DWARF BEAR-POPPY
Arctomecon humilis Coville

Photo by Daniela Roth; USFWS.

5-Year Review: Summary and Evaluation

U.S. Fish and Wildlife Service

Utah Field Office

Salt Lake City, Utah

September 29, 2016

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1. INTRODUCTION

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. Based on the outcome of the 5-year review, we recommend whether the species should be:

1) removed from the list of endangered and threatened species;
2) changed in status from endangered to threatened;
3) changed in status from threatened to endangered; or
4) remain unchanged in its current status.

If we recommend a change in listing status based on the results of the 5-year review, a separate rulemaking process must be conducted to implement the recommendation.

We must use the best scientific and commercial information available when we write a 5-year review. Therefore, we published a Federal Register notice on June 20, 2011 requesting any new information since the last review of the species (76 FR 35906-35908). No comments were received.

This 5-year review was primarily written by the U.S. Fish and Wildlife Service Utah Field Office, with contributions and review by the cooperating regional office.

2. BACKGROUND ON THE SPECIES' LISTING HISTORY

Scientific and Common Name:	*Arctomecon humilis* (Dwarf bear-poppy)
Listing Classification:	Endangered.
Listing History:	44 FR 64250-64252, November 6, 1979.
Critical Habitat:	None designated.
Other Associated Rules:	None.
Recovery Planning:	Dwarf Bear-Poppy (*Arctomecon humilis* Coville) Recovery Plan, 1985
Lead Agency, Region:	Mountain-Prairie Region, U.S. Fish & Wildlife Service
Lead Field Office:	Utah Ecological Services Field Office
Contact Information:	Jennifer Lewinsohn, Botanist, 801-975-3330, ext. 138
Cooperating Offices:	None

3. REVIEW OF THE LISTABLE ENTITY

3.1. Taxonomic Information

Dwarf bear-poppy (*Arctomecon humilis* Coville), is one of three species in the genus *Arctomecon* of the poppy (Papaveraceae) family. The other two species are *A. californica* and *A. merriamii*. The dwarf bear-poppy is the only *Arctomecon* species found in Utah. There are no taxonomic issues with its status as a distinct and clear species (Nelson and Welsh 1993, Welsh *et al.* 2003).

3.2. Application of the Distinct Population Segments (DPS) Policy

Dwarf bear-poppy is a plant species, listed as endangered range-wide. The Distinct Population Segments (DPS) policy does not apply to plants (61 FR 4722, February 7, 1996).

4. BASIC SPECIES INFORMATION

4.1. Brief Species Description

The dwarf bear-poppy is a short-lived (no more than ten years) perennial herb which grows in a circular rosette low to the ground (Nelson 1989; Harper and Van Buren 2004). Nodding buds bloom in April or early May into showy 4-petaled, white flowers that are roughly 1–3 inches (in) (3–8 centimeters (cm)) in diameter (Nelson and Welsh 1993). At the center of the flower is a green large, superior ovary subtended by many yellow stamens. After fertilization, the ovary matures in to a fruit capsule and splits at the top to release small shiny black seeds. Seeds have a fleshy attachment called an aril, which are attractive to ants (Harper and Van Buren 2004; Farrall and Mull 2012; Mull 2012). Each leaf is deeply cut like a paw into three to four sections with a hair or bristle at each tip. Leaf blades are covered with long hairs and waxy film giving them a distinctive blue-grey color (USFWS 1985; Nelson and Welsh 1993). Individual plants may reach up to 10 in (25 cm) in diameter and produce up to 400 flowers at their peak size, although 20-30 flowers per plant is more common (Harper pers. comm. 1990; Armstrong 1993; Nelson and Welsh 1993).

4.2. Basic Life History and Biological Limiting Factors

The dwarf bear-poppy is an extremely restricted species, found only on gypsum soils within a small area in and around St. George, Utah (USFWS 1985; Nelson and Welsh 1993). Plants most commonly occur on soils of the Shnabkaib Member of the Moenkopi Formation, but sometimes are found on the Middle Red Member or Upper Red Member (USFWS 1985; Nelson and Welsh 1993). These soils are slightly basic, high in both gypsum and calcium carbonate, and in comparison with desert shrub soils have lower concentrations of magnesium,

potassium and iron and higher levels of calcium and copper (Nelson and Harper 1991).

The climate across the range of the species is characterized by extreme daily temperature fluctuations, and unpredictable but generally low precipitation, averaging only 0.8 in (2 cm) annually (Harper and Van Buren 2004). Precipitation mainly occurs during the winter months with summer rainstorms contributing roughly a quarter of the annual total precipitation (Nelson and Harper 1991; Harper and Van Buren 2004). A recent habitat model indicates annual precipitation is the strongest predictor of suitable habitat followed by geology, soil gypsum content, and summer maximum temperatures (Bowker 2014). Additionally, the habitat model indicates the majority of existing suitable habitat is currently occupied by the species (Bowker 2014).

Dwarf bear-poppy habitat is sparsely vegetated, and consists of highly weathered rounded hill and dome formations. Roughly half of the soil surface is bare of vegetation, and the majority of the living cover in the habitat is biological soil crust[1] (Nelson 1989a; Nelson and Harper 1991; Simpson 2014). Associated native plants include shadscale (*Atriplex confertifolia*), Torrey's ephedera (*Ephedra torreyana*), nodding buckwheat (*Eriogonum cernum*), desert trumpet (*E. inflatum*), desert pepperweed (*Lepidium fremontii*) and burrobush (*Ambrosia salsola*). Invasive species include red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), barb-wire Russian thistle (*Salsola paulsenii*), and African mustard (*Malcomia africana*) (Harper and Van Buren 2004; Simpson 2014).

Dwarf bear-poppy reproduces sexually by seeds. The species has a mixed mating system and is thus capable of producing seeds through self-fertilization or cross-pollination by pollinators (Tepedino *et al.* 2014). However, the highest number of seeds and fruits are produced when flowers are cross-pollinated (Tepedino *et al.* 2014). Flowers are pollinated by bees and at least nineteen different species from six families have been identified to forage on dwarf bear-poppy flowers, including many native bees and the non-native common honeybee (*Apis mellifera*), although pollinator diversity has declined over the past decade (Tepedino *et al.* 2014). Pollination rate and seed production are related to plant density; as dwarf bear-poppy individuals become more rare on the landscape pollination success and seed production decline (Harper *et al.* 2000; Harper and Van Buren 2004).

Dwarf bear-poppy is a seedbanking species, producing very large amounts of seed, up to hundreds of thousands per acre each year that remain dormant but viable in in the soil for many years (Nelson 1989a; Nelson 1989b; Harper and Van Buren 2004). This species' persistent seedbank cannot be understated for the

[1] Composed of cyanobacteria, green and brown algae, fungi, lichens, and/or mosses; an important component of desert ecosystems that stabilizes soil, promotes water retention and fixes atmospheric nitrogen (Wikipedia 2016).

survival of this species. Long-lived seeds play a critical role in many plant species survival in arid and semi-arid environments and allow species to persist during unfavorable conditions in an unpredictable environment (Cabin *et al.* 2000; Megill *et al.* 2011). Seeds are primarily dispersed by wind and animals, mainly ants and rodents, which are also seed predators (Harper and Van Buren 2004; Farrall and Mull 2012; Mull 2012). Seeds are dispersed before they are mature and they need several years to complete development before they germinate (Nelson 1989b; Allphin *et al.* 1998; Allphin pers. comm. 2014). In a controlled setting, this species is practically impossible to germinate, seedlings have never bloomed in captivity, and individuals have not been successfully transplanted or cultivated by tissue culture (Pence 2016).

Seedling recruitment is episodic and occurs en masse when rainfall is sufficient during the late winter and spring. The species utilizes a pulse-reserve life history strategy where mass seedling recruitment occurs in favorable years that are infrequent (Reynolds *et al.* 2004; Simpson 2014). A large recruitment event occurred in 1992 and was linked to precipitation of at least 2 in (5 cm) between February and April (Harper and Van Buren 2004). Long time intervals are common between recruitment events, longer than the longevity of most dwarf bear-poppy individuals (Nelson and Welsh 1993; Harper and Van Buren 2004). During intervening years between recruitment events, a large fraction of the population remains dormant as a seedbank (Harper and Van Buren 2004). Seedling size is quite variable within a population and size is positively correlated with both survival and reproduction; larger seedlings have higher survival and reproductive rates than smaller seedlings (Harper and Van Buren 1992; Harper and Van Buren 2004). Seedling mortality can be high and was documented as 33 percent, and 50 percent for two years, and may even reach 95 percent (Harper pers. comm. 1990; Armstrong 1993; Harper and Van Buren 2002; Harper and Van Buren 2004). Mortality rates for the large cohort in 1992 ranged from 13 to 87 percent per year (Harper, pers. comm. 1990; Armstrong 1993; Harper and Van Buren 2002; Harper and Van Buren 2004).

Several genetic studies have been performed on dwarf bear-poppy (Van Buren and Harper 1996; Allphin *et al.* 1998; Simpson 2014). All show that different sites within populations have different levels of genetic variability and that not all sites experience an equal amount of gene flow with other sites. Some populations are in danger of becoming genetically isolated, specifically the Shinob Kibe population and the Boomer Hill site within the Red Bluff population. Both of these sites are at the most distant edges of the range and are likely to experience limited gene flow. The Shinob Kibe population may also be experiencing inbreeding depression as a result of its small size (see Section 6.5.1, below for more details).

4.3. Distribution

Dwarf bear-poppy is restricted to approximately 9,000 acres (3,642 ha) of habitat in the vicinity of St. George in Washington County, Utah (see Figure 2). The elevation range the species occupies is 823 to 1,006 m (2,700 to 3,300 ft). Approximately 30 percent of the habitat is located on state, private or municipally administered lands; the remaining 70 percent occurs on federal lands managed by the Bureau of Land Management (BLM) (see Table 1) (BLM 2008, Nelson 1989). We do not know the size of dwarf bear-poppy populations (see section 4.4, Population Status, below) or the percent distribution of the population based on land ownership.

