Species: *Lewisia cantelovii* J.T. Howell, Cantelow's lewisia

Photo Source: CalPhotos (2023)

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Status

Table 1 summarizes the current status of this species or subspecies/variety by various ranking entities and defines the meaning of the status.

Table 1. Current status of Cantelow's lewisia.		
Entity	**Status**	**Status Definition**
NatureServe CA[a]	G2/S2	G2: Imperiled — At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors. S2: Imperiled — Imperiled in California because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or

		other factors making it very vulnerable to extirpation.
California Rare Plant Rank[b]	1B.2	1B: Rare or Endangered — Plants rare, threatened, or endangered throughout their entire range. 0.2: Moderately threatened in California — 20–80% of occurrences threatened / moderate degree and immediacy of threat. This taxon was added to the *CNPS Inventory of Rare and Endangered Plants of California* in 1974 and has undergone no subsequent changes.
California State Listing[c]	CE	Endangered
USDA Forest Service[d]		S: Sensitive
USDI FWS[e]	Not listed	
USDI BLM[f]	S	S: Sensitive
NatureServe OR[g]	Not present	
Oregon State Listing[h]	Not present	
NatureServe NV[i]	Not present	
Nevada State Listing[j]	Not present	

[a] California Natural Diversity Database, California Dept. of Fish & Wildlife [CNDDB 2023, 2023a]
[b] California Native Plant Society [CNPS 2023]
[c] California Department of Fish and Wildlife [CDFW 2023]
[d] US Forest Service Region 5 Forester's List [USFS 2013] and Pacific NW Survey and Manage [USFS & BLM 2014]
[e] US Department of Interior Fish and Wildlife Service [USFWS 2023]
[f] US Department of Interior Bureau of Land Management [BLM 2022]
[g] Oregon Biodiversity Information Center [ORBIC 2023]
[h] Oregon Department of Agriculture [ODA 2018]
[i] Nevada Division of Natural Heritage [NDNH 2022]
[j] Nevada Division of Forestry [NDF 2012]
Note: Individual State Heritage Programs (CNDDB, ORBIC, NNHP) represent NatureServe and contain more up-to-date ranks for their state than NatureServe Explorer.

