Variation, or Trends in Genetic Variation

We are not aware of any information concerning the genetics of *Lepidium barnebyanum*. The species has a very low ratio of ovules developing into seeds which may result in embryonic failure and a loss of reproductive capacity (Weins et al. 1989; Davern pers. comm. 1988). Seedlings of *L. barnebyanum* are rare and more research is needed to determine the conservation implications of these preliminary observations. We are unsure if the low seed to ovule ratios in *L. barnebyanum* affect plant fitness.

2.3.1.4 Taxonomic Classification or Changes in Nomenclature

Lepidium barnebyanum's taxonomic classification has not changed since its listing. This species is the accepted taxonomic status verified with standards met in the Integrated Taxonomic Information System. In 1947, Rupert Barneby discovered a unique mustard in the lower portions of Indian Creek Canyon (55 FR 39881). This plant was later described as *Lepidium montanum* ssp. *demissum* (Hitchcock 1950). James Reveal re-evaluated the species and elevated this mustard taxon to full species level as *Lepidium barnebyanum* (Reveal 1967). All current taxonomic monographs of this species' genus and family (Rollins 1993; Al-Shehbaz 2010), national plants lists (Biota of North America Project 2010; Natural Resources Conservation Service 2010), and regional floras (Welsh et al. 2003; Holmgren et al. 2005) recognize this taxonomic treatment.

2.3.2 Five-Factor Analysis

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range.

As described in the Recovery plan, *Lepidium barnebyanum* occurs at locations that are subject to off-highway vehicle (OHV) use and activities resulting from the development of oil and gas resources (USFWS 1992).

<u>OHV Impacts to Habitat</u>
In our decision to list *Lepidium barnebyanum* and in our Recovery Plan, we cite the species as being threatened by vehicular impacts due to its narrow distribution along ridgelines (55 FR 39862; USFWS 1993). Since the species' listing in 1990, recreational (trail riding and hunting related) OHV use within the species' occupied habitat has been very light due in large part to Tribal control and active policing to prevent trespass. Therefore, we now consider the threat of recreational OHV to be low throughout the species' range. Listing under the ESA provides the Tribe an increased awareness of this species' vulnerability and provides the ability to further protect the species through Section 9(a)(2)(B) by reinforcing laws and regulations pertaining to violations of trespass laws (see section 2.3.2.4 below).

Oil and Gas Energy Development

Lepidium barnebyanum is threatened by exploration and development of oil and gas fields in its habitat. The general area has experienced significant oil and gas drilling and field development activity (Utah Division of Oil, Gas, and Mining (UDOGM) 2009). Special oil and gas field development techniques (e.g. directional drilling) are needed to avoid destruction of the species' habitat. Over the past 10 years, two developments have been proposed within the species' range:

- In 1989, the Coors Energy Company developed three wells within the species' range east of Indian Canyon. These wells were sited and access roads were adjusted to avoid direct impact to the species' occupied habitat (Kung 1989).

- In 2008, the Bill Barret Company proposed 9 wells in the field development area, 4 of which were within the species' range in Skitzy canyon. These proposed well locations and associated infrastructure were sited to avoid direct impacts to the species. The Tribe, BIA, and BLM approved 3 of these 4 sites with modifications that provided a 300-foot buffer from existing *Lepidium barnebyanum* plants for the proposed well sites and a 100-foot buffer from plants for all access roads. In addition, an old vehicle trail running through the east-west long axis of the species' occupied habitat was declared off limits to oil and gas field traffic (Chester pers. comm. 2008; O'Hearn pers. comm. 2008; Secakuku pers. comm. 2008).

Although the BIA reported that additional development within or near the species' range was expected in 2010 (Secakuku pers. comm. 2010), we have not consulted on any projects within the range of *Lepidium barnebyanum* in 2010 or 2011. Over the last 2 years, the BIA has not approved energy development projects within *Lepidium barnebyanum* habitat.