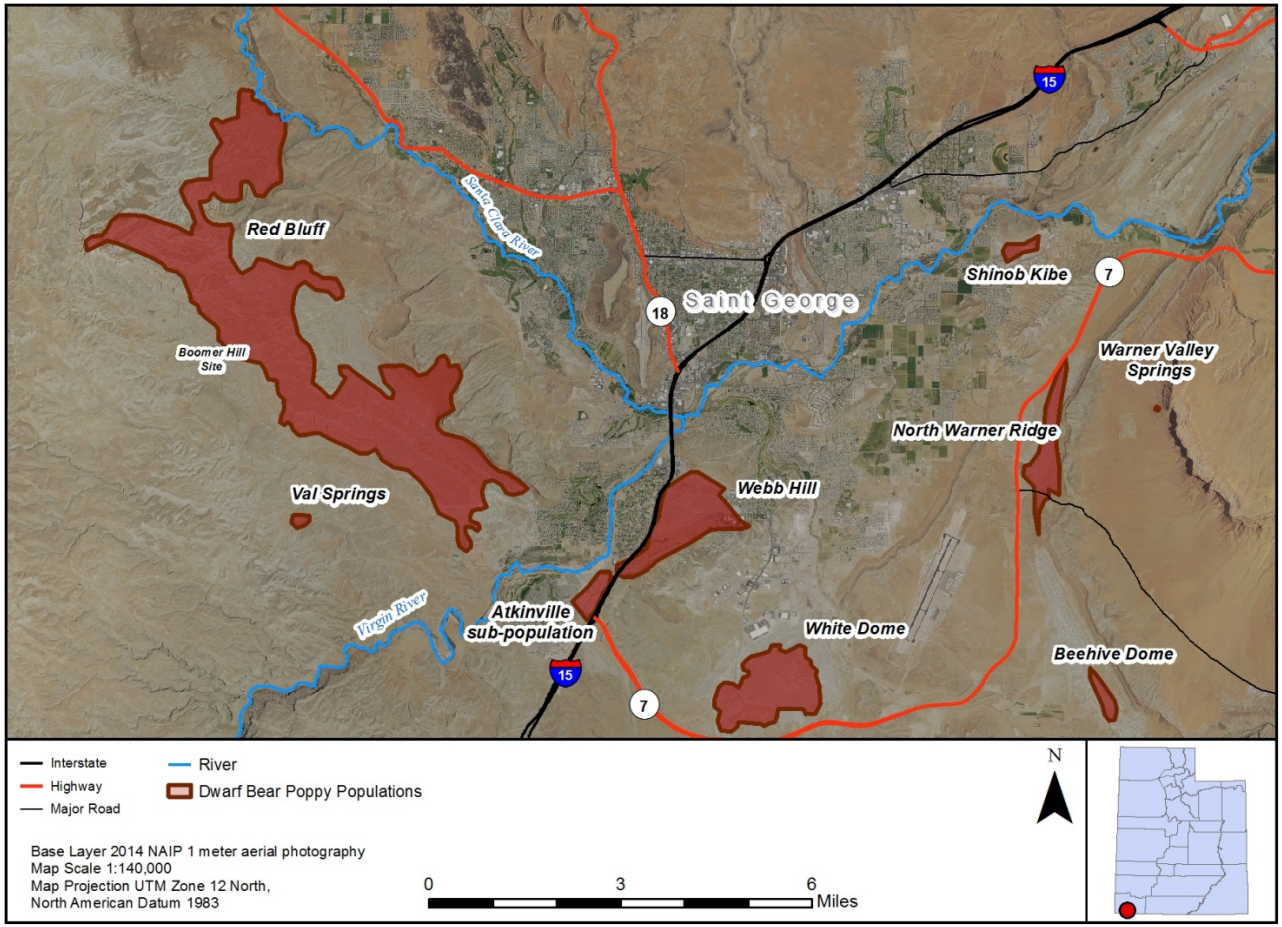

Figure 1. Dwarf Bear-Poppy-Populations

Table 1 - Summary of land ownership by acres for dwarf bear-poppy

Population	BLM	State	Private	TNC	Tribe	Military	Total
Red Bluff	5,221	894	76		30		**6,221**
Webb Hill	417	356	264				**1,037**
White Dome		491		648		5	**1,144**
Beehive Dome	94						**94**
North Warner Ridge	375						**375**
Shinob Kibe	59		15	15			**89**
Val Springs (estimate)	30						**30**
Warner Valley Springs (estimate)		5					**5**
Total	**6,196**	**1,741**	**360**	**663**	**30**	**5**	**8,995**

4.4. Population Status

At the time of listing, 11 populations were identified. Since that time, those population boundaries were re-evaluated and merged using Nature Serve criteria into seven populations and one additional population (Warner Valley Springs) was discovered (Nature Serve 2014). We currently recognize 8 populations (Table 1).

Table 2 - Summary of dwarf bear-poppy populations

Population	Land Ownership	Acres (% total acres)	Current Estimated Size[2] (est./cen., year)	Year of Last Complete Census
Red Bluff[3]	BLM State Private Tribal	6,221 (69%)	Unknown	Never
Val Springs	BLM	30 (<1%)	<300 (*estimate, 2014*)	1993
Webb Hills	BLM State Private	1,037 (12%)	1,000-3,000 (*estimate, 2014*)	Never
White Dome	The Nature Conservancy (TNC) State Military	1,144 (13%)	< 800 (*estimate, 1998*)	Never
Beehive Dome	BLM	94 (1%)	~800 (*estimate, 1998*)	Never
North Warner Ridge	BLM	375 (4%)	~3,000 (*estimate, 1998*)	1993
Shinob Kibe	BLM TNC	89 (1%)	~400 (*estimate, 1998*)	Never
Warner Valley Springs	State	5 (<1%)	<50 (*estimate, 2009*)	Never

We have never been confident of a total population size estimate for the dwarf bear-poppy because of the limited census data we have for most populations (see Table 2). The difficulty in estimating total population size is because there are large fluctuations in plant abundance at all monitoring plots, there is a large fraction of the population that remains dormant and thus non-detectible as a seedbank outside of recruitment years (see Basic Life History and Biological Limiting Factors, above), and vast acreages of suitable habitat within the Red Bluff population have never been surveyed.

Until comprehensive survey information is available, we and species experts generally characterize the size of the total population in terms of acres of suitable habitat (see section 4.3, Distribution, above). In the Recovery Plan, we did not provide an estimated total population size but rather we identified a plant density range of 15–20 plants per acre for the North Warner Ridge population. In this document, we do not present population estimates based on plant density data from monitoring plots. These data provide such a large range for population size

[2] Based on last known census or estimate for each population

[3] The 1998 population estimates provided in Table 1 for the Red Bluff and North Warner Ridge populations (large populations by area) reflect "an educated guess" from researchers of the species at the time based on existing monitoring and survey data.

that they do not provide a meaningful indication of population size or a meaningful evaluation of population trend. Aerial surveys performed by drones or low-flying aircraft during peak bloom are recommended to obtain population estimates for populations with large and medium acreages such as Red Bluffs, Warner Ridge, Webb Hill, White Dome, and Beehive Dome.

Approximately 50 percent of the poppy's historic habitat has been lost to urbanization and degradation from off-road vehicles (Harper and Van Buren pers. comm. 2004). Since 1990, an estimated 326 acres of poppy habitat has been lost to development (Jorgenson 2015) (see section 6.1.1 for more detail). Surveys in suitable habitat south of the state border in Arizona have not located additional populations (Bowker 2014).

A Population Viability Analysis (PVA) for the species indicates a downward population trend within the past 21 years (Meyer *et al.* 2015). Only one successful seedling recruitment and plant establishment event occurred within this time period and it appears that other large seedling recruitment events were not successful due to high seedling mortality from drought conditions. Two years of favorable moisture appear to be necessary to support successful plant establishment and population growth. The downward population trend may be accordance with the pulse-reserve life history strategy where mass seedling recruitment occurs in favorable years that are infrequent (see *Basic Life History and Biological Limiting Factors*, above). However, this downward trend is concerning given the long time-frame of decline. In addition to range-wide surveys, additional monitoring and evaluation of the magnitude and periodicity of future large recruitment events will be necessary to confirm whether the population is truly in decline or exhibits stability or growth over longer time periods than the current monitoring period.

Seedling survival has the strongest influence on population growth, and the PVA identified the one exceptional seedling recruitment event in 1992 which was the driver for species persistence over the past 20 years (Meyer *et al.* 2015). Because the life history of the dwarf bear-poppy is similar to plants from mesic environments that favor environmental stability, the extinction risk of the poppy is predicted to increase with increasing environmental stochasticity as a result of climate change or other sources. The primary management recommendations based on the PVA results is to preserve the habitat that remains for the poppy, identify favorable soil microsite conditions for seedling establishment, actively relocate seeds to those microsites, and support sufficient floral resources for pollinators in nearby habitats.

5. RECOVERY PLANNING AND IMPLEMENTATION

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to

determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species, and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The Recovery Plan was established in 1985 and is extremely out of date. Although down listing and delisting criteria were established in the Recovery Plan, they do not reflect the best available and most up-to-date information on the biology of the species and its habitat, its ecological requirements and threats. In order to determine whether or not a species is endangered or threatened, or has improved to the point of reclassification or delisting, the Act requires an explicit analysis of the five listing/delisting factors. The 1985 Recovery Plan includes some population-and one threats-based recovery criteria, but the Plan does not specifically consider the five listing factors. Therefore, section 8 of this review recommends revising the recovery plan.

