Siler pincushion cactus
(Pediocactus sileri)
5-Year Status Review:
Summary and Evaluation

Photo: Brianna Fogel, USFWS

U.S. Fish and Wildlife Service
Arizona Ecological Services Office
Flagstaff, Arizona
July 2024

5-YEAR REVIEW

Siler pincushion cactus (Pediocactus (=Echinocactus, =Utahia) sileri)

1.0 GENERAL INFORMATION

1.1 Listing History

Species: *Pediocactus sileri*
Date listed: October 26, 1979
FR citation(s): 44 FR 61786
Classification: Threatened

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: We have not designated critical habitat for *P. sileri*.

1.2 Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened species and endangered species to determine whether its status has changed, and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of *P. sileri* as part of a Species Status Assessment (SSA) to inform this 5-year review.

The Service most recently evaluated the biology and status of *P. sileri* as part of a status review conducted on June 25, 2018 (U.S. Fish and Wildlife Service 2018). A complete list of listing and recovery-related documents pertaining to *P. sileri* can be found at our ECOS Website. We examined whether new information was available and whether that new information would alter or affect analyses and conclusions made in the previous status review. Data for this current review were solicited from interested parties through a Federal Register notice announcing the review on January 25, 2024. We also contacted state agencies, federal agencies, tribes, non-governmental organizations, and species researchers to request any data or information we should consider in our review. We incorporated comments and data received into the 5-year review. Additionally, we conducted a literature search and a review of information in our files.

1.3 FR Notice citation announcing the species is under active review:

89 FR 4966. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 22 Species in the Southwest, January 25, 2024.

2.0 REVIEW ANALYSIS

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of

"endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" due to any of the five factors described below.

Section 4(a) of the Act describes five factors that may lead to endangered or threatened status for a species. These include: A) the present or threatened destruction, modification, or curtailment of its habitat or range; B) overutilization for commercial, recreational, scientific, or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; or E) other natural or manmade factors affecting its continued existence.

The identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In assessing whether a species meets either definition, we must evaluate all identified threats by considering the expected response of the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Service recommends whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

2.1 Distinct Population Segment (DPS) policy (1996):

The DPS policy does not apply to *P. sileri*.

2.2 Updated Information and Current Species Status

2.2.1 Biology and Habitat:

Trends in population, demography, and spatial distribution

P. sileri has populations that occur on federal, tribal, and state lands across northern Arizona and southern Utah.

The Bureau of Land Management (BLM) provided population monitoring data for *P. sileri* on the Arizona Strip District. The BLM has surveyed plots in five areas (Atkin Well, Johnson Spring, Yellowstone, Sunshine and Warner Ridge; Figure 1) from 2013 to 2023. Of these five areas, four are in Arizona and on the Arizona Strip District, apart from Warner Ridge which lies in Utah.

Since 2018, the BLM observed decreases in the number of cacti in the Atkin Well plots both inside and outside the livestock enclosure. The Atkin Well Outside plot reported

25 cacti in 2018, and Atkin Well Inside reported 66 cacti in 2018. In 2023, the Atkin Well Outside plot contained 22 cacti and the Atkin Well Inside plot contained 52 cacti. The BLM attributed cacti fatality in the plots to herbivory, drought, or age-related death. The BLM reported only four cacti that they thought died due to livestock (three at Atkin Well and one at Yellowstone). The number of cacti within the Yellowstone plot has steadily increased since 2018, with a record high count of 60 cacti reported during the 2023 monitoring season. The Warner Ridge plot increased in population size from 2018 to 2023, with population numbers peaking at a record high count of 139 cacti reported in 2020. Since then, the population decreased slightly but has stayed consistent since 2021 at 130 cacti reported. The Johnson Spring sites experienced a severe drought that started in 2020 and lasted until 2023 when the area received at or above normal precipitation. No substantial decreases in the number of cacti were observed in the plot during the drought; however, no recruitment was observed either. The population at Johnson Spring West has hovered around 30 cacti since 2018, and Johnson Spring East has had a consistent population since 2020 with 15 cacti reported. The Sunshine monitoring location was surveyed during the 2024 monitoring season, but no *P. sileri* were detected during the surveys.

