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5- Year Review Short Form

Species Reviewed: Dwarf bear-poppy (*Arctomecon humilis*)

Federal Register Notice Announcing Initiation of this Review: January 12, 2021. Endangered and threatened wildlife and plants; 5-year status reviews of 7 species in the Mountain Prairie Region (86 FR 2442).

Current Classification: Endangered

Current Recovery Priority Number: 5C

This recovery priority number is indicative of a species with a high degree of threat, imminent conflicts with land development, and a relatively low potential for recovery.

Methodology used to complete this review:

This review was completed by the Utah Ecological Services Field Office on July 19, 2022. All pertinent literature and documents on file at the Utah Ecological Services Field Office were used for this review, including new information obtained since the last status review (USFWS 2016a). New information for dwarf bear-poppy is summarized in the Appendix.

Review Summary:

The dwarf bear-poppy (*Arctomecon humilis*) is a member of the poppy (Papaveraceae) family, and one of three species in the genus *Arctomecon*. The other two species are Las Vegas bear-poppy (*A. californica*) and white bear-poppy (*A. merriamii*). The dwarf bear-poppy occurs in Washington County, Utah and is the only *Arctomecon* species in Utah.

The dwarf bear-poppy is a low-stature, perennial herb with distinctive blue-grey leaves in the shape of a bear's paw (each leaf is deeply cut like a paw into three to four sections with a hair or bristle at each tip) (Welsh et al. 2003; Harper and Van Buren 2004; Meyer et al. 2015). Plants bloom in April or early May with showy 4-petaled, white flowers; fruits are capsules that split at the top to release small, black seeds (Nelson and Welsh 1993). Fruits and dry petals appear to be well-adapted for wind dispersal (Rominger et al. 2020; Stevens et al. 2021). Seeds have a fleshy attachment called an elaiosome, which is attractive to ants (Appendix; Harper and Van Buren 2004; Farrall and Mull 2012; Mull 2012; Rominger et al. 2020; Stevens et al. 2021).

The dwarf bear-poppy is an endemic plant restricted to gypsum soils in and around St. George, Utah (USFWS 1985; Nelson and Welsh 1993; Welsh et al. 2003). Plants most commonly occur on soils of the Shnabkaib Member of the Moenkopi Formation, but sometimes are found on the Lower, Middle, and Upper Red Members of the Moenkopi Formation and the Kayenta Formation (USFWS 1985; Nelson and Welsh 1993; Rominger 2022). Its habitat is a repeating pattern of cuesta topography (hill or ridge with a gentle slope on one side and steep slope on the other side). Dwarf bear-poppy plants can occur anywhere along this topography where safe sites for seedling emergence (e.g., lichen crust

or junction of two substrates) are available (Hartung et al. 2022). Safe sites are primarily on knoll tops and upper backslopes and almost never on areas with heavy black lichen crust (Appendix; Hartung et al. 2022). The habitat is sparsely vegetated, most of the soil surface is bare or covered in biological soil crust[1] (biocrust; Nelson 1989; Nelson and Harper 1991; Simpson 2014; Hartung et al. 2022). 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).

The dwarf bear-poppy expresses some similar life history characteristics to other plants endemic (restricted) to gypsum soils in semi-arid and arid environments in that they are perennial plants and actively grow throughout the year with no dormant period in the summer (Meyer et al. 2015). Dwarf bear-poppy plants are short-lived with an average life-span of six years and a maximum life-span of nine years (Meyer et al. 2015). The species relies on its seedbank for its persistence with seeds remaining viable for at least eight years in the soil and likely much longer (Stevens et al. 2021). Seeds are dispersed when embryos are immature and need one to several years to complete development and break dormancy before they germinate (Nelson 1989; Stevens et al. 2021). Seedling recruitment is episodic (occurs occasionally at irregular intervals) and occurs en masse in the spring (Nelson and Harper 1992; Searle 2017). Long time intervals are common between recruitment events because of the low frequency of years with adequate winter-spring precipitation to support establishment. Even in a favorable year, most of the population remains dormant as a seedbank (Harper and Van Buren 2004; Meyer et al. 2015).