5.1. Recovery Criteria[4]

Table 3 - Summary of recovery criteria for dwarf bear-poppy

Criterion 1: Remove threats to the dwarf bear-poppy by enforcement of existing regulations, including the Endangered Species Act, National Environmental Policy Act, and the Federal Land Policy Act.	This threat-based criterion does not adequately characterize the level of protection necessary to downlist or delist the species. Additionally, the recovery actions need to be updated because they do not include or evaluate newly emerged stressors such as pollinator limitation and small population size that likely increase the vulnerability of the species to existing threats.	Criterion Needs to be Updated. The intent of this criterion is partially met because of protections afforded to the species on BLM and TNC lands.
Criterion 2: Sustain healthy populations in their natural habitat at the existing sites.	This population-based criterion does not adequately characterize the level of protection necessary to downlist or delist the species, and does not include population trend or persistence considerations. Additionally, the recovery actions need to be updated to include recent research and monitoring recommendations.	Criterion Needs to be Updated. The intent of this criterion is partially met because of research and monitoring funded by the BLM and TNC.
Criterion 3: Develop public awareness, appreciation, and support for the conservation of the dwarf bear-poppy.	This criterion should be updated to include additional recovery actions that are more explicit and similar in nature to updated Recovery Plans for listed plants.	Criterion Needs to be Updated. The intent of this criterion is partially met because of efforts by the BLM, TNC, and Utah Native Plant Society.

5.2. Recovery Actions

The Recovery Actions are out of date and updates on their status do not provide a realistic picture of the progress towards recovery. See Section 5.1 for explanation.

5.3. Does the Recovery Plan Need Updating?

☒ Yes. The current Recovery Plan is 30 years old, does not consider threats based on the five-factor analysis, and our understanding of the species and impacts from known threats have changed drastically since the implementation of the Plan. Many recovery actions identified in the Plan have been implemented but we consider the full suite of recovery actions to be inadequate to achieve recovery.

☐ No.

6. SUMMARY OF FACTORS AFFECTING THE SPECIES

The final rule and the Recovery Plan cite development, Off Highway Vehicle (OHV) recreational use, and collection for ornamental use as threats to the species. Mineral exploration, in the form of gypsum strip mining, was listed as a potential threat to the species and restriction to a specialized soil type and small population size were considered vulnerabilities that intensify the adverse effects of existing threats (USFWS 1978, USFWS 1985). To help identify new threats in addition to assessing the threats we identified when we listed the species, we systematically examined what we know about dwarf bear-poppy's life history in the context of the same five factors we considered when we listed the species. The threats presented in the table are ranked according to our "Draft Guidance for Conducting Threats Assessment under the Act" (Service 2006).

Table 4 - Threats assessment critera

Scope (geographic extent of the stressor)	Localized- extent sums to 1 population.
	Moderate – extent sums to more than 1 population.
	Rangewide – stressor is present throughout the range
Immediacy (timeframe of the stressor)	Imminent – is the stressor present and acting on the target now
	Future – anticipated in the future
	Historic – the impact already occurred
Intensity (the strength of the stressor itself)	Low
	Moderate
	High
Exposure (the extent to which a target resource & stressor actually overlap in space and/or time given the scope)	Small (<10% of total population or habitat exposed)
	Moderate (11-50% of total population or habitat exposed)
	High (>51% of total population or habitat exposed)
Response (level of physiological/behavioral response due to a specific stress considering growth, fecundity, and mortality rates)	Basic need inhibited–basic plant needs for growth & development
	Basic need supported-basic plant needs for growth & development
	Injury – direct physical injury
	Mortality – identifiable reduction in growth rate or survival
Overall Threat Level or Impact from Factor (integration of the scope, immediacy, intensity, exposure, and response at the species level)	Beneficial (no action is needed)
	Not a threat (this factor is a consideration in the overall species assessment but not a threat in and of itself)
	Not a threat due to adequate management (This factor would be a threat if management actions were not in place to mitigate negative effects
	Low (at this point in time, no action is needed)
	Moderate (action is needed)
	High (immediate action necessary)

Table 5. Threats Assesment for Dwarf Bear-Poppy (UNK = Unknown)

Listing Factor	Threat	Mentioned in Listing Decision?	Scope	Immediacy	Intensity	Exposure	Response	Threat Level	Recovery/ Management Potential
Factor A. The present or threatened destruction, modification, or curtailment of the species' habitat or range.	Land development (including utility projects, residential and industry development, and development of permanent and paved roads).	Mentioned in Listing Decision	Rangewide	Historic/ Imminent/ Future	High	High	Basic need inhibited/Injury/Mortality	**High**	**Moderate on Federal lands; Low on state and private lands**
	Strip-mining of Gypsum	Mentioned in Listing Decision as potential threat	-	-	-	-	-	**Not currently considered a threat**	-
	Recreation (including unauthorized use and vandalism)	Mentioned in Listing Decision	Rangewide	Historic/ Imminent/ Future	High	High	Basic need inhibited/Injury/Mortality	**High**	**Moderate on Federal lands; Low on state and private lands**
	Livestock Grazing	Not mentioned in Listing Decision	Moderate-	- Historic/ Imminent/ Future	-UNK	UNK-	- Basic need inhibited/Injury/Mortality	**Potential Threat**	**Moderate on Federal lands; Low on state and private lands**
	Invasive Species	Not mentioned in Listing Decision	-Rangewide	-Future	-UNK	-UNK	- Basic need inhibited	**Potential Threat**	**Low**
Factor B. Overutilization for commercial, recreational, scientific, or educational purposes.	Collecting for Home Gardens	Mentioned in Listing Decision	-	-	-	-	-	**Not currently considered a threat**	-

Listing Factor	Threat	Mentioned in Listing Decision?	Scope	Immediacy	Intensity	Exposure	Response	Threat Level	Recovery/ Management Potential
Factor C. Disease or predation	Small mammal and insect predation	Not mentioned in Listing Decision	Moderate-	UNK-	UNK	UNK	Basic need inhibited/Injury/Mortality -	**Not currently considered a threat**	-
Factor D. The inadequacy of existing regulatory mechanisms.	Inadequacy of Federal, State, and local laws and regulations	Mentioned in Listing Decision	Rangewide	Historic/ Imminent/Future	Moderate	Moderate	Basic need inhibited/Injury/Mortality	**Moderate**	**High because of no protections on state and private lands**
Factor E. Other natural or manmade factors affecting the species' continued existence.	Loss of Pollinators	Not mentioned in Listing Decision	Rangewide-	Imminent/Future	-High	Moderate	- Basic need inhibited	**-High**	**Unknown-**
	Climate Change	Not mentioned in Listing Decision	Rangewide -	- Future	-UNK	-High	UNK	**Potential Threat**	**Low**

6.1. Factor A. The present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. Land development (including residential and industrial development, utility projects, and road development)

Land development was considered a threat to dwarf bear-poppy at the time of listing (USFWS 1979). All known populations occur in Washington County, UT, in and around the city of St. George, which is currently one of the fastest growing metro areas in the country (U.S. Census Bureau 2000, 2010, 2014). Projections indicate that the population of Washington County will likely increase by 243 percent by the year 2050 from recorded 2010 levels (Utah Foundation 2014). To-date approximately 50 percent of the dwarf bear-poppy's historic habitat has been lost to urbanization and degradation from off-road vehicles (Harper and Van Buren pers. comm. 2004). Currently, the poppy no longer occurs on private lands in Washington County except for habitat protected by The Nature Conservancy (TNC) (TNC 2015). Roughly 22 percent of known poppy habitat remains under state ownership by Utah School and Institutional Trust Lands Administration (SITLA). The loss of poppy habitat is highly likely in the next twenty years on the majority of State lands. A priority for recovery is the protection of poppy habitat on State and private lands. Protection options include land exchanges between the BLM and the State of Utah, land acquisition by TNC, a conservation agreement with the State of Utah, or additional protections afforded by the State of Utah and private landowners.

Potential impacts to dwarf bear-poppy from land development include mortality of individuals, habitat loss, degradation and fragmentation, increased soil erosion, increased dust generation, reductions in pollinator populations, reductions in plant reproductive potential, reductions in seed bank quantity and quality, and increasing invasive plant occurrences (Brock and Green 2003). Changes in land use can directly alter plant habitats by reducing occupied area, stability, connectivity, and quality, thus negatively affecting the viability of plant populations (Brigham and Schwartz 2003). Furthermore, development in unoccupied, suitable habitat will limit potential expansion and recovery of the species.

Increased habitat fragmentation and reduced habitat connectivity can negatively affect genetic variability and population viability (Gilpin and Soule 1986), and has the potential to exert a cascading effect through a plant community by modifying inter-specific interactions, exacerbating edge effect, and potentially affecting the genetic composition of populations (Ellstrand and Elam 1993; Young *et al.* 1996; Debinski and Holt 2000). Some of the negative effects of habitat fragmentation to plants are due to effects on pollinators that impact plant reproduction and fitness (see Loss of Pollinator Diversity, below).

Road traffic mobilizes and spreads dust on unpaved roads (Farmer 1993; Trombulak and Frissell 2000), and dust accumulation within nearby habitat can negatively affect plant growth and physiology (Eller 1977; Farmer 1993; Hobbs 2001; Spatt and Miller 1981; Sharifi *et al.* 1997; Thompson *et al.* 1984; Trombulak and Frissell 2000). The distance from a road at which dust can affect vegetation varies (Everett 1980; Spatt and Miller 1981; Walker and Everett 1987; Santelmann and Gorham 1988; McCrea 1984; Myers-Smith *et al.* 2006;), but negative impacts can occur up to 984 feet (300 meters) away from the road, and be long-lasting (Everett 1980, Myers-Smith *et al.* 2006). Road networks contribute to nonnative plant invasions via introduced road fill, vehicle transport of plant parts, and road maintenance activities (Forman and Alexander 1998; Gelbard and Belnap 2003). Many of these invasive species are not limited to roadsides, but also encroach into surrounding habitats (Forman and Alexander 1998; Forman 2000; Gelbard and Belnap 2003).

