

Sneed Pincushion Cactus (*Coryphantha sneedii* var. *sneedii*)

**5-Year Status Review:
Summary and Evaluation**



**U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
Albuquerque, New Mexico
August 2023**

5-YEAR REVIEW

Species reviewed:

Sneed Pincushion Cactus (*Coryphantha sneedii* var. *sneedii*)

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5-YEAR REVIEW

Sneed Pincushion Cactus (*Coryphantha sneedii* var. *sneedii*)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional or Headquarters Office:

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Cooperating Field Office(s):

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Cooperating Regional Office(s):

Not Applicable

1.2 Purpose of 5-Year Reviews:

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

1.3 Methodology used to complete the review:

The Service conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Act. We provided notice of this status review via the Federal Register (88 FR 1602), requesting information on the status of *Coryphantha sneedii* var. *leei* (Lee pincushion cactus) and

Coryphantha sneedii var. *sneedii* (Sneed pincushion cactus). In addition, we contacted Fort Bliss Military Reservation, Bureau of Land Management (Las Cruces District Office and New Mexico State Office), Texas Parks and Wildlife Department, Franklin Mountains State Park, and California Botanic Garden (Rancho Santa Ana Botanic Garden), and submitted an information request via Botanic Gardens Conservation International's PlantSearch application. We received responsive information from the Bureau of Land Management and California Botanic Garden. Our review is based on this information, existing information in our records, and new information discovered during searches of online information databases, such as SEINet, Natural Heritage New Mexico's New Mexico Conservation Information System, Center for Plant Conservation's National Collection of Rare and Endangered Plants, Bureau of Land Management's Mineral and Land Records System, the Texas General Land Office's Land and Lease Mapping Viewer, Data.gov (U.S. government open data), the Federal Register, Google Search, and Google Scholar. This review was conducted by Katie Sandbom and Chuck Hayes (NMESFO) and Chris Best (AESFO).

1.4 Background:

1.4.1 FR Notice citation announcing initiation of this review:

88 FR 1602–1604, January 11, 2023

1.4.2 Listing history:

Original Listing

FR notice: 44 FR 64741

Date listed: November 7, 1979

Entity listed: Subspecies, *Coryphantha sneedii* var. *sneedii*

Classification: Endangered, without critical habitat

1.4.3 Associated Rulemakings:

None

1.4.4 Review History:

U.S. Fish and Wildlife Service (Service). 2015. Lee pincushion cactus (*Coryphantha sneedii* var. *leei*) and Sneed pincushion cactus (*Coryphantha sneedii* var. *sneedii*) 5-year review: Summary and evaluation. Albuquerque, New Mexico: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office: No change in classification recommended.

1.4.5 Species' Recovery Priority Number at start of 5-year review:

Coryphantha sneedii var. *sneedii*: 9

The recovery priority number (9) indicates a subspecies with moderate threats and high recovery potential.

1.4.6 Recovery Plan or Outline

Name of plan or outline: Recovery Plan for *Coryphantha sneedii* var. *sneedii* (Sneed pincushion cactus) and *Coryphantha sneedii* var. *leei* (Lee pincushion cactus): Amendment 1

Date issued: August 28, 2019

Dates of previous plans/amendment or outline, if applicable: Sneed and Lee Pincushion cacti recovery plan approved March 21, 1986.

2.0 REVIEW ANALYSIS

Section 4 of the ESA (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 ESA 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 ESA 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):

Sneed pincushion cactus is plant that would not be subject to the Distinct Population Segment policy, which applies to vertebrate animals.

2.2 Updated Information and Current Species Status

2.2.1 Biology and Habitat

2.2.1.1 New information on the species' biology and life history:

The 1986 recovery plan (Service 1986, pp. 8–13) provides a baseline for our understanding of Sneed pincushion cactus' (hence forward, Sneed's) biology, life history, and species' needs. Updates to the information contained in the 1986 recovery plan include observations about geological substrate specificity (Zimmerman 1985, p. 344; Cook 1987, p. 1), elevation range (Zimmerman 1985, p. 344), associated species (Weber 1977, s.n. Zimmerman 1985, p. 344; Van Devender and Rondeau 1992, pp. 11–12; Baker 1999, 13323; Tonne 2001, p. 8; Allen 2003, pp. 54–55; Baker 2004, p. 23; Heil and McClain 2010, 32233), flowering period (Zimmerman 1985, pp. 343–344), and fruiting period (Zimmerman 1985, pp. 343–344).

2.2.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, birth rate, seed set, germination rate, age at mortality, mortality rate, etc.), or demographic trends:

Sneed's pincushion cactus occurs in 2–5 populations, depending on the taxonomic identity of "Sneed's" plants in the Webb Gap, Bishop's Cap, and Rattlesnake Ridge populations. South to North, these are: South Franklin Mountains, North Franklin Mountains, Webb Gap, Bishop's Cap, and Rattlesnake Ridge (see section 2.2.1.3 for a discussion about "Sneed's" individuals, section 2.2.1.4 for a discussion about new phylogenetic information, and section 2.2.1.5 for a discussion of Sneed's known and potential occurrence locations). This distribution is consistent with Sneed's distribution in its last five-year review (Service 2015, pp. 9–10). Population sizes were initially observed or estimated in 1975 through 2008, and monitoring plots were last observed in 2001, 2002, and 2010 or 2011 on Bureau of Land Management (BLM), Texas Parks and Wildlife Department (TPWD), and Fort Bliss lands, respectively. Therefore, the current abundance, population trends, demographic features, and demographic trends of Sneed's populations are unknown.

Sneed's historically consisted of approximately 1,953–2,653 (2,303) or 8,339–27,896 (18,118) individuals—depending on the taxonomic identity of "Sneed's" plants in the Webb Gap, Bishop's Cap, and Rattlesnake Ridge populations—based on abundance estimates, abundance observations, and plants counts made between 1975 and 2012.

Available historic trend information is derived from targeted plots (plots placed in high density areas rather than at randomly or systematically located points); therefore, we can't reliably estimate population parameters (such as such as population abundance and population growth rate) from the available data because targeted plots are more likely to experience density-dependent effects that result in plot abundance declines that may not be representative of overall population trends (Buckley et al. 2010, p. 1193). Further, plot census count and

abundance trend results are somewhat confounded by detectability, taxonomic uncertainty, and misidentification. Overall, targeted plots may bias growth rates low, low detectability may bias growth rates high, and taxonomic uncertainty and/or misidentification may bias growth rates low. Given available historic information, and accepting these limitations and biases, Sneed's appears to have declined within each of its population study areas, except within North Franklin Mountains plots. Between 1987 and 2001, abundance within North Franklin Mountains plots increased; while between 2001 and 2002, abundance within South Franklin Mountains plots decreased; between 1987 and 2011, abundance within Webb Gap and Bishop's Cap plots decreased; and between 1998 and 2010, abundance within Rattlesnake Ridge plots decreased.

South Franklin Mountains

The South Franklin Mountains population historically consisted of approximately 653–1,153 (903) individuals based on abundance observations and plant counts made in 1992–2012. Targeted plots in this area experienced a deterministic average annual plot growth rate of 0.9875 (or average annual plot abundance decline of 1.25%) between 2000 and 2002.