The main bottleneck for population growth is successful seedling establishment on the harsh surface conditions of gypsum soils. Successful seedling establishment appears to require two consecutive years of adequate winter and spring moisture (average to above-average precipitation) (Meyer et al. 2015). The most recent episodic recruitment events occurred in the spring of 2017, 2019, and 2020 (Searle 2017; Rominger et al. 2021; Meyer 2022). Once established, plants have relatively high survival and high seed production as adults. In a controlled setting, this species is practically impossible to germinate or propagate using tissue culture and transplanted individuals do not survive (Pence 2016; Rominger et al. 2020). We do not have new genetic information (e.g., genetic diversity, genetic exchange between populations, etc.) since our last status review (USFWS 2016a).

Population and demographic monitoring have been established at four populations (Red Bluffs (Tonaquint Block), White Dome, Beehive Dome, and Shinob Kibe) using revamped methodology that includes more and larger monitoring plots, drone imagery collection, and a field component to note the presence of seedlings and measure reproductive output (Rominger et al. 2019, 2021). Initial results indicate that the Beehive Dome population had the highest mean plant density and the Shinob Kibe population had the lowest mean plant density. Plants at Beehive Dome produced significantly more seeds per fruit than the other populations, which is consistent with earlier reports (Tepedino et al. 2014).

[1] Composed of a community 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 (Belnap et al. 2001).

The dwarf bear-poppy is pollinated by many native bees and the non-native European and Africanized honeybee (*Apis mellifera*). Floral visitors have included at least nineteen different species from six families (Tepedino et al. 2014). Pollinator diversity has declined over the past decade with the loss of two specialist pollinators, the native solitary bees, *Perdita meconis* and *Eucera quadricincta* (Tepedino et al. 2014). The loss of specialist pollinators may be the result of the recent invasion of Africanized honeybees to Washington County, Utah (Portman et al. 2017, 2018; Tripodi et al. 2019). One of the primary pollinators is now the Africanized honeybee which appears to be adequately meeting the dwarf bear-poppy's pollination needs in recent years, but the long-term stability of this new mutualism is not yet known (DeNittis 2018; DeNittis and Meyer 2022).

We listed the dwarf bear-poppy as endangered in 1979 (44 FR 64250-64252, November 6, 1979) under the Endangered Species Act of 1973 (Act), as amended. We have not designated critical habitat for the species. At the time of listing, the primary threats were land development, off-highway vehicle (OHV) use, and collection for ornamental purposes. 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 did not designate critical habitat due to the potential for plant collection and vandalism. We completed a recovery plan in 1985 that identified 11 populations or locations and plant density estimates rather than a total population estimate (USFWS 1985).

We now know of nine dwarf bear-poppy populations on Federal (Bureau of Land Management (BLM)), Tribal, State of Utah, and private lands (Table 1). We re-evaluated and merged the original 11 population boundaries into seven populations using Nature Serve criteria (Nature Serve 2020). Two additional populations (Warner Valley Springs and Purgatory Flats) were discovered since 2009 (Washington County Water Conservancy District 2009; USFWS 2019).

In our last status review, we reported the acreage of suitable habitat because comprehensive survey and census information was not available (USFWS 2016a). We now cautiously estimate that 25,129 adult plants occur range-wide, with 71 percent occurring in the two largest fully censused populations, White Dome and Webb Hill (Table 1). This population estimate is based on a recent census of five populations (Webb Hill, White Dome, Beehive Dome, Shinob Kibe, and Val Springs) using drone (unmanned aerial vehicle) imagery, a partial survey of the Red Bluffs population using drones, and recent site visits to two populations (Warner Valley Springs, Purgatory Flats). Census surveys were timed to occur during peak detection years following recruitment events. The uncertainty of our total population estimate is associated with the large, annual fluctuations in plant abundance, the low detectability in average or poor detection years when the species resides as a dormant seedbank, the low detection of seedlings from drone imagery, and lack of a complete census at the Red Bluffs and North Warner Ridge populations. We will update our range-wide estimate as new drone census data become available for the Red Bluffs and North Warner Ridge populations.

Population trends for the species have not been revisited since our last status review (USFWS 2016a). The one population viability analysis (PVA) performed for the species indicated a downward trend over a 21-year period (1992 to 2013) (Meyer et al. 2015). Recent efforts to implement range-wide monitoring will allow for a more robust evaluation of population trends in the future since the 2015 PVA was based on data from one study plot in the Red Bluffs population.