Overall, these populations are maintaining their numbers within their original range. Some plots increased in the number of cacti (Yellowstone, Warner Ridge), others had slight decreases (Atkin Well), and some remained stable (Johnson Spring). The trend of these populations appears to fluctuate in connection with precipitation patterns, with wetter years yielding higher population counts.

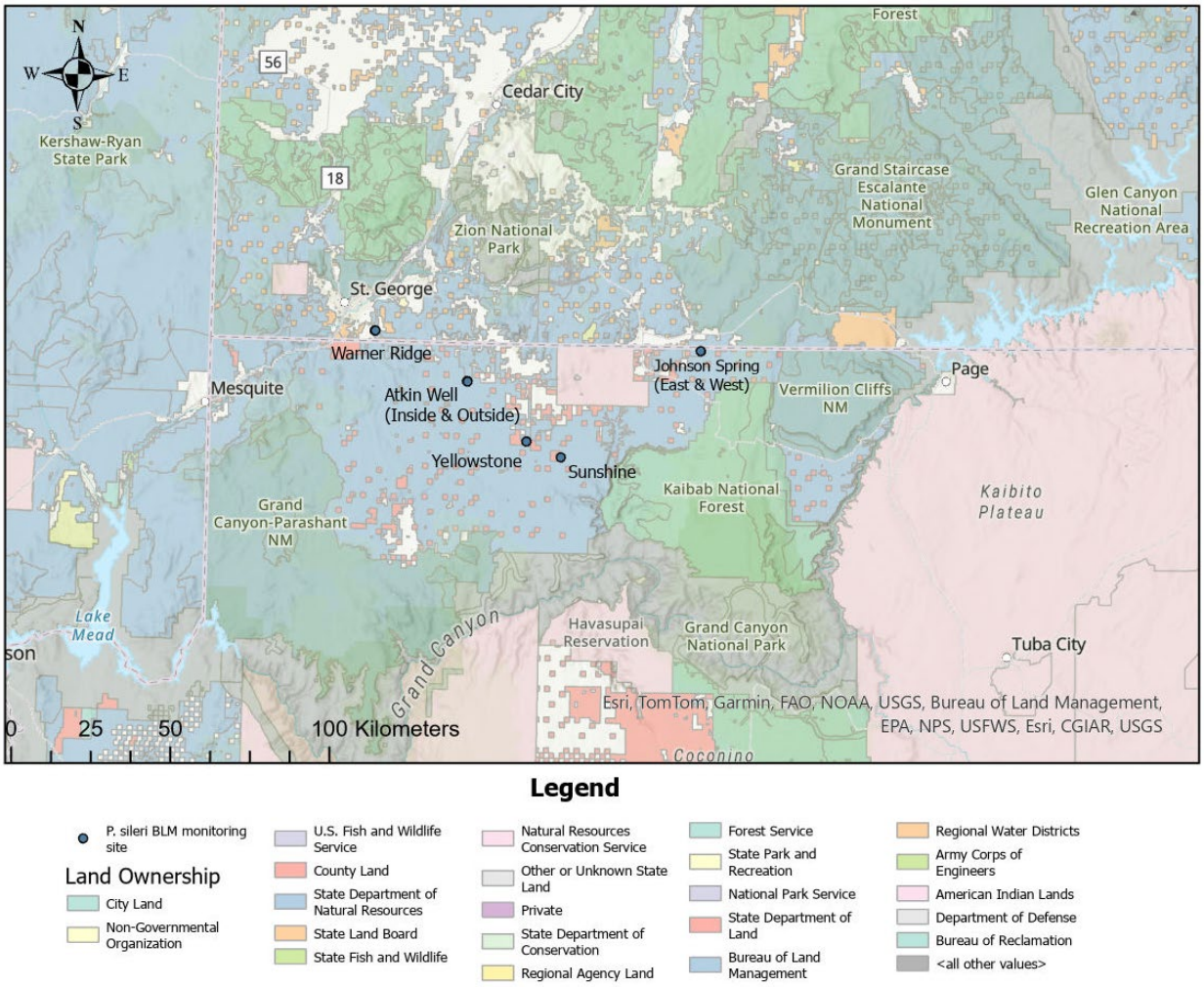

Figure 1: *P. sileri* BLM monitoring locations across northern Arizona and southern Utah.

Translocation

The Nature Conservancy (TNC) organized two *P. sileri* transplanting events between 2021 and 2022, moving about 100 plants from private land into the White Dome Nature Preserve because of proposed development on private land adjacent to the White Dome Nature Preserve. The botanists involved in the transplantation conducted post-translocation surveys in 2023 and reported high survivorship. The Nature Conservancy also coordinated with Utah BLM to salvage six *P. sileri* individuals from a different parcel of private land scheduled for development located north of White Dome Nature Preserve. The Zion National Park greenhouse nursery is currently caring for the plants over the summer prior to transplanting them onto TNC's White Dome Nature Preserve in the fall of 2024. Zion National Park also plans to conduct some grafting experiments with *P. sileri* seedings collected from these translocated individuals.

In 2017, the Kaibab Band of Paiute Indians (Tribe) relocated *P. sileri* populations located on their land. At the time, the Tribe thought the Lake Powell Pipeline project would construct a pipeline along State Route (SR) 389 and destroy the cacti. The Tribal Wildlife Director, along with an outside environmental consultant, identified Habitat Conservation Areas they could use to translocate the cacti out of the proposed pipeline route. These areas are 250 feet from the SR 389 centerline. The project extended for approximately 16 miles parallel to SR 389 across Kaibab Band of Paiute Indians Reservation land. The Tribe transplanted the cacti into three main areas. Area 1 was located directly next to Tribal Headquarters and spanned approximately 1.11 miles, Area 2 was located in between Two-Mile Wash and Sand Wash and spanned approximately 0.95 mile, and Area 3 was located after Sandy Canyon Wash and spanned approximately 1.25 miles.