There are abundance observations for two sites in the South Franklin Mountains: the site west of McKelligon Canyon and the site east of Coronado Country Club. The site west of McKelligon Canyon was estimated to contain >100 plants in 1992 (Van Devender and Rondeau 1992, p. 13). In 2012, South Gulf Research Corporation staff (2012, pp. 3–6) observed 153 flowering individuals in this area while collecting genetic samples. The site east of Coronado Country Club was estimated to contain 500–1,000 plants in 1992 (Van Devender and Rondeau 1992, p. 13). TPWD installed 3 sub-plots in this site in 2000. These plots contained 80 plants in 2000 and 78 plants in 2002 (Hedges and Poole 2000, p. 3; Hedges and Poole 2002, p. 1).

North Franklin Mountains (North from Anthony's Nose and South of Anthony Gap)

The North Franklin Mountains population historically consisted of approximately 1,300–1,500 (1,400) individuals based on historic abundance observations made in 1975–2001. Targeted plots in this area experienced a deterministic average annual plot growth rate of 1.0440 (an average annual plot abundance increase of 4.40%) between 1987 and 2001.

There are abundance observations for three areas in the North Franklin Mountains; these areas are along ridges west of, adjacent to, and east of Anthony Gap.

In 1978, Spellenberg and Spellenberg (1978, 4967) noted that there were many plants in the area west of Anthony Gap, estimating abundance at about 1,000 plants over a 3 hectare (ha) area.

In 1975, the area adjacent to Anthony Gap was estimated to consist of a few hundred plants (Pierce 1975, in Wagner and Sabo 1977, p. 1). While Wagner and Sabo (1977, p. 1) only found 12 plants on private land in this area during an extensive search in 1977, BLM reported that plants were fairly abundant along the ridge in 1987. They documented 186 plants in 12 targeted plots (Cook 1987, p. 1)—of which 97 were located within the 6 plots revisited by Tonne in 2001 (2001, p. 14)—and assumed that there were less than 500 plants in this area on the New Mexico side of the border (Cook 1987, p. 1). In 1998 and 1999, Baker (1998, 13102; 1999, 13323) noted that Sneed's was locally abundant in the area. In 2001, Tonne (2001, p. 14) documented 161 plants in 6 of the 12 original BLM plots, but noted that plot boundaries were ill-defined.

BLM noticed about 6 plants in the area east of Anthony Gap in 1987 (Cook 1987, p. 1); however, 273 plants at 73 occurrences were documented in the Hook Quarry lease area in 2001. Two of these plants were in the project footprint, and another 18 were likely to be disturbed by the project (Bleakly Botanical and Biological and Metric Corporation 2001, p. 7).

Webb Gap (Northwest of Franklin Mountains)

The Webb Gap population historically consisted of approximately 1,670–4,670 (3,170) individuals, 200–300 (250) on BLM lands and 1,470–4,370 (2,920) on Fort Bliss lands) based on abundance observations and estimates. Targeted plots in this area experienced a deterministic average annual plot growth rate of 0.9929 (an average annual plot abundance decrease of 0.71%) on BLM lands between 1987 and 2001 and a deterministic average annual plot growth rate of 0.9658 (an average annual plot abundance decrease of 3.42%) on Fort Bliss lands between 1999 and 2011.

In 1987, BLM noted that total abundance may have been 200–300 plants south of the Fort Bliss boundary (Cook 1987, p. 2). There were 35 plants in 2 BLM plots in 1987 and 30 plants in the plots in 2001 (Tonne 2001, p. 14).

On Fort Bliss lands, TRC Mariah Associates, Inc. (1998, pp. 1-13–1-16) counted 226 individuals along 15 transects and estimated density at 30 plants per ha. Given 49 ha of potential habitat (TRC Mariah Associates, Inc. 1998, p. 8), population abundance would be estimated as 1,470. Worthington (2008, p. 9) counted 76 individuals in 10 quadrats in 2008 and estimated density at 380 plants per ha. Based on Worthington's more conservative estimate of habitat area (11.5 ha), he estimated abundance as 4,370 individuals (Worthington 2008, p. 9). The discrepancies between these estimates reflect differences in sampling methods, not population trends. In 2012, 103 flowering individuals were documented during genetic sampling (Gulf South Research Corporation, pp. 3–6). There were 39 plants in 5 plots at this location in 1999 (Allen 2003, pp. 43–47) and 23 plants in those 5 plots in 2011 (Gulf South Research Corporation 2011, Appendix A).

Bishop's Cap (Organ Mountains)

The Bishop's Cap population historically consisted of 2,106–17,963 (10,035) individuals, 200–7,800 (4,000) on BLM lands, 1,190–5,275 (3,233) on South Hill, and 716–4,888 (2,802) on North Hill) based on historic abundance estimates and observations made between 1975 and 2008. Targeted plots in this area experienced a deterministic average annual plot growth rate of 0.9833 (an average annual plot abundance decrease of 1.67%) on BLM lands between 1987 and 2001 and deterministic average annual plot growth rates of 0.9590 (an average annual plot abundance decrease of 4.10%) and 0.9806 (an average annual plot abundance decrease of 1.94%) between 1999 and 2011 on South Hill and North Hill (Fort Bliss lands), respectively.

In 1977, Weber (1977, unpaginated) observed that plants were common in crevices at the Bishop's Cap population.

In 1975, Zimmerman (1985, p. 349) counted 13 individuals along 5.7 km of 3 m wide transects on BLM lands, and crudely estimated that there may be 7,800 plants on 1,036 ha of BLM land. In 1987, BLM noted that total abundance may have been less than 300 plants west of the Fort Bliss boundary (Cook 1987, p. 2). There were 18 plants in 2 plots in 1987 and 13 plants in the plots in 2001 (Tonne 2001, p. 14).

On South Hill (Fort Bliss), TRC Mariah Associates, Inc. (1998, pp. 1-13–1-16) counted 214 individuals along 9 transects and estimated density at 18.3 plants per ha. Given 65 ha of potential habitat (TRC Mariah Associates, Inc. 1998, p. 1-6), population abundance would have been estimated as 1,190. Worthington (2008, p. 9) counted 42 individuals in 10 quadrats in 2008 and estimated density at 211 plants per ha. Based on Worthington's more conservative estimate of habitat area (25 ha), he estimated abundance as 5,275 individuals (Worthington 2008, p. 9). The discrepancies between these estimates reflect differences in sampling methods, not population trends. In 2012, 130 flowering individuals were documented during genetic sampling (Gulf South Research Corporation, pp. 3–6). There were 118 plants in 12 plots at this location in 1999 (Allen 2003, pp. 43–47) and 60 plants in those plots in 2011 (Gulf South Research Corporation 2011, Appendix A).

On North Hill (Fort Bliss), TRC Mariah Associates, Inc. (1998, pp. 1-13–1-16) counted 86 individuals along 8 transects and estimated density at 8.95 plants per ha. Given 80 ha of potential habitat (TRC Mariah Associates, Inc. 1998, p. 1-6), population abundance would have been estimated as 716. Worthington (2008, p. 9) counted 15 individuals in 8 quadrats in 2008 and estimated density at 94 plants per ha. Based on Worthington's more conservative estimate of habitat area (52 ha), he estimated abundance as 4,888 individuals (Worthington 2008, p. 9). The discrepancies between these estimates reflect differences in sampling methods, not population trends. In 2012, 113 flowering individuals were

documented during genetic sampling (Gulf South Research Corporation, pp. 3–6). There were 31 plants in 5 plots at this location in 1999 (Allen 2003, pp. 43–47) and 23 plants in those plots in 2011 (Gulf South Research Corporation 2011, Appendix A).