Land development and recreation continue to be threats to the dwarf bear-poppy as well as a new threat, the loss of pollinators and pollinator diversity in plant populations (Tepedino et al. 2014;

USFWS 2016a). We no longer consider gypsum strip mining and collection for ornamental purposes to be threats to the species. Climate change and invasive plants are potential threats that can serve to exacerbate the negative effects of existing threats (USFWS 2016a).

Table 1. Summary of dwarf bear-poppy populations.

Population	Landownership	Suitable Habitat (Acres)	Most Recent Survey Year with Citation(s)	Estimate of Individuals	Percent of Total Population
Red Bluff	BLM, State, Private, Tribal	**8,870**	**2018 (Rominger 2019; Rominger 2022b)**	**~3,000**	**12%**
Webb Hill	BLM, State, Private	**1,037**	**2019 (Rominger and Meyer 2021)**	**7,414**	**30%**
White Dome	Private (TNC), State, Utah Army National Guard	**1,144**	**2018 (Rominger and Meyer 2019)**	**10,404 ± 988**	**41%**
Beehive Dome	BLM	**94**	**2019 (Rominger et al. 2019; Taylor 2022)**	**3,425 ± 600**	**14%**
North Warner Ridge	BLM	**375**	**1979 (Franklin 1979)**	**~3,000**	**12%**
Shinob Kibe	BLM, Private (partly TNC)	**89**	**2020 (Rominger 2022b)**	**324**	**1%**
Val Springs	BLM	**22**	**2020 (Rominger 2022b)**	**278**	**1%**
Warner Valley Springs	State	**62**	**2018 (Wheeler 2022)**	**454**	**2%**
Purgatory Flats	Private	**50**	**2016, 2017, 2018 (USFWS 2019)**	**255**	**1%**
Total		**11,649**		**25,129 ± 1,588**	

Land development (including residential and industrial development, utility projects, and roads) continues to be a major threat to the species and has resulted in the loss of plants, occupied habitat, and suitable habitat in Washington County. Since 1990, an estimated 300 acres of occupied habitat has been lost to development (Jorgenson 2015). The recently discovered Purgatory Flats population is located entirely on private lands and is at risk of extirpation from development (USFWS 2019). Dwarf bear-poppy habitat is currently being developed on lands zoned for commercial and residential development in the White Dome and Webb Hill populations. Dwarf bear-poppy habitat has the potential to be developed or modified on lands zoned for open space transitional in the Beehive Dome, Warner Valley Springs, and Red Bluffs populations (USFWS 2021; Blackout Utah 2022). Habitat protections were recently afforded to the Mojave desert tortoise and dwarf bear-poppy within the newly designated Reserve Zone 6 in the Red Bluffs population on state lands managed by the State of Utah Institutional Trust Lands Administration (SITLA) (Appendix; USFWS 2021).

Recreational use (specifically from OHV use, hiking, mountain biking, and horseback riding) results in damage and mortality of individuals, disruption of the seed bank, destruction and fragmentation of habitat, soil compaction and erosion, destruction of biocrusts, and degradation of vegetative community, and may facilitate the spread and establishment of nonnative plants (Brooks and Lair 2005; Ouren et al. 2007; USFWS 2016a). At the time of listing, all known populations were accessible to recreational use. Since that time, BLM fenced the majority of the Warner Ridge population, their lands within the Beehive Dome and Webb Hill populations, and the entire Val Springs population (Appendix; BLM 2020, BLM and Utah Conservation Corps 2021). There are no authorized trails within these populations and recreational use appears to be low at Warner Ridge and Beehive Dome, and moderate at Webb Hill. Since BLM just recently fenced the Val Springs population, it is too early to tell how well the fencing addresses recreational use at Val Springs.

The Red Bluffs and Shinob Kibe populations receive a high level of recreational use. In the Red Bluffs population, recent fencing by the BLM along the Bear Claw Poppy Trail has contained recreational use to the trail, but similar efforts are needed on the state land portion of the bike trail (USFWS 2015). The Shinob Kibe population was fenced at one time, but fencing has been cut or bypassed on BLM and TNC lands (Rominger 2022c). Any recreational use that occurs in the Shinob Kibe population is unauthorized (Portman 2016; York 2022). The Nature Conservancy fenced their lands in the White Dome population and developed a trail system to allow hiking. Compliance is good with the occasional off-trail bike track (York 2022). Recreational use at White Dome is expected to increase in the future as residential housing are built around the perimeter of the TNC preserve (York 2022). Recreational use on state lands is also high within the Red Bluffs population. Recreational use is not occurring in the Purgatory Flats and Warner Valley Springs populations.