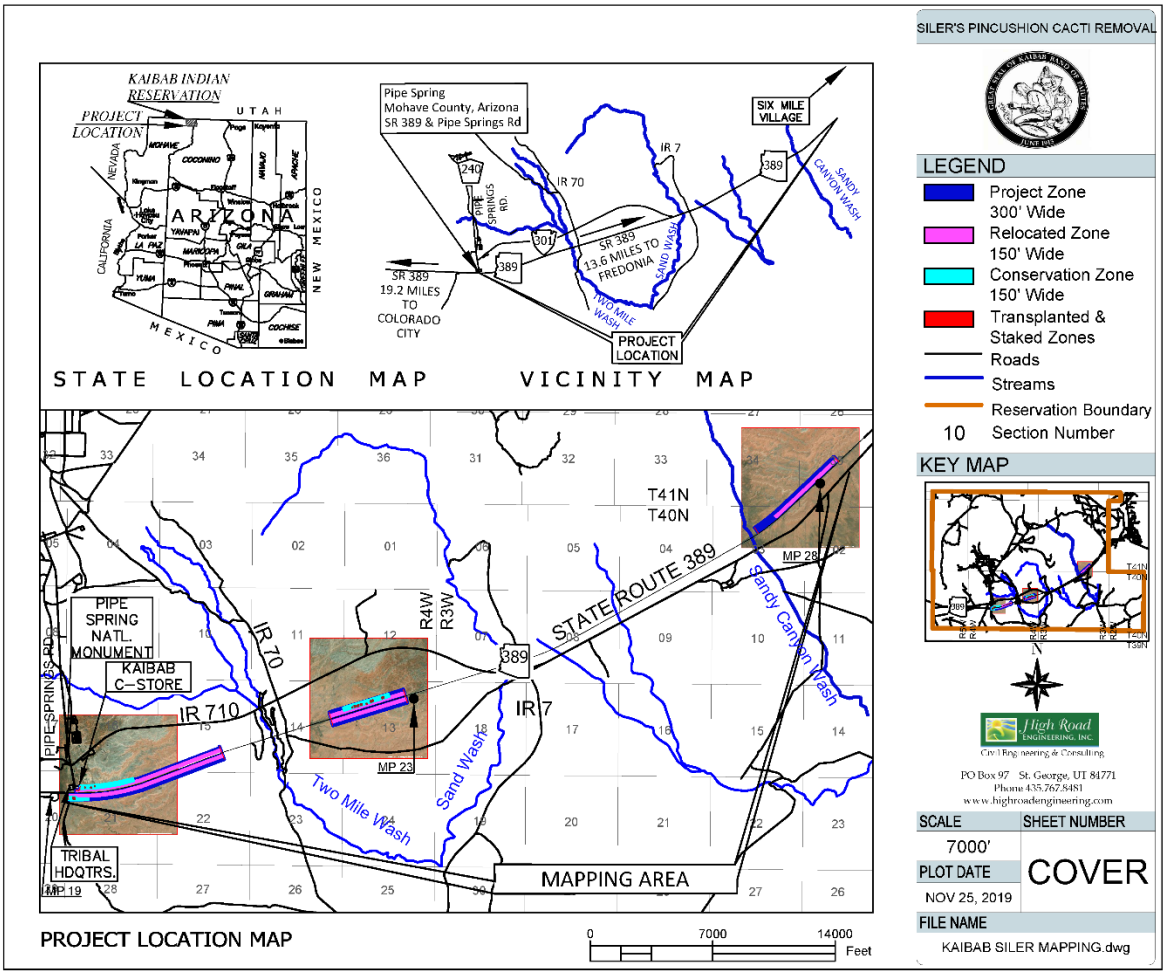

Figure 2: Designated project zones on the Kaibab Band of Paiute Indians Reservation where the Tribe relocated *P. sileri* (Kaibab Band of Paiute Indians 2019)

From May 1 through May 3, 2024, we worked with the Tribe to conduct *P. sileri* population surveys across all three translocation areas. We surveyed 58 randomly

assigned plots for *P. sileri* with each plot having an area size of 0.25 acre. Area 1 contained 21 plots on the north and south side of SR 389, Area 2 contained 20 plots on the north and south side of SR 389, and Area 3 contained 17 plots all located on the north side of SR 389. We documented the number of live and dead *P. sileri* present on the plot, as well as if the cactus was in flower, plant size class, and habitat conditions. We also recorded any *P. sileri* found while walking between plots.

Table 1: *P. sileri* population counts across all three translocation areas on the Kaibab Band of Paiute Indians Reservation.

	Total alive *P. sileri*	Flowering *P. sileri*	Non-flowering *P. sileri*	Dead *P. sileri*	Juvenile (0-5 cm) *P. sileri*
Area 1	52	45	7	10	0
Area 2	7	4	3	5	0
Area 3	18	17	1	2	0
Outside of Designated Survey Areas	126	93	24	31	9
Total	**203**	**159**	**35**	**48**	**9**

Across the 57 randomly selected plots, we documented 77 live *P. sileri* and 17 dead *P. sileri*. Outside of the survey plots, we documented 126 live *P. sileri* and 31 dead *P. sileri*. During the survey the majority of the *P. sileri* found was flowering. Of the plants found dead, we suspect herbivory for one of the plants because we noted bite marks on the plants. In 2017, the engineering and consulting group contracted by the Tribe (High Road Engineering) conducted their own surveys and their field technician recorded 199 *P. sileri* across all three Areas. Comparing their 2017 survey population numbers to our 2024 survey results shows the cactus population is persisting and stable on the Tribe's lands following relocation.