Rattlesnake Ridge (Organ Mountains)

The Rattlesnake Ridge population historically consisted of approximately 2,610 individuals based on the 2008 abundance estimate. Targeted plots in this area had a deterministic average annual plot growth rate of 0.9676 (an average annual plot abundance decrease of 3.24%) between 2012 and 2010.

TRC Mariah Associates, Inc. (1998, pp. 1-13–1-16) counted 141 individuals along 14 transects within 110 ha of the most promising habitat. Worthington (2008, p. 9) counted 29 individuals in 5 quadrats in 2008 and estimated density at 290 plants per ha. Based on Worthington’s estimated habitat area within his sampling area (9 ha), he estimated abundance as 2,610 individuals on two ridges. However, given the potential for 326 ha of habitat on Rattlesnake Ridge, Worthington speculated that there could be as many as 47,355–95,000 plants on Rattlesnake Ridge (Worthington 2008, p. 9). In 2012, 100 flowering individuals were documented during genetic sampling (Gulf South Research Corporation, pp. 3–6). There were 140 plants in 14 plots at this location in 1998 (TRC Mariah Associates, Inc. 1998, pp. 1-13–1-16) and 81 plants in those plots in 2010 (Kutzko et al. 2010, pp. 97–104).

2.2.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Sneed’s plants in the Webb Gap, Bishop’s Cap, and Rattlesnake Ridge populations (“Sneed’s” plants) have genetically and morphologically diverged from those in the Franklin Mountains (Worthington and Freeman 1980, p. 10; Zimmerman 1985, p. 345; Clayton 1987, pp. 1–2; Cook 1987, p. 1; Van Devender and Rondeau 1992, p. 4; Tonne 2001, p. 4; Baker 2004, p. 21; Worthington 2008, pp. 4–7; Gulf South Research Corporation 2011, p. 4-6; Porter 2023, pers. comm.). These plants tend to have wider and fewer stems and longer and fewer spines, making it more difficult to distinguish between these “Sneed’s” and *Pelecypora tuberculosa* (Zimmerman 1985, pp. 344–345; Worthington 2008, p. 8). Samples from these populations (excluding Rattlesnake Ridge, which is pending sequencing) are assigned to a different branch in a phylogenetic tree than the Franklin Mountains samples. Instead of sharing a branch with the Franklin Mountains Sneed’s, they share a branch with *Escobaria organensis* and *Escobaria sandbergii*. Within this branch and the subsequent branches, the Webb Gap (and, potentially, South Hill) samples are monophyletic and the North Hill samples are polyphyletic with *Escobaria sandbergii*. STRUCTURE groupings at K=10 suggest that these populations form a unique group that is more distinct from *Escobaria sandbergii* and

Sneed's than *Escobaria sandbergii* is from *Escobaria organensis* (Porter 2023, pers. comm.). Individuals from these populations may be found to represent a unique taxon. Results are pending additional sequencing and analysis of samples from these populations.

No studies have investigated population genetics for Sneed's, so the status of, and trends in, Sneed's genetic diversity within and between populations is unknown. Preliminary phylogenetic results suggest that there's no gene flow between the Southern Franklin Mountains sites and the Northern Franklin Mountains or between either of these population areas and the population areas north of Anthony Gap (Porter 2023, pers. comm.). Additional analysis is needed to evaluate if there's evidence of gene flow between sites within population areas (such as between South Hill and North Hill at Bishop's Cap) or between population areas north of Anthony's gap (such as between Webb Gap and Bishop's Cap).

Loss of genetic diversity from inbreeding and/or genetic drift can be speculated from self-compatibility and effective population sizes. Sneed's self-compatibility is unknown. Effective population sizes below 50 are associated with deleterious consequences from inbreeding, and effective population sizes of at least 500 are needed to maintain adaptive potential (sustain allelic diversity against genetic drift) (Mace and Lande 1991, pp. 151–154; Jamieson and Allendorf 2012, p. 578). Historical population size estimates range from 653–2,610 (median = 1,670) on the low end to 1,153–17,963 on the high end (median = 2,610). The average effective population size to census population size ratio is 0.10 (Jamieson and Allendorf 2012, p. 578). Applying this ratio to our ranges of historic population size estimates, we estimate that historic effective population sizes may have been somewhere between 65–261 (median = 167) and 115–1,796 (median = 261). Therefore, we suspect that Sneed's is experiencing a loss of evolutionary potential from loss of diversity through genetic drift, except, possibly, at Bishop's Cap, which has an estimated historic effective population size of 1,796 under the high abundance estimate scenario. Populations with effective populations sizes less than 500 have a compromised capacity to adapt to changing environmental conditions.

2.2.1.4 Taxonomic classification or changes in nomenclature:

Sneed's remains a valid taxon. It can more reliably be distinguished from closely related taxa by location than morphology. We maintain the understanding that Sneed's is restricted to the Franklin and Organ Mountains and adjacent foothills (Service 2015, p. 10).

The taxonomy of *Coryphantha* has undergone revisions since Sneed's was listed under the Act. *Coryphantha sneedii*, previously considered a synonym for *Escobaria sneedii* (Missouri Botanical Garden 2023, unpaginated; Integrated Taxonomic Information System (ITIS) n.d., unpaginated), is now also

considered a synonym for *Pelecyphora sneedii* (Boyle et al. 2013, unpaginated; World Flora Online 2023, unpaginated). A recent phylogenetic study of taxa within the genus *Coryphantha* supports the traditional recognition of *Coryphantha* and *Escobaria* as separate genera, but proposed to merge the *Escobaria* genus (Britton and Rose 1923, pp. 53–57) into the *Pelecyphora* genus (Ehrenberg 1843, Col. 737–738; Turland et al. 2018, Art. 11.3; Sánchez et al. 2022, pp. 122–125). Currently, both *Escobaria sneedii* and *Pelecyphora sneedii* are accepted names by different sources (Boyle et al. 2013, unpaginated; Missouri Botanical Garden 2023, unpaginated; World Flora Online 2023, unpaginated; ITIS n.d., unpaginated).

Some authorities recognize several varieties or subspecies within an *Escobaria* (or *Coryphantha*) *sneedii* complex (hence forward, the Sneedii complex) (Zimmerman 1985 pp. 179–180, 186–189; Lüthy 1999, p. 278; Powell and Worthington 2018, pp. 363–365). Based on a phylogenetic study of taxa within the Sneedii complex, these taxa fall within four major, geographically isolated evolutionary lineages. Some or all of these major lineages may meet the definition of a species, but for consistency with existing, accepted taxonomy, we assume that all of these lineages fall under *Pelecyphora sneedii* and call them (east to west) (Porter 2023, pers. comm.):

- **Albicolumnaria**, including
 - *Escobaria sneedii* subsp. *albicolumnaria* (Hester) Lüthy;
- **Leei**, including
 - *Escobaria sneedii* Britton & Rose var. *leei* (Rose ex Boed.) D.R.Hunt,
 - *Coryphantha sneedii* var. *guadalupensis* (S.Brack & K.D.Heil) A.D.Zimmerman, and
 - *Escobaria sneedii* subsp. *villardii* (Castetter & al.) Lüthy);
- **Sneedii**, including
 - *Escobaria sneedii* Britton & Rose var. *sneedii*,
 - *Escobaria sneedii* subsp. *organensis* (D. Zimmerman) Lüthy, and
 - *Escobaria sneedii* subsp. *sandbergii* (Castetter & al.) Lüthy).
- **Orcuttii**, including
 - *Escobaria sneedii* subsp. *orcuttii* (Boed.) Lüthy and

- *Escobaria sneedii* var. *macraxina* (name adapted here from *Escobaria orcuttii* var. *macraxina* Castetter, P.Pierce & K.H.Schwer.).