We identified the loss of pollinators and pollinator diversity as a threat to the dwarf bear-poppy in our last status review (USFWS 2016a). Specialist pollinators of dwarf bear-poppy no longer occur within the species' range and the pollinator assemblage has simplified to generalist pollinators that may not reliably provide adequate pollination services (Tepedino et al. 2014). However, this threat has not been realized in recent years. Pollination by Africanized honeybees is currently adequate and offsetting the loss of pollinators and pollinator diversity for the species (DeNittis 2018; DeNittis and Meyer 2022). We will re-evaluate this threat once we have longer-term monitoring that covers reproductive output in successive low abundance years.

We identified invasive plant species (e.g., weeds) as a potential threat to the dwarf bear-poppy in our last status review (USFWS 2016a). Recent increases in the coverage of invasive annual bromes, red brome (*Bromus rubens*) and cheatgrass (*B. tectorum*), at the White Dome population prompted an evaluation and pilot herbicide treatments (Appendix; Meyer and Rominger 2022). The invasive annual bromes currently occur on dark biocrust that is generally not favorable for establishment of the dwarf bear-poppy. Pilot herbicide treatments to kill the brome seedbank are underway using Rejuvra (indaziflam), a new pre-emergent herbicide, which doesn't appear to negatively affect the biocrust or established dwarf bear-poppy plants (Meyer and Rominger 2022).

We identified invasive livestock grazing as a potential threat to the dwarf bear-poppy in our last status review (USFWS 2016a). Recent drone surveys indicate that livestock use in the Beehive Dome population is extensive (Rominger et al. 2019). However, the preliminary assessment indicates that livestock trampling doesn't appear to result in strong negative population-level effects to the dwarf bear-poppy and may be beneficial in breaking up heavier crusts that impede plant establishment. High levels of livestock grazing at Beehive Dome appear to be the most likely cause for the loss of the

specialist pollinator, the Mojave poppy bee (*Perdita meconis*), due to the removal and loss of other available floral resources that force stronger pollinator competitors like the Africanized honeybees to forage on poppy flowers (Portman et al. 2017, 2018). We recommend adding exclosures to approximately half of the population to serve as a control for evaluating the effects of livestock use (Rominger et al. 2019).

Recommendations on species status:

After reviewing the best available scientific information and recovery criteria, we conclude that the dwarf bear-poppy remains an endangered species. Our review of new information compiled since our last 5-year review (USFWS 2016a) does not change our evaluation of the species status and threats affecting the species under the five factors identified in section 4(a)(1) of the Act. Therefore, we recommend no change in status to the species at this time.

Recommended future actions:

Based on recent discussions with conservation partners, we recommend the following future actions:

1. Work with partners to protect as much occupied and potential habitat as possible and improve habitat conditions for plants and pollinators by providing intact or restored habitat conditions, nesting sites and additional pollen and nectar sources;
2. Work with partners to restrict recreational use and restore degraded habitat areas to support the species and its pollinators in the Red Bluffs, Webb Hill, White Dome, and Shinob Kibe populations;
3. Work with partners to collect seeds prior to development and periodically from all populations to provide a genetically representative, off-site seed collection;
4. Continue range-wide monitoring efforts at the four populations (Red Bluffs (Tonaquint Block), White Dome, Beehive Dome, and Shinob Kibe) and expand to additional populations on protected lands;
5. Work with researchers to develop a fine-scale species distribution model using census imagery to identify favorable seedling microsites for seed additions and support future population augmentation efforts on BLM and TNC lands;
6. Work with partners and researchers to perform pilot seedings on BLM and TNC lands in favorable seedling microsites;
7. Continue to investigate propagation methods for the species to reduce plant and population losses and preserve genetic diversity; and
8. Work with researchers to develop an annual detectability estimate for the species based on population monitoring data to calculate the percentage of the population above ground and detectible for section 7 consultation effects analyses and population estimates.

YVETTE CONVERSE

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Yvette Converse, Field Supervisor
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APPENDIX

New information for the dwarf bear-poppy since 2016 is summarized here by recovery action.