On June 13, 2024, we assisted the Tribe in relocating *P. sileri* in a fenced-in portion of land in front of a gas station on the corner of North Pipe Spring Road and SR 389. According to the Tribal Wildlife Director, these *P. sileri* have been fenced-in at this location since the early 2000s. Of the five cacti present at this location, four were dead. We relocated the remaining surviving cactus east into a large patch of *P. sileri* in Area 1.

2.2.2 Threats Analysis (threats, conservation measures, and regulatory mechanisms):

We conducted a full threats analysis for *P. sileri* in our previous 5-year review (U.S. Fish and Wildlife Service 2018). Therefore, we do not repeat the entire analysis here. Below we briefly discuss relevant recent information pertaining to three of the threats we identified in previous listing and recovery documents.

Human Disturbance and Urban Development

Human disturbance and habitat destruction (Factor A) occurs in *P. sileri* habitat on state and private lands in Arizona and Utah. The use of off-highway vehicles (OHVs) on the Arizona Strip and in Utah are a previously identified threat to *P. sileri* populations. In our previous 5-year review (U.S. Fish and Wildlife Service 2018) we discussed how the BLM designated OHV route systems for a range of recreation opportunities while simultaneously trying to protect the cactus' resources. Left unchecked, these off-road activities can degrade the plant's habitat, indirectly leading to negative effects on the plants themselves. This is especially true in habitat areas near larger population centers such as St. George and Kanab, Utah. Recent documentation from BLM and The Nature Conservancy describes plants being damaged or killed from off-road activities, and this threat may become more substantial as the cities of St. George and Kanab continue to increase in size. Washington County in Utah, where some *P. sileri* populations are located, has been reported by the U.S. Census Bureau to be the fastest growing metro area in the United States in 2021 (U.S. Census Bureau 2022).

Solar Energy Development

The BLM is evaluating solar energy development plans on public lands in Arizona and Utah, with the BLM evaluating the potential effects of several modifications to its current solar energy program. *P. sileri* populations on BLM lands in Arizona and Utah, such as Warner Ridge, Yellowstone, Atkin Well, and Johnson Spring could be adversely affects. The BLM intends to implement conservation measures to avoid, reduce, and compensate for effects on vegetation and soils during construction, operation, and maintenance of solar facilities. The plan is for project developers to create vegetation management plans in coordination with the BLM as well as with other Federal, state, local agencies, and designated qualified biologists who will oversee compliance with protecting ecological resources.

Lake Powell Pipeline

Our previous 5-year species status review (U.S. Fish and Wildlife Service 2018) discussed the proposed Lake Powell water pipeline project. One of the proposed alignments would have gone through the northern portion of BLM-managed land on the Arizona Strip including *P. sileri* habitat and could have potentially caused habitat damage or destruction (Factor A). To our knowledge, the Lake Powell water pipeline project terminated and will not be moving forward. The Washington County Water

Conservancy District say that any possibility of a Lake Powell Pipeline is at least 20 years from entering a planning stage (Reed 2023).

Climate Change

The Colorado Plateau on which *P. sileri* predominantly resides is expected to undergo ecosystem shifts in the face of projected climate change (Winkler *et al*. 2018). Plant species, such as *P. sileri*, that exist on the Colorado Plateau are well-tuned to their arid environment and it's ephemeral and variable precipitation. Climate change projections in the southwest show extremes in precipitation levels, temperature, soil moisture levels, and drought severity that can threaten our ability to conserve these species (Williams *et al*. 2022; Finger-Higgens *et al*. 2023). Global climate model projections for the Southern Colorado Plateau depict a warmer future in which annual temperatures in this region are predicted to increase by 1.5°Celsius (°C) to 3.6°C (34.7°Fahrenheit (°F) to 38.5°F) by the mid-century, and 2.5°C to 5.4°C (36.5°F to 41.7°F) by the end of the century, as well as a decline of 11 to 45 percent of early summer precipitation during the 21st century (Garfin, Gregg M. et al. 2010). As soil moisture is predicted to decrease in the southwest, these conditions may push the dryland ecosystem of the Colorado Plateau through three hypothesized stages of degradation: a vegetation decline phase, followed by a soil disruption phase, and ending in a systematic breakdown of the ecosystem (Berdugo *et al*. 2022).