Each of the taxa (listed above) within these major lineages is genetically, geographically, and—for the most part—morphologically distinct. Therefore, we consider Sneed pincushion cactus (*Pelecypora sneedii* var. *sneedii*, the taxa listed as *Coryphantha sneedii* var. *sneedii*) to be a taxonomically valid infraspecific taxon. Sneed pincushion cactus is now understood to be restricted to the Franklin and Organ mountains and adjacent foothills. Therefore, we consider *Pelecypora sneedii* individuals within the Guadalupe mountains previously identified as Sneed pincushion cactus to be Lee pincushion cactus, consistent with Sneed’s previous five-year review (Service 2015, p. 10). Within the Franklin and Organ Mountains, the Webb Gap, Bishop’s Cap, and Rattlesnake Ridge populations have genetically and morphologically diverged from those in the Franklin Mountains. An understanding of the magnitude of this divergence and any implications that it might have regarding the taxonomic identity of these populations is pending additional sequencing and analysis of samples from these populations (see section 2.2.1.3).

2.2.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, pollinator availability, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species’ within its historic range, etc.):

Historical Range

The historic range of Sneed’s has contracted due to taxonomic revisions. Historically, Sneed’s range was described as including the South Franklin Mountains and North Franklin Mountains (isolated by intervening inappropriate geology) (Worthington 2008, p. 6), Webb Gap, Bishop’s Cap, Rattlesnake Ridge, and the Guadalupe Mountains (Zimmerman 1985, p. 344; Service 1986, p. 5; Cook 1987, pp. 1–2; Gulf South Research Corporation 2011, p. 1-1). Plants described as Sneed’s from Guadalupe Mountains National Park in the Guadalupe Mountains were subsequently assigned to a new taxon, *Escobaria guadalupensis* (Heil and Brack 1986, p. 165), which is currently referred to as *Coryphantha sneedii* var. *guadalupensis* (S.Brack & K.D.Heil) A.D.Zimmerman. As stated in section 2.2.1.4 above, the remaining plants within the Guadalupe Mountains that were historically identified as Sneed’s are no longer considered Sneed’s. This is consistent with Sneed’s previous 5-year review (Service 2015, p. 10).

As discussed in section 2.2.1.3 above, the taxonomic identity of “Sneed’s” plants at the Webb Gap, Bishop’s Cap, and Rattlesnake Ridge populations is uncertain. A phylogenetic investigation including samples from these populations is in progress and may clarify this uncertainty. Preliminary results suggest that the morphologically distinct (relative to the plants in the Franklin

Mountains populations) “Sneed’s” plants at these populations are also genetically differentiated (Porter 2023, pers. comm.). If these plants represent a unique taxon, Sneed’s historic range would contract from the range known at the time of listing, which included Bishop’s Cap and, presumably, Webb Gap in addition to the populations in the Franklin Mountains south of Anthony Gap (44 FR 64741). Therefore, Sneed’s range extends either approximately 40 km (25 mi) or 19 km (12 mi) north/south, depending on the taxonomic identity of “Sneed’s” plants in the Webb Gap, Bishop’s Cap, and Rattlesnake Ridge populations.

There are 3–4 sites (depending on site separation distance and the rigor with which one accepts valid records) documented in the South Franklin Mountains and 4 sites documented in the North Franklin Mountains. In the South Franklin Mountains, these sites include a site in west McKelligon Canyon, a site south of Fusselman Canyon, a site at the low point of the crest of Franklin Mountain (with the same coordinates as the McKelligon Canyon site), a site east of Coronado Country Club, and a site near Canutillo, Texas (which lacks a source of information). In the North Franklin Mountain, these sites include Anthony’s Nose and three ridges south of Anthony Gap, which we’ll refer to as Hook Ranch, Anthony’s Cave, and Section 33. There is 1 site documented at Webb Gap, 3 sites documented at Bishop’s Cap, and 1 site documented at Rattlesnake Ridge. The 3 sites at Bishop’s Cap are South Hill, North Hill, and the third ridge east of Bishop’s Cap.

Connectivity

Sneed’s inhabits rugged terrain in relatively remote natural areas that have been historically used for recreation, ranching, and military training. While there are major roads and highways that intersect the species range, they are unlikely to significantly alter gene flow, and there are no known new barriers to pollinators or dispersal agents. Existing roads and highways are unlikely to significantly alter gene flow because birds can fly over transportation corridors and pollinators (members of the Halictid bee family) and other seed dispersal agents (small mammals) that could be adversely affected by transportation corridors have smaller, more local territories (Service 1986 pp. 11, 28). There appears to be no gene flow between sites in the South Franklin Mountains and sites in the North Franklin Mountains (Porter 2023, pers. comm.). These populations are isolated by intervening unsuitable geology (Worthington 2008, p. 6). Trends in populations of Sneed’s pollinators and dispersal agents are unknown.

2.2.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Sneed’s grows in semi-desert grassland habitats (Service 1986, p. 8) on or near limestone and/or dolomite (Zimmerman 1985, p. 344; TRC Mariah Associates,

Inc. 1998, p. 1-1). There are 22,881.93 ha of area within 1 kilometer of mapped limestone and/or dolomite intersecting shrub/scrub or grassland/herbaceous vegetation associations within Sneed's range, including areas north of the Franklin Mountains (Horton et al. 2017, unpaginated; Dewitz 2021, unpaginated). Of these areas, 10.90% were classified as grasslands in 2019, 5.74% have converted from grassland/herbaceous to shrub/scrub vegetation types between 2001 and 2019, 0.95% have converted from shrub/scrub to grassland/herbaceous vegetation types, 0.17% have converted from forest to either, and 0% have converted from either to development (Dewitz 2021, unpaginated). There are 18,286.75 ha of area within 1 kilometer of mapped limestone and/or dolomite intersecting shrub/scrub or grassland/herbaceous vegetation associations within Sneed's range, including only the Franklin Mountains (including Webb Gap) (Horton et al. 2017, unpaginated; Dewitz 2021, unpaginated). Of these areas, 10.98% were classified as grasslands in 2019, 4.59% have converted from grassland/herbaceous to shrub/scrub vegetation types between 2001 and 2019, 1.00% have converted from shrub/scrub to grassland/herbaceous vegetation types, 0.18% have converted from forest to either, and 0% have converted from either to development (Dewitz 2021, unpaginated). Overall, since 2001, habitat has not been lost to development, but within habitat, grassland conversion to shrub steppe is outpacing conversion of other vegetation types to grasslands. Therefore, habitat suitability may be gradually decreasing.