Recovery Action 1: Remove threats to the species

- The State of Utah is protecting approximately 894 acres of land for long-term habitat protection for the Mojave desert tortoise known as the Tonaquint Block, part of the Desert Tortoise Reserve Zone 6, an area that also includes 5,221 acres of BLM land. The Tonaquint Block is in the eastern portion of the Red Bluffs population for the dwarf bear-poppy. State lands were surveyed for the dwarf bear-poppy during two separate efforts, field survey and drone survey, in 2018 and plant abundance was reported as approximately 2,965 plants and 2,206 ± 86 plants, respectively (McCormick and Wheeler 2018; Rominger 2019).

- The Nature Conservancy (TNC) and State of Utah are funding researchers to map and treat invasive annual bromes, red brome and cheatgrass at the White Dome population. Gypsum soils historically resisted the invasion of invasive annual bromes, red brome and cheatgrass, but brome invasion was evident at the White Dome population in 2020 possibly due to a combination of nearby disturbance and seed sources, high precipitation, and lower gypsum content of the soil surface occupied by dark biocrust (Meyer and Rominger 2022).

- The BLM designated two Areas of Critical Environmental Concern (ACECs; South Hills ACEC, Webb Hills ACEC) to protect the dwarf bear-poppy and its habitat in their 2016 Resource Management Plan Amendment (BLM 2016; USFWS 2016b).

- The BLM fenced the entire Val Springs population to monitor the species and protect plants and habitat from the negative effects of recreational use (BLM 2020; BLM and Utah Conservation Corps 2021). The wildlife fencing allows the Mojave desert tortoise and other animals to entire, possibly even allow some livestock to enter.
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Recovery Action 2: Sustain healthy populations in their natural habitat

- Researchers developed new dwarf bear-poppy monitoring protocols for BLM and TNC lands (Rominger et al. 2020; Rominger et al. 2021). Each population has nine monitoring plots (1.5 acres in size) that will be censused using drone imagery with a field component to count seedlings and reproductive output. (Recovery Action 2.1.3)

- Recent drone surveys indicate that livestock use in the Beehive Dome population is extensive (Rominger et al. 2019). The preliminary assessment indicates that livestock trampling doesn't appear to result in strong negative population-level effects to the dwarf bear-poppy and may be beneficial in removing heavier crusts that impede plant establishment. Recommendations include adding exclosures in the population to serve as a control (Rominger et al. 2019). High levels of livestock grazing in this population appear to be the most likely cause for the loss of the specialist pollinator, the Mojave poppy bee (*Perdita meconis*), at Beehive Dome due to the removal and loss

of other available floral resources that force stronger pollinator competitors like the Africanized honeybees to forage on poppy flowers (Portman et al. 2017, 2018).

- Researchers initiated a 15-year seed retrieval study in 2019 and 2020. Initial results suggest the species produces varying levels of dormant seeds in any given year that allows for germination over the next three years while retaining a fraction of the seedbank persisting over a longer time period (Stevens et al. 2021).

- Researchers evaluated seedling and plant microsite studies to assess preferred microsites for plant establishment based on topographic position, surface characteristics, and chemistry. Juvenile plants exhibited a preference for knoll tops and upper back slopes topographic features, white soils, and contact zones between lichen crust and gravels (Hartung et al. 2022). Initial results indicate these locations provide the most favorable recruitment locations (Hartung et al. 2022; Meyer and Rominger 2022).

- A fine-scale species distribution model is planned once the drone census work is complete to inform a seedling microsite assessment and pilot seedings to augment populations (Stevens et al. 2021).

- Washington County Habitat Conservation Plan (HCP) staff and other conservation partners have collected approximately 102,680 seeds on non-federal lands in the White Dome population (Meyer 2018; DeNittis 2020).

- Recent field observation suggest that large harvester ants are not effective seed dispersers. Seeds brought to subterranean ant nests and are too deep for successful germination. However, smaller ants (possibly *Myrmecocystus semirufus*) appear to distribute but not bury seeds. More research is needed to confirm their identify and evaluate foraging distances. Fruits and dry petals appear to be well-adapted for wind dispersal (Rominger et al. 2020; Stevens et al. 2021).

<u>Recovery Action 3: Develop public awareness, appreciation, and support for conservation</u>

- Washington County HCP staff participate in seed collections and enlist and educate volunteers on the importance of the species.