The location of the species' habitat on the top of relatively level ridgelines in an area of very steep topographic relief exposes the species to an increased likelihood of habitat destruction from oil and gas industry related activities (i.e., OHV use, pipeline installation, and road and well-site construction). These threats affect all stands of the species' single population (UDOGM 2009; Chester pers. comm. 2008; O'Hearn pers. comm. 2008; Secakuku pers. comm. 2008). Oil and gas field development is the current action that has the greatest potential to adversely affect *L. barnebyanum*. Oil and gas development related activities are a significant threat to the species because the entire area containing the known population has been leased for development. This is the only known activity that is likely to affect this species that has a direct Federal nexus, making this activity subject to requirements of the ESA.

Because specific data for the effects of petroleum resource development on *Lepidium barnebyanum* do not yet exist, we have analyzed data from other species to determine the most likely impacts to this *Lepidium barnebyanum* and its habitat, including habitat fragmentation, plant-pollinator interactions, and other effects.

Habitat fragmentation results in smaller populations that are more isolated (Aizen et al. 2002; Soons 2003; Lienert 2004). Although some species occur in naturally fragmented habitats, human-caused habitat fragmentation tends to occur too quickly for species to adapt (Soons 2003; Lienert 2004). Rapid changes and habitat fragmentation resulted in significant losses of specialized plant species (Fischer and Stocklin 1997). In addition, species' densities tend to decrease when habitat fragmentation results from human sources (Mustajarvi et al. 2001).

Lepidium barnebyanum exists in one population with three stands that may be prone to negative effects from habitat fragmentation. For example, smaller populations have been shown to fluctuate more widely over time and the smaller the remnant, the more susceptible the population is to extinction (Soulé et al. 1992; Forman and Alexander 1998; Menges 2002; Lienert 2004). Small plant populations can lose genetic variation and their population viability decreases (Ellstrand and Elam 1993; Lienert 2004; Kolb 2008). Fruit set, germination rate, offspring survival, and total numbers of flowers per plant were higher in larger populations than in small populations (Paschke et al. 2002). Similarly, the number of capsules per plant and the number of seedlings per plant were positively correlated with population size (Schmidt and Jensen 2000).

Other negative effects could result from roads associated with energy exploration. With increased oil and gas development, more roads are developed in and near suitable habitat. Ecological effects of roads can extend more than 100 meters from the road (Angold 1997; Forman 2000; Forman and Deblinger 2000). Disturbance can occur directly from construction or indirectly from road material pollution (including dust) and traffic (Angold 1997). Traffic densities also will affect the extent to which the road influences the natural biota. Many studies have reported findings that strongly correlate vegetation composition and health with distance from a road, and it may take decades for the full effects of road development to be realized (Auerbach et al. 1997; Myers-Smith et al. 2006).

Habitat fragmentation also can negatively affect plant-pollinator interactions (Debinski and Holt 2000; Moody-Weis and Heywood 2001; Aizen et al. 2002; Gathmann and Tscharntke 2002; Lennartsson 2002; Kolb 2008). Self-compatible and self-incompatible plant species are negatively affected by human-caused habitat fragmentation (Aizen et al. 2002). Fragmented plant populations appear to be less attractive to insect pollinators, which spend more time in larger, unfragmented plant habitats

(Aizen et al. 2002; Lennartsson 2002; Kolb 2008; Goverde et al. 2002). Furthermore, insect pollinator diversity increases in larger populations (Mustajarvi et al. 2001) and decreases in isolated habitats with smaller plant population sizes (Steffan-Dewenter and Tscharntke 1999). Lower pollinator visitation rates are associated with lower seed sets and reproductive success in fragmented sites compared to intact sites (Jennersten 1988), and this could explain why *Lepidium barnebyanum* was observed to have low seed set (see section 2.3.1.3 above and 2.3.2.5 below).

Bumblebees visit more flowers on fewer inflorescences in sparser plant populations (Mustajarvi et al. 2001; Goverde et al. 2002), leading to increased self-pollination or near-neighbor pollination contributing to inbreeding (Goverde et al. 2002; Lennartsson 2002). Additionally, inbred plants produce fewer flowers and seeds, have smaller plant height and smaller leaf-size, and reduced reproductive success (Steffan-Dewenter and Tscharntke 1999; Lienert 2004; Kolb 2008).