Most of the residential, industrial, and road development that has occurred since listing has directly impacted five populations: Webb Hill, Red Bluff, White Dome, Shinob Kibe, and North Warner Ridge. These five populations represent the majority of the species total habitat and population. An estimated 326 acres of poppy habitat has been lost to development since 1990 (Jorgenson 2015).

Within the Webb Hill population, residential development and grading of the land for future residential development has resulted in loss of plants and habitat on State lands within this population. The Webb Hill population is now completely surrounded by major roads (including Interstate 15) and has no habitat connectivity to other extant populations.

In 1997, a land exchange between the BLM and the State of Utah reconfigured the ownership to consolidate State parcels and minimize impacts to dwarf bear-poppy (BLM 1997). While there may be no easy way to directly compare density between sites, it is known that all parcels contained poppy habitat. The result of the Webb Hill land exchange is that 130 acres of occupied habitat left Federal management. The gain was that 103 acres entered Federal management in order to create a larger block of continuous dwarf bear-poppy for management and protections (BLM 1997). BLM lands within this population are completely fenced to clearly delineate the land ownership boundary and exclude other uses in plant habitat. The BLM has proposed that all poppy habitat in this population be designated as an Area of Critical Environmental Concern to identify the area as a priority biological area that will emphasize conservation and restoration efforts for the poppy (see Factor D, below).

At the Red Bluff population, residential development has occurred on the majority of State and private lands and likely resulted in the direct loss of plants and habitat over the past two decades (SITLA 2005; TNC 2015). We do not

anticipate future expansion of residential development on adjacent State lands within this population because of the popularity of the Bear Claw Poppy Trail with recreational users (see Recreation). There appears to be habitat connectivity between the Red Bluff and Val Springs populations.

At the White Dome population, The Nature Conservancy and Utah Department of Transportation have acquired approximately 800 acres of State lands to-date to protect and manage for the conservation of the species over the past two decades. Known as the White Dome Preserve, these lands are completely fenced to prevent unauthorized OHV access. Additionally, the Army National Guard fenced and is excluding use on approximately 3 acres of the species habitat (Johnson pers. comm. 2015). However, this small parcel of land is surrounded by industry (Utah National Guard 2012). On remaining State lands within this population, an industrial area, gravel mine operations, and access roads (including River Road) have been built within habitat to accommodate truck traffic from the industrial area. We anticipate industrial and road development will occur on much of the remaining State lands within the population in the future. The White Dome population is completely surrounded by major roads (including Southern Corridor) and has no habitat connectivity to other extant populations (TNC 2014).

At the Shinob Kibe population, residential development has occurred on the majority of state and private lands and likely resulted in the direct loss of plants and habitat over the past two decades. Excavation of soils for future homes along TNC's Dwarf Bear Poppy Nature Preserve property border has resulted in a 20 ft (6.1 m) vertical drop that may result in future habitat loss on the Preserve due to slumping or collapsing of soils. The Shinob Kibe population is completely surrounded by major roads and residential development and has no habitat connectivity to other extant populations (TNC 2014).

At the North Warner Ridge population, the Southern Corridor highway is under construction along the western edge of the population to accommodate future residential traffic from the surrounding area. This highway will provide a larger barrier to the Shinob Kibe population than the existing two lane road.

The populations of Beehive Dome, Warner Valley Springs, and Val Springs do not face immediate plans for development. However, all populations are likely to experience negative potential impacts from habitat fragmentation that can trigger other adverse effects such as the disruption of plant-pollinator interactions. It already appears that the species' important pollinators are not able to tolerate and adapt to the current level of development and habitat fragmentation within the species range with likely effects to all eight populations (see Section 6.5.2 for more details).

Two proposed water projects, the Warner Valley Reservoir Project and the Lake Powell Pipeline, have the potential to impact the dwarf bear-poppy. The Warner

Valley Reservoir Project would fill the entire Warner Valley with water for use by southern Utah residents. This project has the potential to directly impact both the Warner Valley Springs and North Warner Ridge populations, and possibly the Beehive Dome population. Direct impacts from the Lake Powell Pipeline are uncertain at this time. This project has the potential to impact suitable habitat outside of known populations. One survey conducted in 2010 did not find any individuals in suitable habitat within the project right of way (Utah Board of Water Resources 2010). However, 2010 was a year with little to no above ground plant abundance based on BLM monitoring at the Red Bluff population. Therefore, the potential remains for the species to occur within the proposed project area. Both proposed water projects would provide water for use by southern Utah residents, and indirectly affect the species by promoting growth and development within unprotected poppy habitat on State lands in Washington County.

Due to the high exposure and intensity of development in and around dwarf bear-poppy habitat, the continued and increasing levels of development in Washington County and around St. George, and the severity of the direct and indirect impacts to the species resulting from development, we assign development a **high** threat level for dwarf bear-poppy.

6.1.2. Strip-mining of Gypsum

Strip-mining of gypsum was considered a potential threat to dwarf bear-poppy at the time of listing (USFWS 1979). However there are no current mining claims in occupied habitat and commercial mining does not occur in or directly adjacent to dwarf bear-poppy populations. Therefore, mining is no longer considered to be a threat to the species.

6.1.3. Recreation (including OHV use, hiking, mountain biking, horseback riding, unauthorized recreational use, and vandalism).

OHV use was considered a threat to dwarf bear-poppy at the time of listing (USFWS 1979). We evaluated this recreational use as well as other forms of recreation that occur in the habitat such as hiking, mountain biking, and horseback riding.

Impacts from all forms of recreational use evaluated here include damage and mortality of individuals, destruction and fragmentation of habitat, soil compaction and erosion, destruction of biocrusts, and degradation of vegetative community (Harper *et al*. 1998; Brooks and Lair 2005; Ouren *et al.* 2007; Roth 2012). Recreational use modifies the natural Mojave desert ecosystem including soil components, such as biological living crusts, associated native plant communities, and pollinator community and the potential for encroachment of non-native weeds in disturbance areas (Adams *et al.* 1982; Goeft and Alder 2001). Soil compaction

and erosion may render the habitat unsuitable for the poppy and affect future recruitment of the species in some locations. Studies show that the majority of environmental impacts occur within the trail footprint because soil compaction and erosion are generally confined to the existing trail margins with minimal change to adjacent areas (White *et al.* 2006; Goeft and Alder 2001).

Recreational use by OHVs was by far the most common recreational activity impacting dwarf bear-poppy, and nearly all areas of occupied habitat have experienced OHV impact in the past 30 years. Extensive damage to the habitat by OHVs has occurred at Red Bluffs, Webb Hill, North Warner Ridge, and White Dome. OHV use is now prohibited throughout much of occupied habitat on BLM lands (BLM 1999) and TNC lands. However, impacts to the land from previous use may last for decades to come (Abella 2014). Today, OHV use is further restricted in areas by perimeter fences or fences that tie back into steep formations for a significant area at Red Bluff; all of BLM owned Webb Hills; all of TNC owned White Dome; along the road edge from Beehive Dome to North Warner Ridge; and both BLM and TNC areas at Shinob Kibe. These fences have significantly reduced, but not ended, the unauthorized use of OHV within fenced habitat. Unfortunately, OHV use continues on adjacent State land occupied by dwarf bear-poppy without any restriction.

Unauthorized OHV use has been recorded at all known populations (either where it was prohibited, or off-trail use where OHV travel was restricted to designated routes). Illegal land uses such as building a motorbike course with illegal earth-moving equipment have been documented by BLM and USFWS within the North Warner Ridge population (Douglas 2016). Fences have also been repeatedly cut on TNC and BLM lands. Unauthorized motorized use occurs in the Red Bluff population, but the frequency of this use has declined over time. The decline in motorized use is supported by BLM monitoring of motorized tracks in the Red Bluff ACEC that identified 157 tracks in 1987 and only 2 tracks in 2009 along the Bearclaw Poppy Trail between Clavicle Hill and the Bloomington Trailhead. In addition, the number of citations for illegal motorized use and the frequency of fence repairs declined from 1987 through 2009 (BLM 2012). One problem area for illegal motorized use in the ACEC was a location at the northern end of the Red Bluff ACEC along Stucki Springs Road. At this location between 2007 and 2009, BLM law enforcement officers wrote multiple citations made 25-30 fence repairs annually, or an average of once every two weeks. Since 2009 at this location, there has been a downward trend in unauthorized motorized use with the incorporation of frequent patrols by the BLM and the notification of infractions by non-motorized users of the Bearclaw Poppy Trail (BLM 2012).

Mountain biking is a non-motorized use that is authorized on one designated trail by the BLM within the Red Bluffs population, the largest population of the species. The Bear Claw Poppy Trail, is a popular mountain biking trail that is approximately 10 miles in length and includes portions of the following

commonly known mountain bikes routes: Green Valley Loop, Stucki Springs Loop, and Red Bluff Competitive Area Trails (BLM 1999; BLM 2012). The Bear Claw Poppy Trail is a reclaimed ATV route that varies in width from 3-7 feet. The Trail is used heavily and unauthorized use has occurred to create a network of spur trails and shortcuts that are not considered part of the designated Trail, particularly within the State lands portion of the Trail. This repetitive tracking creates an enduring trail that becomes more susceptible to regular use (Brooks and Lair 2005, Ouren *et al.* 2007). On State lands, there is no formal or regulatory protection for the poppy and there are no formal enforcement or management measures to protect the species from recreational use or to restrict recreational use within poppy habitat. The State informally allows the BLM to repair fences and to establish signs to educate recreational users about the Bear Claw Poppy Trail and the importance of the protecting poppy habitat on State lands.