Biological soil crusts which are essential to these drylands may also be negatively affected by diminished soil water availability (Muñoz-Rojas *et al*. 2018; Phillips *et al*. 2022). *P. sileri* is known to be very closely associated with habitats that contain biological soil crusts and declines in this biocrust can decrease nitrogen cycling, lead to higher erosion rates, and decrease near surface water holding capacity (Winkler *et al*. 2018). A recent ten-year precipitation reduction experiment was conducted across the Colorado Plateau that observed large declines for all dominant plant functional types, where they observed less plant cover, less biological soil crust cover, warmer and drier soil conditions, and significant changes to nitrogen soil availability (Finger-Higgens *et al*. 2023). As this ongoing regional drought continues, we expect these climate and soil conditions to worsen, which may diminish habitat suitability for *P. sileri*.

The Service in Las Vegas, Nevada, recently conducted a climate change vulnerability assessment of imperiled plants in the Mojave Desert under future climate change scenarios (Wilkening *et al*. 2021). The Service categorized *P. sileri* as "extremely vulnerable" to climate change. Climate change effects may be particularly severe on *P. sileri* since it is a habitat specialist restricted to gypsiferous soils. The Mojave Desert in which *P. sileri* partially resides is projected to have a 2.2°C to 4.4°C (~36°F to 40°F) increase in annual temperature by the end of the century (2070 through 2099) and a reduction of 30 percent in snowpack which serves as the regions' main water source (Khatri & Strong 2020).

The online United States Geological Survey (USGS) National Climate Change Viewer (NCCV) uses 20 different climate models to predict atmospheric temperature and six

precipitation variables as they change due to a lower carbon dioxide (CO_2) emissions scenario and a higher CO_2 emissions scenario (Alder & Hostetler 2013). Using the NCCV Mean Model for high and low emission scenarios, the USGS assessed future climate scenarios for Mohave and Coconino counties in Arizona, and Washington, Iron, and Kane counties in Utah. Climate projections under these scenarios for the above counties all include increased temperatures and evapotranspiration, and decreased winter precipitation. These effects may be especially severe in the southwest region of the United States, and plants such as *P. sileri* will have to survive longer droughts, warmer temperatures, fewer frost days, and an increase in extreme weather events (Archer & Predick 2008; Garfin *et al*. 2014; Cook *et al*. 2015). Annual monitoring of *P. sileri* will be necessary to understand the actual effects of climate change on populations.

2.3 Synthesis:

Currently we are aware of 27 populations of *P. sileri* across Arizona and Utah. The BLM in Arizona and Utah has designated six Areas of Critical Environmental Concern (ACECs) that encompass 24 of the 25 *P. sileri* populations. The 26th population occurs on the Kaibab Band of Paiute Indians Reservation. In addition, TNC manages the 27th population at White Dome Preserve in Utah as private land with land-use restrictions that has removed threats to cactus on the preserve. All known populations of *P. sileri* have some level of increased management and protection from known threats.

We acknowledge the BLM has made substantial efforts to conserve *P. sileri*. They have continuously surveyed habitat and documented populations of the cactus on a yearly basis and established long-term monitoring plots. As described above, changes in land management policies on BLM-managed lands have reduced or eliminated many of the threats that affect those *P. sileri* populations. We are still aware of reported incidents of OHV use on State and private lands in Arizona and Utah, as well as potential livestock grazing trampling effects. Where livestock numbers are high, the threat of the livestock coming across and trampling *P. sileri* may increase. However, we do not currently know the full extent of these threats. Increased urban development in Utah and threats from natural events such as severe drought remain a possibility.