We have concluded that without protection under the ESA, *Lepidium barnebyanum* and its habitat face potential destruction from direct and indirect impacts from oil and gas development activities.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes.

We are not aware of threats to *Lepidium barnebyanum* from overutilization for commercial, recreational, scientific, or educational purposes.

2.3.2.3 Disease or predation.

Livestock grazing was reported as a concern in the Recovery Plan for adverse impact to *Lepidium barnebyanum* and its habitat. However, grazing is no longer allowed within *L. barnebyanum* habitat (Secakuku pers. comm. 2011). Thus, although we do not know how much livestock grazing impacted this species historically, we no longer consider livestock grazing to be a threat.

Lepidium barnebyanum has no known diseases that adversely affect the species on a range-wide basis.

2.3.2.4 Inadequacy of existing regulatory mechanisms.

Prior to listing *Lepidium barnebyanum* as endangered, no Tribal, Federal, State, or local law or regulation provided adequate protection to this species from threats to its habitat. Recreational OHV use has been curtailed in large part due to Tribal control and active policing to prevent trespass. Oil and gas development on the Uintah and Ouray Reservation is

regulated by both the BIA and BLM, creating a Federal nexus for compliance under the ESA. While listed, the species can be protected through the development and implementation of conservation measures on proposed actions (federally regulated oil and gas field development actions) through Section 7(a)(2) of the ESA.

Without the protection of the ESA, no existing regulatory mechanisms would protect the species from its current primary threat, oil and gas development. The entire range of the species could experience energy development levels similar to other areas on Tribal lands with well spacing up to 1 well per 10 acres. At higher well spacing densities, the threats described in 2.3.2.1 would significantly affect the survivability and recoverability of the species. At this time, this threat is only mitigated through the requirements of Section 7(a)(2) of the ESA.

2.3.2.5 Other natural or manmade factors affecting its continued existence.

Compared to closely related taxa in the same genus, *Lepidium barnebyanum* has a reduced seed/ovule ratio (i.e., a small percentage of embryonic seeds becoming mature seeds) (Davern pers. comm. 1988). This would tend to lower reproductive success and reduce population viability. The species has a very low ratio of ovules developing into seeds, which may result in embryonic failure and a loss of reproductive capacity (Weins et al. 1989). Reasons for this are unknown. Seedlings of *L. barnebyanum* are rare, and more research is needed to determine the conservation implications of these preliminary observations.

The degree of genetic diversity of *Lepidium barnebyanum* is unknown. The species is a long-lived perennial with an apparent low rate of reproduction (Davern pers. comm. 1988; England pers. comm. 2008). Knowledge of the degree of genetic similarity within and between its three separate sites may offer insights into the individual significance of each of the species' sites and its ability to adapt to environmental changes. In one tropical tree, low seed to ovule ratios appear to increase plant fitness by decreasing competition with genetically highly related siblings (Mohana et al. 2001). However, we are unsure if the low seed to ovule ratios in *L. barnebyanum* affect plant fitness.

The restricted range and small population size of *Lepidium barnebyanum* increases the possibility that inadvertent disturbance, either natural or human caused, could impact a substantial portion of the species' population and habitat.

The vegetative structure of the species' plant community appears to be stable, but introduced weeds (*Bromus tectorum* and *Halogeton glomeratus*) are invading in disturbed areas near roads and well pads (Chester pers. comm. 2008; England pers. comm. 2008; Secakuku pers.

comm. 2008). Spread of invasive species via roads coupled with increased road dust can exacerbate the impact on native species: an increase in fine dust particles can increase nonnative, exotic plant species (Reynolds et al. 2001).