An evaluation of the Trail was performed by the BLM and identified 54 miles of linear disturbance from authorized and non-authorized use within the Red Bluff ACEC in 2009 (BLM 2012). The Bearclaw Poppy Trail comprises 10 miles of the historic disturbance amount. This disturbance is equivalent to 0.003 percent of the ACEC area. The majority of the linear disturbance (40 miles) was created prior to 1990 from motorized vehicles. The poppy habitat is slow to recover from recreational impacts; historic recreational use remains visible on the landscape for decades even for trails that have not received recreational use since 1999. Between 1990 and 2009, a total of 14 miles of new disturbance was created by recreational use because of unauthorized spur trail sand shortcuts.

Land managers have been aware of trail issues and have made efforts in the past to direct users by placement of signs, rocks, and raking out of unwanted trails but these efforts have not been successful because barriers are often moved and trails reestablished. (Douglas 2016; Roth 2012). In 2004, the BLM in consultation with our office developed the Bearclaw Poppy Trail into a one-way loop that was intended to minimize trail widening from two-way bike traffic within dwarf bear-poppy habitat. As noted by researchers of the species, the BLM effort to confined recreational use to marked trails has been largely successful (Harper and Van Buren 2004; Searle 2014). In 2015, the BLM in consultation with our office is rehabilitating and reclaiming unauthorized roads and trail segments within poppy habitat, installing additional directional signs to provide guidance for recreational users and installing new trailhead interpretive panels and regulatory signs (BLM 2014). Overall, dwarf bear-poppy habitat that is adjacent to recreational trails within the Red Bluff population receive occasional use, but the dwarf bear-poppy population appears to be healthy despite the occasional use (Searle 2013; Searle 2014).

Horseback riding has not been found to be a significant impact on any population, although unauthorized use continues to occur at Shinob Kibe. Hiking is also a popular activity on old OHV trails at the Webb Hill population where no

recreation is authorized and at Red Bluff population on both the authorized and unauthorized trail segments.

While OHV use in the habitat has declined significantly since 1999, the impact to the habitat and the species continues into the future. Old OHV trails continue to be used by non-motorized users and the majority of this use is unauthorized. Since enforcement is sporadic, we do not have good reporting of the current level of unauthorized recreational use in the majority of the populations. We anticipate the level of recreational use will increase in poppy habitat with an increase in local population growth, with smaller buffers between residential development and poppy habitat, and with fewer options for recreation as open space is developed in and immediately surrounding the St. George city limits. Therefore, we designated the threat level from recreation as **high** for dwarf bear poppy.

6.1.4. Additional threats and factors not included in listing decision

Livestock Grazing

The final rule for dwarf bear-poppy did not identify livestock grazing as a threat; however, we evaluate this stressor because livestock grazing occurs at Red Bluff, Beehive Dome, and North Warner Ridge populations.

Grazing can have particularly detrimental impacts on plant community composition for gypsum specialists such as the dwarf bear-poppy by disturbing the soil crust (Meyer and Garcia-Moya 1989; Pueyo *et al.* 2008). Impacts include changes in vegetation composition and abundance, increased soil erosion and compaction, a reduction in water infiltration rates, and an increase in runoff (Gifford and Hawkins 1978; Robinson and Bolen 1989; Waser and Price 1981; Holechek *et al.*1998; Loftin *et al.* 2000), leaving less water available for plant production (Dadkah and Gifford 1980). The ecological impacts of grazing include: (1) Alteration of species composition of communities, including decreases in density and biomass of individual species, reduction of species richness, and changing community organization; (2) disruption of ecosystem functioning, including interference in nutrient cycling and ecological succession; and (3) alteration of ecosystem structure, including changing vegetation stratification, contributing to soil erosion, and decreasing availability of water to biotic communities (Fleischner 1994). Livestock may also increase the spread of cheatgrass and red brome (DiTomaso 2009) (see Invasive Species, below).

At the Red Bluff population, two of three grazing allotments found within the population are active. Grazing has not occurred in the Curly Hollow allotment (approximately 3,000 acres of this allotment occurs within the population) since 2000, when the Grand Canyon Trust obtained the grazing rights for poppy habitat in this allotment. The Boomer Hill allotment has approximately 1,850 acres

occurring within the population and the Santa Clara Creek allotment has approximately 13 acres occurring within the population.

At the Warner Ridge population, the Dome, Warner Ridge, and Fort Pearce grazing allotments are actively used. Approximately 30 acres of the Dome allotment occur with the population, approximately 363 acres of the Warner Ridge allotment occur within the population, and approximately 3 acres of the Fort Pearce allotment occur within the population. Approximately 9 acres of the Fort Pearce grazing allotment also occur within the Beehive Dome Population.

Livestock grazing of individual poppy plants is not common because of the high alkaloid content in the leaves (see Factor C, below). However in 2014, juvenile cows grazed only the flowers of approximately two-thirds of the flowering plants at Beehive Dome in one week. Permittees had already removed the cows from the habitat but a number of cows returned to the habitat after a breach in the livestock fence from illegal recreational users allowed access (O'Brien 2014). This is the only evidence of livestock grazing on poppy plants.

We determine that livestock grazing is a **potential threat** to dwarf bear-poppy because we do not have evidence of a population level impact to the species. We will continue to assess the potential of livestock grazing to pose a threat to the species. Regular monitoring of livestock grazing in poppy habitat is recommended and research on the direct and indirect impact of livestock grazing to the species is needed.

Invasive Species

Invasive species were not considered a threat in the dwarf bear-poppy listing decision. However, we evaluate this stressor because invasive plants are present in dwarf bear-poppy habitat with new species invading the habitat.

Invasive plants can exclude native plants and alter pollinator behaviors (D'Antonio and Vitousek 1992; DiTomaso 2009; Mooney and Cleland 2001; Levine *et al.* 2003; Traveset and Richardson 2006). For example, cheatgrass and red brome out-compete native species for soil nutrients and water (Melgoza *et al.* 1990; Aguirre and Johnson 1991; Brooks 2000), as well as modify the activity of pollinators by producing different nectar from native species (Levine *et al.* 2003) or introducing nonnative pollinators (Traveset and Richardson 2006). Nearly all form of anthropogenic disturbance including the previously discussed threats of development, recreation, and livestock grazing provide avenues for invasive plants to spread.

Red brome, an invasive annual grass, was the only non-native plant specifically noted in the species' habitat from the earliest plant community assessment (Nelson and Harper 1991). Red brome was occasionally present in the habitat

with very low percent cover, rarely near poppy plants, but was commonly abundant at the base of shrubs. Currently, three additional invasive plant species occur in dwarf bear-poppy habitat: African mustard (*Malcomia africana*), cheatgrass (*Bromus tectorum*) and barb-wire Russian thistle (*Salsola paulsenii*) (Simpson 2014). At White Dome, two additional non-native annual plants were found in 2014, redstem stork's-bill (*Erodium cicutarium*), and a split grass species (*Schismus* spp.) (Abella 2014).

The total percent cover of all of invasive plant species in the poppy habitat is still low but has increased since 1991. The present level of non-native grasses and forbs likely denotes a change in the Mojave ecosystem affected by human impacts (Lovich and Brainbridge 1999). At sites visited by Simpson, African mustard has the highest percent cover of the four invasive plants in dwarf bear-poppy habitat at 0.33 percent relative cover (Simpson 2014). Shinob Kibe, Webb Hills, and White Dome have a relatively high cover of African mustard, but still less than 1 percent (Simpson 2014). African mustard had the highest frequency of all associated plant species at White Dome (Searle and Yates 2008) and total cover for all non-native annuals was (<2 percent) in 2014 (Abella 2014). African mustard is absent at Beehive Dome and the southern end of Red Bluff, possibly because these areas receive low human use. Barb-wire Russian thistle is common in disturbed soils near dwarf bear-poppy habitat at the Armory in the White Dome population (Johnson, pers. comm. 2014), and is present in the habitat at three populations (Webb Hills west of I-15, White Dome, and Shinob Kibe) (Simpson 2014).

We determine invasive species are a **potential threat** to dwarf bear-poppy because they are present at a low level in the habitat and we do not have evidence of a population level impact to the species. We will continue to assess the potential of invasive species to pose a threat to the species. Regular monitoring of invasive species in poppy habitat is recommended and research on the direct and indirect impact of invasive species to the species is needed.

6.2. Factor B. Overutilization for commercial, recreational, scientific, or education purposes

The final rule for dwarf bear-poppy considered collection of the species for ornamental use in home gardens to be a threat (USFWS 1979). We do not have any information that collecting plants for home gardens is presently occurring. The plant has a long taproot system that is difficult to fully remove from the soil. Due to this, in the rare instances transplanting has been attempted by Federal agencies, the plant has not survived (Douglas pers. comm. 2014). A review of the internet and known reports does not show the public taking any part of the dwarf bear-poppy from the wild to cultivate or use in landscaping.

Attempts to propagate the species from seed at Red Butte Gardens and in tissue culture at the Cincinnati Zoo have proved unsuccessful (Meyer 1996; Pence 2016). Dwarf bear-poppy seeds are difficult to germinate due to multiple seed dormancy mechanisms (Nelson 1989b; Meyer 1996).

We no longer consider collection for ornamental or other purposes to be a threat to the dwarf bear-poppy since it is not occurring at this time and is not likely to occur in the near future.

6.3. Factor C. Disease or predation

The final rule for dwarf bear-poppy did not consider predation or disease to be a threat. Although predation from rabbits and insects has been recorded, it appears to be uncommon (Raynie *et al*. 1991, Harper and Van Buren 2002). Evidence of root herbivory by ground mammals is suspected to occur at Red Bluff, Webb Hill, White Dome, and North Warner Ridge, but we do not have confirmation of this herbivory or documentation of the extent of this impact. There is no evidence that disease or predation has any significant, population level impact on the species. Therefore we do not designate it as a threat at this time.