Herbivory is also negatively affecting *P. sileri*. Monitoring conducted by the BLM at Jackson Spring and Atkin Well indicated herbivory of *P. sileri* occurred in an area with ample forage and where there was no grazing by livestock. This information indicates that small mammal herbivory can be high even in non-drought years and when competition with livestock for forage is not an issue. There may be other unknown triggers for *P. sileri* herbivory by rodents and lagomorphs, and more study is necessary to define the natural role of these animals in contributing to cactus mortality.

Even though mortality by herbivory has not been increasing during drier years at these BLM plots, there have been reports of increased herbivory in dry years with other *Pediocactus* species such as *P. knowltonii* (Knowlton cactus), *P. bradyi* (Brady's pincushion cactus), and *P. peeblesianus* var. *fickeiseniae* (Fickeisen Plains Cactus) (U.S. Fish and Wildlife Service

2013). With predicted rising future temperatures, we anticipate that rodent and lagomorph herbivory may increase in the future as food sources become scarcer. Thus, herbivory could become a substantial threat to *P. sileri*.

We think the most substantial threat to the species is climate change. Increased drought throughout the range of the cactus could cause declines in their populations; however, we have insufficient data at this time to determine the severity of potential droughts and whether they will affect *P. sileri*. Warmer temperatures, longer droughts, fewer frost days and an increasing extreme weather events are all consequences of regional climate change that may negatively affect the long-term status of this species.

After reviewing the best available scientific information, we conclude that *P. sileri* remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in our June 25, 2018, remains an accurate reflection of the species current status.

3.0 RESULTS

3.1 Recommended Classification:

No change is needed.

3.2 New Recovery Priority Number:

Currently classified as 8 (moderate degree of threat/high recovery potential). No change is recommended at this time.

Brief Rationale:

The threats listed in our previous 5-year review (U.S. Fish and Wildlife Service 2018) for *P. sileri* still affect the species today (OHV use, habitat destruction, and climate change) or are currently no longer a threat (*e.g.*, Lake Powell pipeline project). However, as recommended in the previous 5-year review, discussions regarding reclassification of the recovery priority number should occur as we obtain additional monitoring data.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

We will work with our partners to implement the following recommended actions during the next five-year review period:

- Work to reconvene a recovery team to determine recovery action implementation and if updates to the Recovery Plan (U.S. Fish and Wildlife Service 1986), which we last amended in 2019, are necessary. The BLM has created more detailed maps and location information that we should include in a potential revised recovery plan.

- Work to establish monitoring plots in additional populations throughout the range of the cactus and monitor the plots on a regular basis. The revised Recovery Plan

recommends a minimum of 15 years of consecutive monitoring to determine long-term population trends.

- Work to ensure no more than two percent of the suitable gypsiferous and calcareous clay soil habitat as defined in the Recovery Plan (U.S. Fish and Wildlife Service 1986) within each of the populations are disturbed over a 15-year period.

- Work to provide technical and monetary assistance to the Tribe to conduct surveys and develop conservation measures, such as long-term demographic monitoring plots, for *P. sileri* on their lands.

- Work to revise the BLM monitoring protocol to quantify seedling survivorship. We recommend using random plots/transects so we may statistically analyze population demographics.

- Work with the BLM to continue to close areas to OHV use that support concentrations of *P. sileri*.

- Work to study the effect of rodent and lagomorph herbivory on *P. sileri* and assess how the drought may be increasing herbivory. We also recommend studying other potential stressors such as invasive grasses, habitat disturbance, and insect herbivory on *P. sileri* fruits.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Siler pincushion cactus (*Pediocactus sileri*)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

No change is recommended.

Appropriate Listing/Reclassification Priority Number, if applicable:

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, Arizona Ecological Services Office

Approve HEATHER WHITLAW Digitally signed by HEATHER WHITLAW Date: 2024.08.12 16:04:21 -07'00'