The presence of *Bromus tectorum* shortens fire return intervals and allows *B. tectorum* to out-compete native shrubs and grasses that are adapted to longer fire return intervals (Gorrell et al. 2005; Zouhar 2003). Fires within *B. tectorum* infested areas also tend to occur earlier in the season leading to further damage to native vegetation (Zouhar 2003). Similarly, *Halogeton glomeratus* quickly infests areas that have been either left barren from fire or disturbed from mechanical or land management means (Pavek 1992). Mitigation for these threats should be addressed during the development of conservation measures during the Section 7(a)(2) process.

Climate Change

Climate change could potentially impact *Lepidium barnebyanum* or its pollinators, although the specific impacts of altered temperature and precipitation regimes are unknown. *L. barnebyanum's* phenology could be altered and could result in disruption of pollinator availability and activity, germination, or other life history needs. Over the next 2 decades, temperatures are expected to warm a total of 0.4°C, with a possibility of a 0.6 to 4.0°C increase by the end of the century (IPCC 2007). In the southwestern United States, including Utah and areas where *L. barnebyanum* grows, temperatures have increased ~0.8°C (1.5°F) compared to a 1960-1979 baseline (Karl et al. 2009). By the end of this century, temperatures are expected to warm a total of 2 to 5°C (4 to 10°F) in the Southwest (Karl et al. 2009). Additionally, hot extremes, heat waves, and heavy precipitation may increase in frequency, with the Southwest experiencing the greatest temperature increase in the continental United States (IPCC 2007). This temperature increase is likely to be coupled with a 10-30% precipitation decrease in western North America (Milly et al. 2005).

Within the range of the species, we experienced a drought during the first half of the current decade (2000–2004). Years of reduced precipitation may adversely impact the population.

Under the highest emissions scenario, by the end of this century precipitation is predicted to increase 10-15% in the winter and decrease 5-15% in spring and summer throughout *Lepidium barnebyanum's* range, (Karl et al. 2009). Fall precipitation is expected to stay the same (Karl et al. 2009). The levels of aridity of recent drought conditions and perhaps those of the 1950s drought years will become the new climatology for the southwestern United States (Seager et al. 2007). In fact, much of the Southwest remains in a 10-year drought, "the most severe western drought of the last 110 years" (Karl et al. 2009).

Alternately, *Lepidium barnebyanum's* occupied habitat has very low effective soil moisture due to very shallow and poorly developed soils and micro-topographic position at the top of slopes and ridges. Species associated with *L. barnebyanum* have wider distributions. *L. barnebyanum* occupies the most xeric sites within its range. It is reasonable to expect that a reduction in precipitation may give *L. barnebyanum* an enhanced competitive edge within its plant community because of its adaptation to low soil moisture regimes. These factors may mitigate in the species' favor given the expected reduction in precipitation projected as a consequence of global warming.

The initiation of population and habitat monitoring is essential for the long term conservation of this species. We need to determine the demographic and spatial changes of the species' population as it, or if it, occurs and develop, through adaptive management, conservation measures to ensure the species' population and ecosystem viability in the long term.

2.4 Synthesis

We listed *Lepidium barnebyanum* as endangered in 1990 under the ESA (55 FR 39860) and finalized a Recovery Plan in 1993. We knew the species to occur solely in one population exclusively on Tribal lands. At the time of listing and the development of the Recovery Plan, the primary threat to the species was the threat of individual and habitat destruction through oil and gas development activities. This remains the species' most significant threat. Habitat destruction through OHV use and livestock grazing are, at present, not significant threats to the species. The species' reproductive fitness is unknown and may be of concern to the species' survival and its ability to adapt to environmental changes. Since the development of the Recovery Plan, we have had virtually no access to *L. barnebyanum's* occupied habitat due to its occurrence solely on Tribal lands. Surveys have been conducted adjacent to the Uintah and Ouray Reservation, but no new populations have been discovered. No new populations have been introduced into suitable habitat elsewhere. Therefore, we have been unable to demonstrate any of our downlisting criteria for the species. Currently, we have reinitiated positive contact with the Tribe and are confident that needed surveys, monitoring, and biological studies are possible.