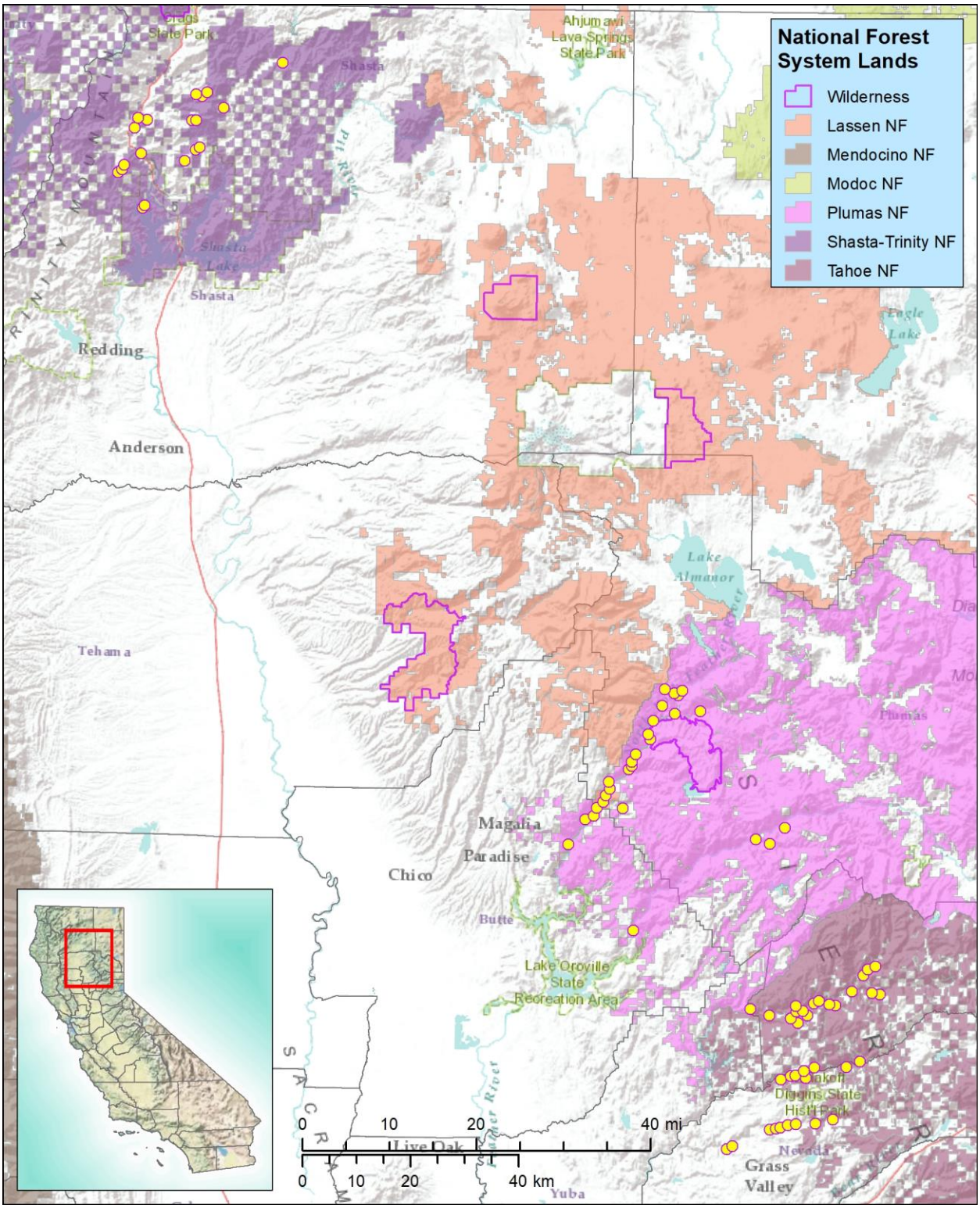
Distribution, abundance, and population trend on the planning unit[1]

Table 2 summarizes the distribution and frequency of this species or subspecies/variety within National Forest System Lands in California. Table 4 in Appendix 1 lists all known occurrences of this species or subspecies/variety within California. Individual occurrences are defined as sites that contain an individual, population, or groups of populations of the plant that are located more than 1/4 (0.25) of a mile apart from each other as defined by the CNDDB.

[1] 1909.12 Chapter 10, Section 12.53, components 2, 3, and 4.

Table 2. Known occurrence frequency of Cantelow's lewisia within the planning area (NRIS, CNDDB, Calflora/CCH databases).

National Forest System (NFS) lands in California	Record #s (from Table 4)	CNDDB EOs	Non-CNDDB Records	Recent (seen in past 20 years)	Historical (not seen in past 20 years)	Most Recent Obs. Date	Total Records on NFS lands
Plumas:	24, 36–38, 40–46, 48–62	26	-	9	17	20-Jan-2022	26
Shasta-Trinity:	63–67, 69, 74, 75, 78, 81	9	1	8	2	7-Jul-2020	10
Tahoe:	8, 10–13, 16–23, (24), 25–35	18 (1)	6	15 (1)	9	7/5/2021	24 (1)
Totals:	N/A	53	7	32	28	N/A	60



Sources: *Distribution*: NRIS (2022), Calflora (2023), CalPhotos (2023), CCH2 (2023), CNDDB (2023), including unprocessed CNDDB field survey forms. *Baselayers*: 2013 National Geographic Society, i-cubed, Esri, Garmin, NOAA, NPS, USGS.