6.4. Factor D. Inadequacy of existing regulatory mechanisms

The Act provides no legal protection for listed native plants and their habitats on non-federal lands.

Endangered Species Act

The Act is the primary Federal law that provides protection for dwarf bear-poppy since its listing in 1979. Section 7(a)(1) states that Federal agencies, in consultation with the Service, shall carry out programs for the conservation of endangered species. Section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund, authorize, or carry out does not jeopardize a listed species. Under Section 9 (a)(2) of the Act the following are unlawful activities: (1) Removal and reduction to possession (i.e., collection) of endangered plants from lands under Federal jurisdiction, and (2) malicious damage or destruction on lands under Federal jurisdiction, and (3) 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.

National Environmental Policy Act

With the listing of dwarf bear-poppy as federally endangered, multiple protections became available. The National Environmental Policy Act (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, the 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, the 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 Act's protections, it is unclear what level of consideration and protection Federal agencies would provide through the NEPA process.

Land Management Designations

Dwarf bear-poppies that occur on BLM land are subject to the Federal Land Policy and Management Act (FLPMA) (Pub. L. 94–579), a law that requires the BLM to manage land for "multiple use," including protecting and preserving land for fish and wildlife resources (BLM 2011, p. 1). Under FLPMA, the BLM is required to develop resource management plans (RMPs) to ensure compliance with FLPMA (BLM 2011, p. 1). Under their existing RMP, the St. George BLM Field Office has established several ACECs to protect the poppy. An ACEC is designated as an area where special management attention is needed to protect, and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, and other natural systems or processes. The management prescriptions at these ACECs vary slightly, but they provide protection including but not limited to protection from mineral development and mining, limits on motorized vehicle use to designated roads and trails, and limits on non-motorized recreational use (BLM 1999).

The Warner Ridge/Ft. Pearce ACEC was designated in the 1999 St. George Field Office Resource Management Plan and encompasses 4,281 acres. It was fenced and posted along its western, northern, and southern boundaries in 1999 (BLM 1999). The Red Bluff ACEC, also established in 1999, encompasses 6,168 acres. Both ACECs were established partially or entirely for the purposes of protecting dwarf bear-poppy (BLM 1999). In addition to the two established ACECs, the BLM recently proposed the Webb Hill ACEC (BLM 2015).

As previously described (see Section 6.1.1) the BLM has provided a number of protections for the poppy that include a completed a land exchange with the State of Utah to consolidate poppy habitat under BLM ownership in the Webb Hill

Population (south of Brigham Road). During the past several years BLM and TNC have completed approximately 8 miles of protective fencing for the poppy. The following populations are now fenced from OHV and other surface disturbing activities: Shinob Kibe, Webb Hill (both north and south of Brigham Road), and Red Bluff.

Through the Federal Land Policy and Management Act of 1976 (FLPMA) and BLM Policy Manual 6840 – Special Status Species Management, the BLM would have authority to manage lands for sensitive (special status) species including species of concern, should the species be considered for delisting. Some 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 lands (BLM 2008b, entire). According to BLM sensitive species management policy, the "special status" designation is intended to afford protection at least comparable to (if not greater than) the treatment of candidates for Federal listing (BLM 2008b, p. 43). Therefore, BLM policy affords some protection to the poppy so long as it is retained as a special status species by the BLM.

In the absence of the Act's protection, we believe the existing regulatory mechanisms would not provide dwarf bear-poppy with adequate protection from threats. Under the Act's protection, a review of Federal actions potentially impacting the species can be performed. Because the species occurs on Federal land, threats to the species can be addressed by regulatory mechanisms, and some threats (development, recreation) have been addressed. Enforcement of unauthorized recreation is not being addressed on Federal land, but that is not a result of lacking regulatory mechanisms. A newly identified threat to the species, the loss of specialist pollinators, is also not being addressed on Federal land but we need more information about this threat in order to identify adequate regulatory mechanisms. There are no regulatory mechanisms on State and private lands to protect the species from these threats. We assign an overall threat level of **high** because development and recreation are high threats to the species and are not adequately being addressed by existing State regulatory mechanisms.

6.5. Factor E. Other natural or manmade factors affecting the species' continued existence

6.5.1. Restricted range, small population size, and restricted gene pool

The restriction to a specialized and localized soil type and a low total population level consisting of disjunct populations with a resultant restricted gene pool, are factors which tend to intensify the adverse effects of threats to dwarf bear-poppy (44 FR 64250). Allphin *et al.* (1998) studied the genetic diversity and gene flow of dwarf bear-poppy and found the total gene flow across all populations to be low, possibly due to founder effects or genetic drift. Recent genetic work showed

the species is in danger of becoming too isolated and there's evidence of inbreeding in at least the Shinob Kibe population (Simpson 2012). Endangered plants often occur in small, disjunct populations with reduced genetic diversity due to increased habitat fragmentation and inbreeding (Allphin *et al.* 1998). The development of I-15 and Bloomington might explain the genetic differentiation between some of the populations (Allphin *et al.* 1998). Genetic studies have confirmed the existence of gene flow restriction and other negative impacts of isolated populations since the time of listing (Allphin *et al.* 1998; Simpson 2014; Van Buren and Harper 1996).

Plant density and to some degree population size may help predict extinction rate for isolated populations (Fischer and Stöcklin 1997; Harper *et al.* 2000). Small plant populations are at an increased risk of extinction due to the potential for inbreeding depression, outbreeding effects, loss of genetic diversity, and lower sexual reproduction rates (Ellstrand and Elam 1993; Wilcock and Neiland 2002). In addition, extinction is significantly more likely for species like dwarf bear-poppy, which undergo large fluctuations in population size (Fisher and Stöcklin 1997). Species with limited ranges and restricted habitat requirements are also more vulnerable to the effects of many other listing factors such as drought, climate change, invasive species, and restricted gene pools (Jump and Penuelas 2005; Maschinski *et al.* 2006; Krause 2010). Species with limited ranges and restricted habitat requirements are also more vulnerable to the effects of climate change (see Climate Change, below).

Within the species' range, four populations: Red Bluff, Webb Hills, White Dome, and North Warner Ridge, occupy medium to large habitat areas. However, within these areas, the occupancy is patchy and non-uniform and the distribution is not well understood. In the roughly 6,200 acres of habitat at Red Bluff, no comprehensive surveys were conducted in the past twenty years. Thus, it is unknown how contiguous the population is within the occupied habitat. Beehive Dome and Shinob Kibe are small populations of around 100 acres, while Val Springs, and Warner Valley Springs are believed to occupy habitat less than 20 acres each and are very small in size and population number and extremely vulnerable to extirpation from stochastic events (See Section 4.3).

Based on recent genetic work, the genetic composition of the species varies greatly by population. Red Bluff shows the highest heterogeneity and is the largest population by area. Within the Red Bluff population, Van Buren and Harper (1996) found a unique marker at the Santa Clara Butte and Boomer Hill sites. Stucki Springs and Boomer Hills have the highest genetic variability of any study sites (Allphin *et al.* 1998; Simpson 2014). Boomer Hill contains unique genetic markers that indicate this site has been separate from other areas for a long period of time (Simpson pers. comm. 2014).

The Webb Hills population occupies a medium-size habitat area. Population genetics vary with high levels of heterogeneity, but the most continuously occupied portion of the population south of Brigham road is very homogeneous (Simpson 2014; Van Buren and Harper 1996). The land formation south of Brigham Road is mostly white soils, which may be influencing the genetics (Simpson 2014). Located in the central most position, Webb Hills appears to provide a genetic corridor between eastern and western populations (Simpson 2014).

The White Dome population occupies a medium to large habitat area that is genetically homogenous. In terms of unique DNA markers, White Dome had fewer markers than average (Van Buren and Harper 1996). The low genetic variation may be due to heavy OHV use or the homogeny of the white soils at this location (Allphin *et al.* 1998; Simpson 2014). White Dome has a genetic structure similar to the nearby population of Beehive Dome (Simpson 2014).

Shinob Kibe occupies a small habitat area and is the least genetically variable of all dwarf bear-poppy populations, but the most unique in terms of private alleles (Allphin *et al.* 1998; Simpson 2014; Van Buren and Harper 1996). These private alleles are not variable and are becoming more fixed over time, indicating that this population is extremely genetically isolated and showing evidence of inbreeding depression (Allphin *et al.* 1998; Simpson 2014).

The dwarf bear-poppy populations at Beehive Dome (small habitat area) and North Warner Ridge (large habitat area) are mid-range in genetic variability (Simpson 2014; Allphin *et al.* 1998) compared to the other populations. North Warner Ridge has a similar genetic structure to the Shinob Kibe population (Simpson 2014).

In summary, the restricted range, small populations and restricted gene pool of dwarf bear-poppy in and of itself is not considered a threat; however, we consider these factors to increase the vulnerability of the species to climate change and identified threats of development and recreation.

6.5.2. Additional potential threats and factors not included in the listing decision

Climate Change

Climate change was not identified as a threat to dwarf bear-poppy at the time of listing. The term ‘‘climate change’’ refers to a change in the mean or the variability of relevant properties, which persists for an extended period, typically decades or longer, due to natural conditions (e.g. solar cycles) or human-caused changes in the composition of atmosphere or in land use (IPCC 2013). Scientific measurements spanning several decades demonstrate that changes in climate are occurring. In particular, warming of the climate system is unequivocal, and many of the observed changes in the last 60 years are unprecedented over decades to millennia (IPCC 2013a). The current rate of climate change may be as fast as any extended warming period over the past 65 million years and is projected to accelerate in the next 30 to 80 years (National Research Council 2013).