There are BLM Assessment, Inventory, and Monitoring (AIM) plots in habitat areas at Anthony Gap, Webb Gap, and Bishop's Cap. These plots are used to measure habitat characteristics relevant to rangeland health (Table 1). Sneed's don't occur in these plots, but the plots represent general conditions for the respective portions of Sneed's range. The data from these plots indicate that habitat suitability may be compromised within each of these areas. Lehmann lovegrass (*Eragrostis lehmanniana*), an invasive exotic grass, is present in the Anthony Gap area; the Webb Gap plot has very low forb (herbaceous) cover, no or trace grass cover, and high amounts of bare soil; and one of the Bishop's Cap plots has very low forb and grass cover and high shrub cover. The second plot in the Bishop's Cap area, however, has low amounts of bare soil and high forb and grass cover, indicating high quality habitat. Lehmann lovegrass can aggressively compete for available water and nutrients, change microclimates (reduce space, light, and soil moisture available for native species), and increase fire intensity and frequency (Williams and Baruch 2000, p. 128). Fire, increased carbon dioxide concentrations, and grazing may facilitate its spread (Williams and Baruch 2000, pp. 135–136). While there's Lehmann lovegrass in the general area of North Franklin Mountains sites, it's unknown if Lehmann lovegrass has invaded Sneed's population areas.

Table 1. Habitat characteristics in AIM plots. Soil stability is on a scale of 1–6, with 1 being the least stable and 6 being the most stable. Other attribute values, starting with bare soil, represent percent cover within each plot. Veg = vegetative, Nx = noxious. Noxious vegetative cover is from a perennial grass, Lehmann lovegrass.

Area	Plot	Soil Stability	Bare Soil	Veg Foliar	Forb	Grass	Shrub	Nx Veg
Anthony Gap	Lime-292	3.4	2.33	44.67	3	20	16	7
Webb Gap	Lime-303	2.13	28.33	18.67	0.67	0	17.67	0
Bishop's Cap	Lime-300	3.55	7.33	30	1	1	24.67	0
Bishop's Cap	MINELEV1200-04	NA	6	48.67	16	28.67	10.67	0

2.2.1.7 Other:

None.

2.2.1.8 Conservation Measures:

Efforts to ameliorate threats to Sneed's include endangered plant protections, special land use designations, ex-situ collections, research and monitoring, and outreach and education.

Endangered Plant Law, Regulation, and Policy

Sneed's is currently listed as a Federally endangered species without designated critical habitat, a BLM special status species, a New Mexico endangered species, and a Texas endangered species. Each of these statuses confers some level of protection for Sneed's plants. Overall, harm to Sneed's plants without a valid permit is prohibited across the species' range, except for incidental take associated with agricultural activities on the private land portion of Hook Ranch in New Mexico and any plants on private lands in Texas. The putative Sneed's site near Canutillo may be on private property in Texas.

The Act prohibits unpermitted import, export, removal and reduction to possession from lands under federal jurisdiction, commercial transport, and sale or offer for sale of endangered plant species (50 CFR § 17.61); requires federal agencies, in consultation with the Service, to ensure that federally authorized, funded, or implemented actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat; and directs federal agencies to use their authorities to carry out conservation programs for the recovery of listed species (16 U.S.C § 1536(a)(1)).

BLM special status species are managed for conservation and/or recovery on BLM-administered lands, in accordance with BLM Manual 6840 (Special Status Species Management), by minimizing and eliminating factors that limit species viability and/or enhancing habitat quality (MS 6840.2.C). Federally listed plants are retained as BLM special status species for at least five years post-delisting. This manual is currently under revision (Goss 2023, pers. comm.), so the extent of future policy protections under this manual could increase, decrease, or remain static.

Under New Mexico endangered plant rules (19.21.2 NMAC: Endangered Plant Species List and Collection Permits), the taking of endangered plants, other than pursuant to a permit issued by the state forester, is prohibited in New Mexico. Therefore, it is illegal to remove, harm, kill, destroy, possess, transport, export, sell, or offer for sale any New Mexico endangered plants, or parts thereof, from the places in the state of New Mexico where they naturally grow—including lands under any Federal, State, private, or other non-tribal jurisdiction—other than by Tribal members for religious purposes, as an incidental result of agricultural practices, or by federal employees working within their lands of jurisdiction for the purposes of scientific study or propagation. This prohibition of take of State endangered plant species is new in 2023, so the effectiveness of regulatory protections for Sneed’s plants at the state level in New Mexico is currently uncertain.

Under Texas endangered plant code and rules (5 PW 88.001–.011: Endangered Plants; 31 TAC 69.1–8: Endangered, Threatened, and Protected Native Plants), it is illegal to take (collect, pick, cut, dig up, or remove), possess, transport, or sell an endangered, threatened, or protected native plant from Texas public lands without a valid scientific or commercial collection permit other than by TPWD personnel working within Texas public lands for the purposes of conservation, education, or scientific studies.

Special Land Use Designations

Nearly all known occupied and/or historically documented Sneed’s occurrences are afforded protections via special designations. The exceptions include plants on private lands on Hook Ranch and, possibly, the putative site near Canutillo, Texas (which lacks precise locality information).

Texas Parks and Wildlife Department

In 1979, Texas Legislature passed the Franklin Mountains State Park Act, establishing Franklin Mountains State Park and requiring the TPWD to acquire said lands (Legislative Reference Library n.d., Acts 1979, 66th R.S., ch. 736, General and Special Laws of Texas). TPWD acquired the lands in 1981, the park opened in 1987, a Management Plan for Franklin Mountains State Park was completed in 1994, and TPWD acquired the park’s mineral rights in 1997 (Franklin Mountains Wilderness Coalition 2015, unpaginated; Texas Parks and

Wildlife Department n.d., unpaginated). The site in west McKelligon Canyon, the site at the low point of the crest of Franklin Mountain, the site east of Coronado Country Club, possibly the site near Canutillo, Texas, the site at Anthony's Nose, and sites south of Anthony Gap that are south of the Texas border are all within this park.

Castner Range

The Castner Range portion of the Franklin Mountains, which contains the Sneed's site south of Fusselman Canyon, was proclaimed a national monument—Castner Range National Monument—in 2023 (88 FR 17999–18004). All federal lands and federal interests in lands within the boundaries of this national monument are now “withdrawn [subject to valid existing rights and not precluding rights-of-ways (ROWs)] from all forms of entry, location, selection, sale, or other disposition under the public land laws or laws applicable to the Department of the Army, including withdrawal from location, entry, and patent under the mining laws; from disposition under all laws relating to mineral, solar, and geothermal leasing; and from conveyance” (88 FR 18001–18002). Additional management decisions will be established in a Department of Defense (DOD) management plan (88 FR 18001–18002).

Fort Bliss Military Reservation

Fort Bliss lands are withdrawn from mineral entry, subject to prior rights (Bureau of Land Management n.d.d, pp. 1, 61). Sneed's plants on DOD lands at Webb Gap, Bishop's Cap (South Hill and North Hill), and Rattlesnake Ridge are located within Off Limits Areas (OLAs) and are closed to livestock grazing and off-road vehicle travel (Fort Bliss 2016, pp. 2-74–2-75, G-3). OLAs prohibit use or entry by military personnel (32 CFR §631.11).