Cantelow's lewisia was last updated in the CNDDB on 18 May 2018 (CNDDB 2023). For the present analysis, occurrences were estimated using the GIS tools and methods described by Green and Sims (2018).

A Californian endemic, this species is found mainly in the northern High Sierra Nevada (nSNH) bioregion of Plumas, Butte, Sierra, and Nevada counties (62 known occurrences). Another cluster of 19 occurrences is in northwestern Shasta County (near Shasta Lake and northward), within the eastern extension of the Klamath Ranges (KR) bioregion described by Lindstrand et al. (2016) (NRIS 2022, Calflora 2023, CalPhotos 2023, CCH2 2023, CNDDB 2023 including unprocessed CNDDB field survey forms). The distributional gap between the nSN and KR populations is 82 miles.

Sixty (74 %) of the known occurrences are at least partly on U.S. Forest Service land including the Plumas NF (25 occurrences), the Tahoe NF (24), the Shasta-Trinity NF (10), and one occurrence straddling the boundary between the Plumas NF and Tahoe NF (Table 2). None of the occurrences are in federally designated Wilderness. The remaining occurrences are on land owned by Sierra Pacific Industries (8), BLM (5), South Yuba River State Park (3), State Lands Commission (1), or of unknown (presumably private) ownership (4). Thirty-eight (47 %) of the occurrences are historical (not seen within the past 20 years), and 43 (53 %) are recent.

Based on census data from 73 occurrences, most populations of Cantelow's lewisia range in size from 1 to 2,000 plants, with the average being 623 plants, the mode 1,000 plants, and the median 165 plants (NRIS 2022, Calflora 2023, CNDDB 2023, including unprocessed CNDDB field survey forms). Nine occurrences had larger numbers of plants, including four with 2,500–3,000, two with 4,300–5,000, and three with an estimated 10,000 plants each. Several observers noted that steep and inaccessible terrain made it impossible to determine the full extent of the population. Occurrences of this species generally consist of isolated colonies mapped in several (up to 11) separate polygons. In some cases, it is evident that only a portion of the occurrence was visited on a certain date, and therefore not all individuals or polygons were counted. Because of this inconsistency in the data, comparison between sites or between years is difficult. Thirty-four occurrences have been revisited over a period of two to 84 years, indicating that their populations are persistent over time but without any clear population trends.

At the bottom of Table 4, there are 22 rows (highlighted in pink) representing records that were not included in the present analysis. Seven of these are CCH2 (2023) records from Nevada or Placer counties representing populations now placed in a separate species, *Lewisia serrata* (Heckard and Stebbins 1974, Foster et al. 1997). Another CCH2 (2023) record based on a collection from Fresno County (*Quibell 5135* in RSA) is misidentified and better assigned to *L. pygmaea*. Three CCH2 (2023) records are based on plants collected from the wild and cultivated in gardens at Berkeley (Alameda Co.) or Ross (Marin Co.). Yet another CCH2 (2023) record (based on *Lefebre s.n.* in CAS) was excluded because the locality description is vague and could not be georeferenced. Ten Calflora (2023) records were excluded because their location quality was said to be low, and they could not be confidently assigned to any known occurrences.

Sixty-seven of the 81 occurrences of Cantelow's lewisia are currently in the CNDDB (2023). The 14 non-CNDDB records (#s 3, 4, 13, 18, 21, 26, 27, 31, 39, 67, 68, 70, 71, and 80) would seem to represent new occurrences, as they are located 0.4 to 4.5 miles from the nearest CNDDB occurrence. These 14 records should be evaluated for addition to the CNDDB. The land ownership information for records of this species also needs updating in the CNDDB. In six cases, the GIS tool of Green and Sims (2018) merged multiple CNDDB occurrences into a single record: CNDDB EO #s 38 and 39 were merged into record # 28; EO #s 55 and 56 were merged into record # 47; EO #s 53 and 54 were merged into record # 48; EO #s 45 and 46 were merged into record # 53; EO #s 11 and 24 were merged into record # 62; and EO #s 48 and 49 were merged into record # 76 (for further details see Table 4).