The species has a very limited population and range and, therefore, has a significant inherent vulnerability to habitat destruction or modification. The location of the species' occupied habitat within known oil and gas development areas poses a significant threat. Adverse impacts associated with oil and gas development activities are occurring within the species' range in part due to the species' topographic position at the top of ridges, where most of the activities take place. The recent observation of invasive weeds within disturbed areas of the species' occupied habitat is a conservation concern.

3. RESULTS

3.1 Recommended Classification

___Downlist to Threatened
___Uplist to Endangered
___Delist
X No change is needed

3.2 New Recovery Priority Number

At the start of this 5-year review, the recovery priority number for *Lepidium barnebyanum* was 5c. After this review of the species' status and a more rigorous application of the Recovery Priority Numbers within our 1983 guidance, we are reclassifying the species' number to 11c. This ranking indicates: 1) the plant's taxonomic standing as a full species; 2) a moderate degree of threats (indicated by stable populations and management of the primary threat, oil and gas development, through section 7 consultation); 3) continued low recovery potential (due to the species' limited population, limited potential habitat, and likely significant threats in the absence of the Act's protections); and 4) that the species conservation needs potentially conflict with development projects.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic Genus	1	1C
		Species	2	2C
		Subspecies/DPS	3	3C
	Low	Monotypic Genus	4	4C
		Species	5	5C
		Subspecies/DPS	6	6C
Moderate	High	Monotypic Genus	7	7C
		Species	8	8C
		Subspecies/DPS	9	9C
	Low	Monotypic Genus	10	10C
		Species	11	**11C**
		Subspecies/DPS	12	12C
Low	High	Monotypic Genus	13	13C
		Species	14	14C
		Subspecies/DPS	15	15C
	Low	Monotypic Genus	16	16C
		Species	17	17C
		Subspecies/DPS	18	18C

4. RECOMMENDATION FOR FUTURE ACTIONS

The Recovery Plan was written in 1993 without delisting criteria. We believe it is appropriate to revise the Recovery Plan to include these criteria, reevaluate threats, and provide updated conservation recommendations.

In the interim, we will continue fostering our renewed coordination effort with the Tribe and the BIA to conserve *Lepidium barnebyanum* in relation to oil and gas development actions within the habitat of the species. In addition, we will provide technical assistance to the Tribe and begin population monitoring of the species and additional surveys to further define the species' range and population. These actions will implement key portions of a revised species' Recovery Plan.

Specific Tasks Include:

- The BIA, with support of the Tribe and the USFWS, should conduct population surveys within the species' known range and potential habitat in the general region (Uinta Basin of northeast Utah) to better understand the species' range, abundance and potential threats.

- The BIA, with support of the Tribe and the USFWS, should conduct population monitoring to determine natural population dynamics and trends.

- The BIA, with support of the Tribe and the USFWS, should conduct monitoring to avoid impacts to the species' habitat from oil and gas development and other possible threats.

- The BIA, with cooperation of the Tribe and the Service, should conduct research of the species' life history including reproduction.

- We will ensure that the Section 7(a)(2) process addresses threats posed by invasive plants, dust, habitat fragmentation from road development and other indirect impacts from oil and gas development.

- We will work with the Tribe and BIA to evaluate the potential to establish a conservation area or a management plan to protect the species in perpetuity.

- We will investigate the species' response to climate factors by collecting the appropriate data during monitoring and by compiling relevant information from surrogate species.

- Denver Botanic Gardens currently has several thousand seeds of *Lepidium barnebyanum* in long term storage, although the collection is not considered complete. We will work with Denver Botanic Gardens to determine how much additional seed collection is needed, and we will work with the Tribe and BIA to obtain additional seeds.

Conservation actions in connection with interagency consultation under Section 7(a)(2) of the ESA, along with internal conservation actions by the Tribe, are considered essential for the species' long term survival.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of *Lepidium barnebyanum*

Current Classification: Endangered range-wide

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Review Conducted By: Jessi Brunson, Botanist, Utah Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 7/22/11
Field Supervisor, Utah Ecological Services Field Office

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Fish and Wildlife Service

Approve _____ Date 8/4/11
Acting Assistant Regional Director for Ecological Services, Region 6