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of greenhouse gas (GHG) emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions. Model results yield very similar projections of average global warming until about 2030, and thereafter the magnitude and rate of warming vary through the end of the century depending on the assumptions about population levels, emissions of GHGs, and other factors that influence climate change. Thus, absent extremely rapid stabilization of GHGs at a global level, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by human actions regarding GHG emissions (IPCC 2013b; IPCC 2014). Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (IPCC 2013c; IPCC 2014) and within the United States (Melillo *et al.* 2014). Therefore, we use ‘‘downscaled’’ projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (Glick *et al.* 2011).

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) (Franco *et al.* 2006; Forister *et al.* 2010; Galbraith *et al.* 2010; Chen *et al.* 2011). In addition to considering individual species, scientists are evaluating potential

climate change-related impacts to, and responses of, ecological systems, habitat conditions, and groups of species (Deutsch *et al.* 2008; Berg *et al.* 2010; Euskirchen *et al.* 2009; McKechnie and Wolf 2010; Sinervo *et al.* 2010; Beaumont *et al.* 2011; McKelvey *et al.* 2011; Rogers and Schindler 2011).

Both the Intergovernmental Panel on Climate Change and the U.S. Global Climate Change Program conclude that changes to climatic conditions, such as temperature and precipitation regimes, are occurring and are expected to continue in western North America over the next 100 years (Smith *et al.* 2000; Solomon *et al.* 2007; Trenberth *et al.* 2007). By the end of this century, temperatures are expected to warm a total of 4–10 °F (2–5 °C) in the Southwest (Karl *et al.* 2009). Annual mean precipitation levels are expected to decrease in western North America and especially the southwestern States by mid-century (IPCC 2007; Seager *et al.* 2007). These changes are likely to increase drought in the area where dwarf bear-poppy occurs. An increase in the intensity and frequency of drought conditions may lead to a decline in abundance or range adjustments for the species. Some estimate that approximately 20 - 30 percent of plant and animal species are at increased risk of extinction if increases in global average temperature exceed 2.7–4.5 °F (1.5–2.5 °C) (IPCC 2007). Drought conditions led to a noticeable decline in survival, vigor, and reproductive output of rare plants in the Southwest during the drought years of 2001 through 2004 (Clark & Clark 2007; Hughes 2005; Roth 2008 a & b; Van Buren & Harper 2002 and 2003).

Dwarf bear-poppy appears well-adapted to a dry climate and drought conditions of the past (see Basic Life History and Biological Limiting Factors, above). If future climate conditions are within the historic natural climatic variation experienced by the species, plants such as the poppy of arid and semi-arid systems may be less vulnerable to the effects of climate change (Tielbörger *et al.* 2014). A climate vulnerability assessment for dwarf bear-poppy was performed in 2015 that identifies the species as ranging from extremely vulnerable to relatively less vulnerable to climate change based on the results of two models (Still *et al.* 2015). High habitat specificity and limited seed dispersal were mentioned as factors contributing to the species vulnerability score. In addition to these factors, the ability of the species' seed bank to persist between favorable precipitation conditions for recruitment will also be important to determining the vulnerability of the species to climate change.

In summary, we find it difficult to analyze the potential effects of climate change on dwarf bear-poppy in the absence of demographic trend data that would allow us to predict the species' responses to changes in environmental conditions, including prolonged drought. We anticipate this will be evaluated in the population viability analysis due by the end of 2015. The cumulative effects posed by development, recreation, and small population size may exacerbate the effects of climate change for dwarf bear-poppy in the future. At this time, we believe that the state of knowledge concerning the localized effects of climate

change is too speculative to determine whether climate change is a threat to this species in the foreseeable future. We will continue to assess the potential of climate change to pose a threat to the species as better scientific information becomes available.

Loss of Pollinators and Pollinator Diversity

Loss of pollinators and pollinator diversity was not identified as a threat or vulnerability to dwarf bear-poppy at the time of listing. We evaluate this stressor because a specialist pollinator of the poppy appears to be extirpated from Washington County and the pollinator community for dwarf bear-poppy has changed dramatically (Tepedino *et al.* 2014).

Over the past two decades, there has been a loss of diversity in the pollinator community of dwarf bear-poppy. Poppy flowers were previously visited by both specialist and generalist native ground nesting bees and the introduced honeybee. Now the pollinator assemblage appears to be restricted to generalist pollinators with the loss of specialist pollinators (Tepedino *et al.* 2014). One of the primary pollinators is now the honey bee, which is documented to be in decline worldwide.

The specialist pollinators that were absent from poppy flowers in 2012 and 2014 during a range-wide pollinator study include two native solitary bees, *Perdita meconis* and *Eucera quadricincta* (Tepedino *et al.* 2014). *Perdita meconis* was likely a primary pollinator of the poppy prior to European settlement (Harper *et al.* 2000). *Perdita meconis* is a specialist that only collects pollen from plants in the genera *Arctomecon* and *Argemone* (prickly poppy). It is a rare species that may be extinct in Utah and its recolonization in Utah in unlikely because the nearest known population is a considerable distance away in the Lake Mead National Recreation Area, Nevada. *Eucera quadricincta* is more common and will likely recolonize habitat if provided adequate floral resources and nesting habitat.

The loss of specialist pollinators is concerning because generalists cannot be considered reliable visitors to poppy flowers (Tepedino *et al.* 2014). Generalist pollinators visit flowers less often than specialist pollinators and prefer areas of dense floral resources irrespective of plant composition. While this may not be a concern for sites or populations with high flowering poppy density, these locations are few and do not comprise the majority of the total habitat area for the species. Only the White Dome and Beehive Dome populations and select sites within the Red Bluff population contain an aggregation or high densities of plants (Harper *et al.* 2000).

Researchers have already documented significant declines in poppy reproduction from pollinator behavior that is influenced by variable plant density across the

landscape (Harper *et al.* 2000; Harper and Van Buren 2004). Declines in reproductive success have been documented with a corresponding decline in poppy densities, although specific pollinators were not evaluated (Harper *et al.* 2000; Harper and Van Buren 2004) (see Table 4). Inter-plant distance has a significant effect on poppy reproductive output with reductions in seed set of more than 75 percent for plants far removed from other flowering individuals (Harper *et al.* 2000). We anticipate this negative effect to reproduction will be exacerbated in the present and future by reduced visitation rates from generalist pollinators in areas with moderate to low poppy densities. We also anticipate that reductions in the number and diversity of pollinators would exacerbate the negative genetic effects of isolated populations and further restrict population gene flow (Tepedino *et al.* 2014).

Table 1. Poppy reproductive success at Red Bluff population as reported in Harper (2000) and Harper and Van Buren (2004).

Plant density	Percent Pollination (Fruit Set)	Percent Seedfill (Seed production)
568 plants/acre	92%	67%
119 plants/acre	90%	50%
10 plants/acre	64%	35%

Researchers have already documented significant differences in poppy reproduction among the various populations (Tepedino *et al.* 2014). Seed production and seed weights were significantly lower at the North Warner Ridge, Red Bluff, White Dome, and Webb Hill populations than other studied populations. While it is premature to attribute the significant declines in reproduction solely to pollinator loss or scarcity because genetic factors (inbreeding depression or genetic load) or plant density that influences pollinator behavior may also be contributing factors, these results indicate which populations are at greater risk of decline.

Bee pollinator diversity is strongly related to plant diversity and the floral resources those plants provide in terms of relative abundance of pollen and nectar quality (Potts *et al.* 2003). Loss of pollinators and pollinator diversity is likely the result of factors that impact those resources and may include the following disturbance factors present on the landscape: development (loss or fragmentation of pollinator habitat) (Tepedino 2005); recreation (loss or reduction in nesting sites); and livestock grazing (loss or reduction in nesting sites and floral resources).

Some negative effects of habitat fragmentation to plants and pollinators have been documented (Aizen *et al.* 2002; Debinski and Holt 2000; Gathmann and Tscharntke 2002; Kolb 2008; Lennartsson 2002; Moody-Weis and Heywood 2001). Fragmented plant populations appear to be less attractive to insect pollinators, which spend more time in larger, unfragmented plant habitats (Aizen *et al.* 2002; Goverde *et al.* 2002; Kolb 2008; Lennartsson 2002). Lower pollinator visitation rates are associated with reduced reproductive success in fragmented sites compared to intact sites (Jennersten 1988). Furthermore, insect pollinator diversity increases in larger plant populations with larger habitat areas(Mustajarvi *et al.* 2001) and decreases in isolated habitats with smaller plant populations (Steffan-Dewenter and Tscharntke 1999).

Impacts associated with soil disturbance from recreation and livestock trampling include changes in soil stability, reduction of native plants and floral resources, and compaction of habitat for ground nesting solitary bees, which the dwarf bear-poppy relies on for pollination.

In summary, we have evidence that primary pollinators of dwarf bear-poppy no longer occur within the species' range and that the pollinator assemblage has simplified to generalist pollinators that can only be relied upon to provide adequate pollination services in areas of high plant density. The species' new primary pollinator, the honey bee, is in decline and may not be a reliable pollinator in the future. We also have documented impacts to reproduction that are likely due in part to pollinator limitation. We anticipate the level of development and habitat fragmentation to increase in poppy habitat with an increase in local population growth and it already appears that the species' important specialist pollinators are not able to tolerate and adapt to the current level of development and habitat fragmentation within the species' range. Given these considerations and the critical importance of seed production for the dwarf bear-poppy, we now determine the loss of specialist pollinators is a threat to the species now and in the foreseeable future, and we assign a **high** threat level. We strongly encourage the synergistic feedback of this threat and other stressors be evaluated and mitigated to prevent extinction (see Brooks *et al.* 2008 on synergies among extinction drivers).