Bureau of Land Management

All known Sneed's occurrences on BLM lands in New Mexico (the plants in BLM surface ownership at Anthony Gap, Webb Gap, and Bishop's Cap) are currently within the Organ/Franklin Mountains Area of Critical Environmental Concern (ACEC). This ACEC excludes plants at the Hook Ranch site in the Anthony Gap area. The areas within this ACEC are closed to leaseables, petitioned for withdrawal for locatables, closed to saleables, excluded for ROWs, not considered for land disposal, prioritized for land acquisition, and managed as Visual Resource Management (VRM) Class I (BLM 1993, pp. 5-39–5-40). VRM Class I lands are managed to limit management activities, allow for natural ecological changes, and to preserve the existing character of the landscape (Bureau of Land Management 1993, p. 2-57). This ACEC is also currently managed in accordance with BLM's 1989 Organ Mountains Coordinated Resource Management Plan (Bureau of Land Management 1987, pp. DR-1, 2, 5, 37; Bureau of Land Management 1993, pp. 2-64, 5-39), which

incorporates the 1987 Sneed's Pincushion Cactus (*Coryphantha sneedii* var. *sneedii*) Habitat Management Plan (HMP) (Bureau of Land Management 1987, entire) for the Franklin Mountains (Anthony Gap and Webb Gap) and Bishop's Cap. Most of the protections included in the HMP are explicitly stated in the Organ Mountains Coordinated Resource Management Plan. This plan includes protection of all formations of Fusselman Dolomite from removal of saleable minerals and by avoiding or minimizing impacts to the habitat from other surface disturbing activities. It also prescribes complete mineral withdrawals for approximately 113 ha of occupied habitat, law enforcement patrols for unauthorized removal or damage of Sneed's plants; and tri-annual (one population per year, annually) quantitative population monitoring (BLM 1989, p. 65). Additional protections incorporated by reference from the 1987 HMP include limited use off-road vehicle (ORV) designations, recommending the HMP area for ORV closure, informing miners who submit exploration notices about Endangered Species Act responsibilities, and full fire suppression with a resource adviser to guide placement of fire control activities (Bureau of Land Management 1987, pp. 6–8).

The Organ/Franklin Mountains ACEC withdrawal, subject to prior rights, has been pending since 2011 (Bureau of Land Management n.d.a, p. 8). A subset of this area, including Sneed's on BLM lands at Anthony Gap and Webb Gap, has an inactive historical withdrawal record under serial number NMNM 0554608 01, but the record couldn't be found (Bureau of Land Management n.d., unpaginated). BLM land acquisitions within the ACEC and near Sneed's populations have also been made (Bureau of Land Management n.d., unpaginated; Bureau of Land Management n.d.c, entire; Bureau of Land Management n.d.b, entire).

A subset of this ACEC area was designated as a national monument—Organ Mountains Desert Peaks National Monument—in 2014. All federal lands and federal interests in lands within the boundaries of this national monument are now “withdrawn from all forms of entry, location, selection, sale, leasing, or other disposition under the public land laws, including withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument” (79 FR 30434). The monument designation also restricts public vehicle travel to designated routes and limits development of new ROWs. Additional management decisions will be established in a BLM resource management plan (RMP) (79 FR 30435; 88 FR 40846). This national monument's boundaries, however, exclude the Anthony Gap Sneed's population area, so the fate of this portion of the Organ/Franklin Mountains ACEC is uncertain until the Organ Mountains Desert Peaks National Monument RMP (88 FR 40846) and/or the BLM Las Cruces District Office's TriCounty RMP (Bureau of Land Management 2018, entire) are finalized.

Ex-situ Collections

There are an unknown number of Sneed's individuals from wild and cultivated sources in ex-situ conservation and private plant collections. A search of botanical garden records returned 3 collections searching for Sneed's under *Coryphantha* and 2–3 collections searching for Sneed's under *Escobaria*. It is unknown if these are redundant or additive records. It's also unknown if source germplasm for any of the collections is from "Sneed's" in the Guadalupe Mountains. There are no ex-situ conservation seed or other germplasm collections documented in the Center for Plant Conservation's records (Center for Plant Conservation n.d., unpaginated)

Research and Monitoring

Difficulty differentiating this species from other *Pelecyphora*/*Escobaria* taxa and the resulting uncertainty about the taxonomic identity of this species have complicated research and monitoring. Monitoring efforts appear to have paused, pending resolution of this uncertainty, with the initiation of a phylogenetic study of the *Escobaria sneedii* complex in 2012 (Porter et al. 2012, entire). Unfortunately, challenges with species identification confounded the 2012 study's sampling, and that study was discontinued. A new phylogenetic study of the complex is underway, and final results are pending additional sample sequencing and analysis. Once the taxonomic uncertainties surrounding these taxa are resolved, research and monitoring should be able to resume more confidently and effectively.

Previous monitoring efforts included presence/absence surveys in areas targeted by overlay analysis models of conceptually suitable habitats throughout the species' range in New Mexico, documenting density in plots at known locations north of Anthony Gap, long-term demographic monitoring in plots at each of the known occupied areas in the Fort Bliss Military Reservation, and abundance trend monitoring in plots across the species range.

Outreach and Education

Nationally, the Service and NatureServe maintain websites that provide public conservation information about Sneed's. In Texas, TPWD maintains a website that provides public conservation information about Sneed's. In New Mexico, Natural Heritage New Mexico and New Mexico's Forestry Division partner to maintain a website that provides public conservation information about Sneed's. Globally, the IUCN's Red List's public conservation information doesn't address the listed varieties of *Escobaria sneedii*.

2.2.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms):

2.2.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Sneed's 1986 recovery plan lists private land use; residential, commercial, and transportation system development; and, potentially, military artillery impact use as potential threats to habitat (Service 1986, p. 15). In addition to these, recreational trail construction, use, and maintenance; ungulate trampling; and mineral materials development are documented habitat threats (Bureau of Land Management 1987, pp. 4–8; Cook 1987, p. 2; Van Devender and Rondeau 1992, p. 14; Bleakly Botanical and Biological and Metric Corporation 2001, 7). No additional habitat or range threats are documented via formal Endangered Species Act Section 7 consultations (Service n.d., unpaginated).

When initially listed, a significant portion of Sneed's range was in private ownership. Since then, TPWD has acquired private lands in Texas and BLM has acquired private and state lands in New Mexico. Currently, nearly all documented Sneed's occurrences are on public lands that are managed for conservation: Franklin Mountains State Park, Castner Range National Monument, Organ/Franklin Mountains Area of Critical Environmental Concern, Organ Mountains Desert Peaks National Monument, and Fort Bliss Off-Limits Areas. Sites not covered by these special designations include plants on private lands at Hook Ranch in New Mexico and, potentially (depending on the validity and precise locality of the record), the site near Canutillo, Texas. These special designations protect plants from military artillery use and residential, commercial, and transportation system development and can facilitate avoidance or minimization of impacts from recreational trail construction, use, and maintenance.

These areas may also provide protections from mineral materials development. Areas within the Organ/Franklin Mountains ACEC are proposed for withdrawal, and the application is pending. Areas within the national monuments are withdrawn by proclamation, but not yet registered within BLMs Mineral and Land Records System. TPWD owns the mineral rights in Franklin Mountains State Park lands, but minerals owned by, or held in trust for, TPWD may be leased by the Board for Lease for Parks and Wildlife Lands under Texas Natural Resources Code §34.051 for the purpose of prospecting or exploring for and mining, producing, storing, caring for, transporting, preserving, selling, and disposing of the oil, gas, or other minerals (Texas Parks and Wildlife Commission 2006, unpaginated). There are currently two hard rock mineral leases intersecting the park (HM10945 and HM113842), neither of which intersect documented Sneed's occurrences (The Texas General Land Office n.d., unpaginated). Amelioration of threats from mineral materials development, therefore, is in progress but not yet finalized on federal lands and may be contingent upon assurances that the Board for Lease for Parks and Wildlife Lands will avoid leasing Sneed's habitat in Franklin Mountains State Park.

2.2.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

In 1979, at the time of listing, overutilization severely limited Sneed's viability in the Anthony Pass area, which is relatively accessible to collectors (44 FR 64741). Clark Champie began horticultural production of this species in the 1960s for the purposes of alleviating pressure on wild populations (Weniger 1970, p. 142). New Mexico (NMAC 19.21.2) and Texas (5 PW 88.001–.011; TAC 69.1–8) have prohibited unpermitted collection of Sneed's (as a state endangered species) since 1985 and 1997, respectively. The last report of cactus collection within Sneed's population was in 1987 (Cook 1987, p. 1). Reports that collection pressure was alleviated began in 2001 (Tonne 2001, 6), and no observations of collection impacts have since been reported.

Multiple collection events for scientific purposes are documented via formal Endangered Species Act Section 7 consultations (Service n.d., unpaginated). Terms and conditions on state and federal collection permits minimize adverse effects to both plants and populations from scientific collections. Therefore, overutilization for scientific purposes is no longer a threat.

Overutilization via illegal collection for recreational or spiritual purposes is a potential emerging future risk. Recent taxonomic revisions have placed Sneed's in the *Pelecyphora* (peyotillo) genus (see section 2.2.1.4), which is known for having psychoactive properties similar to the *Lophophora* (peyote) genus (Neal et al. 1972, entire). This association could result in illegal collection for ethnobotanical exploration, but there is no evidence of renewed collection pressure to date. Sneed's is not known or thought to be psychoactive.

2.2.2.3 Disease or predation:

Fungi, bacteria, insects, small mammals, and ungulates are known to prey on cacti (Kelly and Olsen 2011, entire). While Sneed's dense spination provides some defense against vegetative herbivory (Kelly and Olsen 2011, p. 7), its reproductive structures remain vulnerable. Herbivory has not been previously documented as a threat but exhibits some ability to result in significant adverse effects. In 2000, spring flower herbivory at Fort Bliss resulted in reduced reproduction that year and mortality of many grazed plants by the following year. Further, no Sneed's were observed flowering in 2001 (Allen 2003, pp. 1-7–1-8). In 2012, insect or fungal damage (sticky webbing on flowers) was observed on Sneed's flowers; this pathogen affected not more than 5 percent of plants in populations (Gulf South Research Corporation, pp. 2–3). Insect and mammal herbivory on cacti increases during drought (Russell and Felker 1987, p. 440; Kelly and Olsen 2011, pp. 8–9; Hayes et al. 2013, p. 110; Shryock et al. 2014, p. 1951), so herbivory may increase in response to climate change. Sneed's is likely most vulnerable to small mammal herbivory.

2.2.2.4 Inadequacy of existing regulatory mechanisms:

Nearly all known occupied and/or historically documented Sneed's occurrences are afforded protections via special designations (see section 2.2.1.8). However, BLM mineral withdrawals are pending and management plans for conservation areas on BLM and TPWD lands are either unavailable, pending creation, or pending revision. Therefore, the conservation value of these special designations for Sneed's is uncertain in New Mexico and undetermined in Texas.

Sneed's is currently listed as a Federally endangered species without designated critical habitat. It is also a BLM special status species, a New Mexico endangered species, and a Texas endangered species. Each of these statuses confers some level of protection for Sneed's plants (see section 2.2.1.8). In New Mexico, the state endangered plant rule (prohibiting unpermitted take) is new, and, therefore, effectiveness of regulatory protections for Sneed's plants at the state level in New Mexico are currently uncertain.

2.2.2.5 Other natural or manmade factors affecting its continued existence:

Drought and Climate Change

Climate change is increasing the severity and duration of droughts in the Southwest (Williams et al. 2022, p. 234). 2000–2021 was the driest 22-year period since at least 800. Between 2000 and 2021, the Southwest experienced 18 negative soil moisture anomalies, and multi-year droughts within Sneed's range spanned 2002–2004, 2011–2014, and 2020–2022 (Williams et al. 2022, p. 232; National Integrated Drought Information System n.d., unpaginated). 2002 was the driest year on record (since 1901), and 2021 was nearly as dry as 2002 (Williams et al. 2022, p. 232). Between 2040 and 2069, projected temperatures across Sneed's range substantially increase without a corresponding substantial increase in precipitation. Projections for mean spring maximum temperatures increase by 3.0–3.5°C (5.4–6.3°F) while mean spring precipitation decreases by a projected 0.5–1 mm (-0.002–-0.039 in) under RCP 4.5 and 8.5 scenarios, respectively. Projections for mean summer maximum temperatures increase by 3.0–3.2°C (5.3–5.7°F) across Sneed's range while mean summer precipitation only increases by a projected 4–7 mm (0.145–0.272 in) (MACA n.d., 31.7816 to 32.2639 N x -106.6077 to -106.4424E). Therefore, we expect growing season drought severity, frequency, and/or duration to increase into the future. Sneed's may respond to drought by aborting flower buds (Konings 2008, p. 1), but no additional drought responses are documented for this species. Therefore, while it appears reasonable to assume that changes in temperature and precipitation will affect Sneed's, we lack sufficient certainty to know how climate change specifically will affect Sneed's. Rising temperatures will likely result in decreased recruitment and survival, both directly (via inadequate soil moisture) and indirectly (via increased herbivory, altered disturbance regimes, and

phenological mis-matches) (Roth 2020, p. 4; Wroblewski et al. 2023, pp. 7, 9, S2).

2.3 Synthesis

Recovery Progress

Delisting recovery criteria are outlined in Sneed's recovery plan amendment (Service 2019, p. 4–7). Land managers have made significant progress toward achieving Sneed's recovery in terms of regulatory mechanisms that conserve Sneed's populations and, hence, species redundancy. The current status and/or long-term trends of resiliency (stable to increasing population growth rates) and representation (the maintenance of relatively normal inbreeding coefficients and persistence of multiple subpopulations) within Sneed's populations, however, are unknown.

Delisting Criteria 1: All core populations demonstrate stable or increasing trends in abundance over a 20-year period.

- Trend data was last collected in 2002 on TPWD lands, in 2001 on BLM lands, and in 2010–2011 on Fort Bliss lands. Therefore, current population trends are unknown. When trend data was last collected, the North Franklin Mountains population had an increasing trend and the South Franklin Mountains, Webb Gap, Bishop's Cap, and Rattlesnake Ridge populations had declining trends.

Delisting Criteria 2a: Maintain a minimum of three geographically separated core populations for each species over a 20-year period.

- Sneed's occupies 2–5 geographically isolated population areas, depending on phylogenetic analysis results for "Sneed's" plants in the Webb Gap, Bishop's Cap, and Rattlesnake Ridge populations. While the current status of all historically documented populations is unknown, we believe that all populations remain extant and have persisted for over 20 years.