7. SYNTHESIS

At the time of listing, land development, OHV use, and collection for ornamental purposes were considered threats to dwarf bear poppy. Additionally, gypsum strip mining was considered a potential threat and the extremely restricted range, small population size, and restricted gene pool were considered factors intensifying other threats to the species. We no longer consider gypsum strip mining and collection for ornamental purposes to be threats to the species. However, development and recreation continue to be high threats to the species.

Land development on dwarf bear-poppy habitat has had a significant negative impact on the species since listing, with up to 50 percent of the habitat lost and development continuing to increase in the area, likely resulting in additional habitat loss on State and private lands. This habitat loss and fragmentation has also resulted in a reduction in pollinator diversity for the species, which can negatively impact reproduction and decrease gene flow. With increased human population and development comes increased pressure from recreation, which may also impact pollinator presence and diversity.

Livestock grazing is a potential threat, although inadequate data exists to determine if a population level effect on the species exists. Livestock grazing can also increase habitat fragmentation, negatively impact pollinations, cause erosion, and exacerbate the effects of drought. Additionally, cattle find the flower blooms palatable and desirable, which may negatively impact reproduction.

The designation of ACECs at two of the populations on BLM lands and the creation of TNC Nature preserves at two more has provided some protection from both development and recreation; however, illegal or unauthorized recreation and vandalism still occur at these areas and past use of motorized vehicles still heavily impacts populations within protected habitat. While ACECs and the TNC preserves do provide some protection for the species outside of the Act, the remaining populations have few to no legal protections and the ACEC protections may not be adequate to preserve the species. We consider the lack of legal protections on State and private lands to constitute a high threat to the species at this time.

Restricted range, small isolated populations, and a restricted gene pool are factors that intensify the existing threats. Although additional populations and occurrences have been discovered since the listing decision, habitat fragmentation has increased, large amounts of habitat have been lost, and populations have grown increasingly isolated. Genetic studies support the theory that the species is at risk from inbreeding depression in at least one population, and several others exhibit a lack of heterogeneity. This reduces the ability of the species to respond to existing or new threats as well as to stochastic events and increases the likelihood of extinction or extirpation.

Climate change is also a potential threat to this species, and the effects of climate change and drought can serve to exacerbate the negative effects of habitat loss and fragmentation, livestock impacts, and recreation impacts. Additionally, a species or population with a restricted gene pool will be less able to respond to changing climactic conditions.

The loss of pollinators and pollinator diversity likewise exacerbates the impact of the existing threats, and many of the identified threats have likely contributed to the recorded drop in pollinator diversity. We now consider the loss of pollinators to constitute a high magnitude threat to the species.

Dwarf-bear-poppy is still extremely imperiled. We consider the cumulative threats and factors negatively impacting the species to be high, and are concerned that the magnitude of past and current impacts to the species may not yet be fully evident. This species requires significant threat abatement and successful propagation methods to prevent extinction and improve its chances of survival.

8. RECOMMENDATIONS FOR FUTURE ACTIONS

The goal of a recovery program is to achieve the long-term viability of Dwarf bear-poppy in the wild, resulting in its reclassification from endangered to threatened, and ultimately, its removal from the Federal List of Endangered and Threatened Plants (44 FR 64250-64252). Dwarf bear-poppy is in imminent danger of extinction given the species negative population trend over the past two decades, and threats to the species that include urban development, recreation use, inadequacy of regulatory mechanisms on state and private lands, and the loss of pollinators and pollinator diversity. Our recommendations for future actions are based on this current status assessment and a preliminary evaluation of what is needed for recovery given the population status, threats, biological constraints, and information gaps that remain for the species.

A reduction in the high, near-term risk of extinction for the dwarf bear-poppy such that it would be reclassified from endangered to threatened may be possible if a number of recovery actions and regulatory protections are in place to reduce threats in combination with the development of successful plant propagation and establishment protocols and assisted gene flow measures to adequately offset plant population declines, habitat loss, and habitat fragmentation. To guide recovery efforts in the near-term with an outdated recovery plan, we recommend that the following seven actions be prioritized over the next five years to reduce threats, update the status, and address critical biological constraints:

1. **Protect occupied and suitable habitat from urban development.** This includes the acquisition or in-perpetuity easement by BLM, TNC, or other willing conservation partners for remaining state and private lands at White Dome, Webb Hill, Shinob Kibe, and other populations where urban development is imminent, followed by land acquisition at Red Bluffs where habitat degradation is imminent. Habitat acquisition should be prioritized based on proximity and connectivity to protected habitat, plant abundance, and high habitat quality. This effort also could include the implementation of strong regulatory protections on state lands for the species.

2. **Protect occupied and suitable habitat from degradation and additional fragmentation.** This includes immediate reductions in unauthorized recreational use on federal lands and recreational use on non-federal lands via increased enforcement, signs,

fencing repairs, and possibly additional fencing. This also includes avoidance of future infrastructure and other projects within occupied and suitable habitat to minimize habitat fragmentation within populations that may restrict pollinator movement and gene flow.

3. **Support and monitor pollinators in occupied and suitable habitat as well as in adjacent habitat.** This includes maintaining adequate floral resources to support specialist and generalist pollinators of the dwarf bear-poppy and periodic monitoring of the pollinator community and plant reproduction. This may require additional planting, pollinator augmentation and translocation, and reductions in livestock utilization within and near populations.

4. **Perform research on suitable microsites for seedling establishment.** Seedling establishment is the life-stage that imposes the largest restriction on population growth. Research to support seedling establishment will aid seed relocation and augmentation efforts to support population growth. This research may also inform propagation protocol development.

5. **Perform propagation research using seeds and plant tissue.** Successful propagation protocols are critical to the recovery of this species, and will aid conservation efforts to offset population declines and plant and habitat loss.

6. **Perform a comprehensive census of the medium and large dwarf bear-poppy populations (Red Bluff, Warner Ridge, Webb Hill, White Dome, and Beehive Dome).** The use of drones or low flying aircraft during peak bloom will be necessary to avoid habitat impacts within populations. Census and plant location data will then be used to aid in the selection of plot locations to monitor population trend.

7. **Update the Recovery Plan.** This will provide a comprehensive evaluation of what is needed for recovery given the population status, threats, biological constraints, and information gaps that remain for the species. These updates should provide a realistic picture of the progress towards recovery.

The following actions are also important and will need to be implemented as opportunities arise, as they are needed, or in conjunction with the seven recovery actions above:

8. **Conduct Census and Monitoring Studies.** Comprehensively census all known populations on a regular basis in order to produce an accurate picture of population number and distribution to adequately characterize the species' status. In addition to the populations identified in #6, above:
   a) Locate and survey the Warner Valley Springs population on foot.
   b) Survey the Shinob Kibe population on foot.
   c) Based on census results, develop and implement a range-wide monitoring plan to determine population trends and select monitoring plot locations to regularly monitor recruitment, plant reproduction, and pollinator assemblage. Evaluate population breeding system.

d) Monitor crust recovery of land scars periodically. BLM and TNC assistance with this action is essential.
e) Regularly monitor and assess recreational use within plant populations. BLM, TNC, and State assistance with this action is essential.

9. **Abate Heavy Land Use.**

a) Identify with GIS all land scars and degradation of habitat within populations and evaluate every 5 years. BLM and State assistance with this action is essential.
b) Utilize technical expertise (USGS Las Vegas and Moab or universities) for habitat restoration, trail planning, and assessment of vehicular routes including mountain bikes trails in dwarf bear-poppy habitat.
c) Assess and if necessary remove or redirect activities that negatively impact dwarf bear-poppy habitat.
d) The Service should be a cooperator on the Washington County Comprehensive Travel and Transportation Management Plan.
e) Update ACEC management prescriptions at Red Bluff and Warner Ridge/Fort Pierce to reflect current levels of impact on dwarf bear-poppy:

- Provide regular, adequate, and responsive monitoring and management at ACECs.
- Update Implementation Schedule of needed activities.
- Update ACEC Activity Plans.

f) Provide ACEC management protections for the remaining dwarf bear-poppy populations on BLM lands.
g) Provide consistent, scientifically based, range-wide management plans for the species.
h) Engage and educate recreational user groups that are creating heavy use impacts.

10. **Provide Adequate Law Enforcement to address unauthorized recreation use.**

a) Support law enforcement officials in promoting compliance with off-highway vehicle laws (and regulations) and effective deterrents of abuses of public land.
b) Increase patrol of BLM lands to reduce non-compliant land use.
c) Seek support and help from the Cities of St. George, Santa Clara, and Washington to manage use within poppy habitat.
d) Prioritize and schedule regular land use patrol at high use areas (suggested Red Bluff near Bloomington, Red Bluff near Boomer Hill, Webb Hills at Brigham Road, White Dome at River Run Road, and North Warner Ridge).

11. **Conduct Research to Better Understand Species and Species Response to Stressors and Threats**

    a) Repeat Population Viability modeling using new census and monitoring data on a regular basis.
    b) Evaluate the synergistic effect or feedback of multiple threats and stressors on the landscape and design a mitigation strategy to prevent extinction.
    c) Evaluate and implement a human-assisted gene flow pilot study.
    d) Evaluate and implement a pollinator rearing or transplant pilot study.

12. **Coordinate with State, County, City Officials and Developers**

    a) Coordinate advance planning of development and infrastructure to avoid, minimize, and mitigate impacts to dwarf bear-poppy habitat. Conservation measures include permanent habitat protections with pollinator buffers to offset impacts, and seed and soil salvage operations to preserve the seedbank and genetic diversity when habitat is lost.
    b) Evaluate, address and offset habitat impacts from increased land use due to easier access provided by highways.

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10. RESULTS

Classification:

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

- ☐ Downlist to Threatened
- ☐ Delist
- ☒ No revision needed

Recovery Priority Number: 5C (No change requested)

LEAD AUTHORS

Review Conducted By:

APPROVAL

Approve _____ Date 9/29/2016

Field Supervisor
Utah Ecological Services Field Office