Delisting Criteria 3a. Maintain genetic diversity within all core populations as measured by the fixation indices inbreeding coefficient (F_{IS}) at or within one standard deviation of the F_{IS} of a closely related species with similar reproductive strategies and demonstrated acceptable viability.

- While a phylogenetic study of Sneed's populations and populations of closely related species is underway, inbreeding coefficients for Sneed's populations or populations of closely related species aren't part of the study's proposal and haven't been calculated.

Delisting Criteria 3b: Maintain presence in 80 percent of subpopulations over 20-year monitoring period and outside of the core populations, with any subpopulation extirpations compensated by a newly identified or colonized subpopulation.

- While all historically documented subpopulations may remain extant, the current statuses of all historically documented subpopulations are unknown.

Delisting Criteria 4: Develop and implement a Habitat Management Plan (HMP) for Sneed and Lee pincushion cacti conservation.

- The BLM established an HMP for Sneed's occurrences on BLM lands in 1987 (Bureau of Land Management 1987, entire). HMP prescriptions are carried forward in BLM's 1989 Organ Mountains Coordinated Resource Management Plan and 1993 Mimbres Resource Management Plan (Bureau of Land Management 1987, pp. DR-1, 2, 5, 37; Bureau of Land Management 1993, pp. 2-64, 5-39).
- The Department of Defense's 2016 Fort Bliss Integrated Natural Resources Management Plan includes prescriptions for the conservation of Sneed's populations on Fort Bliss lands (Fort Bliss 2016, pp. 2-74–2-75, G-3).
- TPWD finalized a Management Plan for Franklin Mountains State Park in 1994, but the Service hasn't been able to obtain a copy of this plan (Franklin Mountains Wilderness Coalition 2015, unpaginated). Therefore, we don't know if this plan contains prescriptions for the conservation of Sneed's populations.

Representation

Sneed's currently occupies 2–5, geographically isolated and genetically distinct representation areas, depending on phylogenetic analysis results: South Franklin Mountains, North Franklin Mountains, Webb Gap, Bishop's Cap, and Rattlesnake Ridge. Genetic diversity within and between sites and/or populations is unknown. Based on small population sizes, we suspect that Sneed's is experiencing a loss of evolutionary potential from loss of diversity through genetic drift, except, potentially, at Bishop's Cap. Therefore, Sneed's may have a compromised capacity to adapt to changing environmental conditions.

Redundancy

Sneed's occupies 2–5 geographically isolated population areas, depending on phylogenetic analysis results. Therefore, Sneed's range extends approximately 40 km (25 mi) north/south based on our current interpretation of taxonomic identities but is reduced to 19 km (12 mi) north/south if "Sneed's" plants in the Webb Gap, Bishop's Cap, and Rattlesnake Ridge populations represent a different taxon. While isolation among populations decreases the likelihood that a single, localized catastrophic event (such as uncharacteristic wildfire or herbicide exposure) could simultaneously affect all populations, it also decreases the potential for populations to rescue one another following catastrophic events, especially given that seeds are primarily dispersed by small mammals and not designed to attract birds. While there are Sneed's plants in ex-situ collections, the quality and diversity of ex-situ germplasm is likely inappropriate and inadequate for successful reintroduction. Further, neither 40 km (25 mi) nor 19 km (12 mi) is a sufficient distance to ensure redundancy in the face of regional drought and other destructive, broad-scale severe weather events.

Resiliency

Initial population estimates were made in 1975 through 2008, and the most recent trend data is from 2001 to 2011, depending on the area, so the current abundance and trends of Sneed's

populations are unknown. Based on available historic information, Sneed's pincushion cactus appears to have been declining range-wide and within each of its populations, excepting the North Franklin Mountains population, which was increasing. This historic information is unlikely to be a reliable estimate of current abundance and/or trends given the extended droughts of 2002–2004, 2011–2014, and 2020–2022 (National Integrated Drought Information System n.d., unpaginated). Since 2001, habitat has not been lost to development, but within habitat, grassland conversion to shrub steppe is outpacing conversion of other vegetation types to grasslands. Therefore, habitat suitability may be gradually decreasing.

Viability

Sneed pincushion cactus consists of a single “definitively Sneed's” population with a historically stable or increasing population trend, one other “definitively Sneed's” population last known to have a decreasing population trend, and three “Sneed's” populations last known to have decreasing population trends. For all populations, we lack current status and trend data (Factor A), collection pressure, which previously limited populations, has been alleviated, but resumed collection pressure is a potential emerging future risk (Factor B), climate change resiliency and adaptive capacity are unknown (Factors C and E), and special land use designations limit incompatible land use activities (Factors A and D). However, the mineral withdrawal status and management prescriptions for some of these special designation areas are uncertain or unknown (Factors A and D). Therefore, we conclude that Sneed pincushion cactus remains endangered within the foreseeable future throughout its range. We recommend reviewing the status of Sneed pincushion cactus relative to these factors following completion of the ongoing phylogenetic study of the Sneedii complex, collection of more recent population abundance and trend data, and finalization of RMPs or HMPs for Franklin Mountains State Park, Castner Range National Monument, BLM Las Cruces District Office's Tri-county planning area, and Organ Mountains Desert Peaks National Monument.

3.0 RESULTS

3.1 Recommended Classification:

No change is needed.

3.2 New Recovery Priority Number (indicate if no change; see 48 FR 43098):

No change recommended.

Brief Rationale:

Due to the lack of current quantitative scientific data specific to Sneed pincushion cactus, it is difficult to ascertain any trends that could recommend a change in classification. The recovery priority number (9) remains appropriate because Sneed pincushion cactus is still a subspecies with moderate threats and high recovery potential.

3.3 Listing and Reclassification Priority Number, if reclassification is recommended (see 48 FR 43098):

Reclassification (from Threatened to Endangered) Priority Number: Not applicable.

Reclassification (from Endangered to Threatened) Priority Number: Not applicable.

Delisting (Removal from list regardless of current classification) Priority Number: Not applicable.

Brief Rationale:

No change in classification recommended.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Resolve the taxonomic identity of “Sneed’s” plants in the Webb Gap, Bishop’s Cap, and Rattlesnake Ridge populations.
- Create a digitized map of outcrops of the geologic layers associated with Sneed’s.
- Once mapped, survey suitable geologic layer outcrops for the presence/absence and extent of Sneed’s occurrences.
- Map the bounds of Sneed’s occurrences within occupied areas, using standardized and repeatable methods.
- Install randomly or systematically located demographic and density monitoring plots throughout the species’ range. Determine the plot specifications and sample sizes needed to achieve the desired statistical power experimentally.
- Assess Sneed’s resiliency to, and capacity to adapt to, projected future climate changes.
- Collect seeds along >50 maternal lines per site for ex-situ, long-term conservation storage. Consider what germplasm may be needed for successful reintroductions when planning collections (Maschinski et al. 2012, entire).
- Finalize protections for Sneed’s occupied and adjacent and intervening habitats, including future habitats, via special designations and associated mineral withdrawals and management prescriptions for the purpose of conserving Sneed’s.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Sneed Pincushion Cactus (*Coryphantha sneedii* var. *sneedii*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: Not applicable.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, New Mexico Ecological Services Field Office

Approve _____