Brief description of natural history and key ecological functions[2]

Cantelow's lewisia is a perennial herb from a short, thick caudex and taproot. Its fleshy, evergreen, spatulate leaves are arranged in a basal rosette and have denticulate margins. The inflorescence is a bracteate panicle 15–30 cm high with flowers appearing in May to October. The sepals have glandular-dentate margins, and the petals are white to pale pink with deep pink veins (Howell 1942, Hohn 1975, Hershkovitz and Hogan 2003, JEPS 2023).

The habitat of this species is generally in crevices of mossy, north-facing rock outcrops and cliff faces surrounded by lower montane coniferous forest, broadleaved upland forest, or chaparral at elevations from 1,100 to 4,500 feet. Its populations are found on both granitic and metamorphic rocks and sometimes also on ultramafics (serpentinite). Occurrences in the Sierra Nevada are generally in river canyons while those in Shasta County are often on upper slopes or below ridgelines. These sites are typically mesic in spring and early summer, becoming completely dry by July. Frequently noted plant associates include the trees *Pseudotsuga menziesii*, *Quercus chrysolepis*, *Calocedrus decurrens*, and *Pinus ponderosa*; shrubs *Toxicodendron diversilobum* and *Diplacus grandiflorus*; herbs *Sedum spathulifolium*, *Heuchera micrantha*, *Polystichum imbricans*, *Streptanthus tortuosus*, *Ranunculus hystriculus*, *Selaginella wallacei*, *Epilobium canum* subsp. *latifolium*, and *Myriopteris gracillima*; and unidentified mosses. Other rare or uncommon plants co-occurring with Cantelow's lewisia in portions of its range include *Ageratina shastensis* (CRPR 1B.2), *Eriogonum ursinum* var. *erubescens* (1B.3), *E. congdonii* (4.3), *Sedum albomarginatum* (1B.2), *S. paradisum* subsp. *paradisum* (1B.3), *Adiantum shastense* (4.3), and *Monardella stebbinsii* (1B.2) (Hohn 1975, Woolhouse 2012, NRIS 2022, Calflora 2023, CCH2 2023, CNDDB 2023 including unprocessed CNDDB field survey forms, CNPS 2023).

The genus *Lewisia* (Montiaceae) is endemic to western North America and comprises 25–30 species (Hazelquist et al. 2022), all of which are intercrossable although most hybrids are sterile (Mathew 1989, Hershkovitz and Hogan 2003; but see Hohn 1975). The species of this group are taxonomically difficult because of morphological variability and intergradation (Hershkovitz and Hogan 2003). Cantelow's lewisia has been placed in *Lewisia* section *Cotyledon* (Hohn 1975, Mathew 1989), and within this group it is evidently close to *L. serrata*, another rare Sierran

[2] Basis for other 1909.12 Chapter 10, Section 12.53 components.

endemic occurring 20–40 miles further south in Placer and El Dorado counties (CNDDB 2023, CNPS 2023). *Lewisia serrata* was treated as a synonym of Cantelow's lewisia by Hershkovitz and Hogan (2003) but notably differs in having leaf margins more coarsely serrate (vs. denticulate), inflorescence shorter (10–25 vs. 15–40 cm), pedicels longer (3–8 vs, 0.3–4 mm), and petals smaller (5–6 vs. 6–9 mm) (Heckard and Stebbins 1974, Hohn 1975, JEPS 2023). The two taxa are also geographically isolated and genetically distinct from each other (Foster et al. 1997). Plants of Cantelow's lewisia growing on serpentinite are significantly smaller in comparison to non-serpentinite populations, but it is not yet known whether this difference has a genetic basis or may be due to phenotypic plasticity (Woolhouse 2012). Also in need of study are the possible morphological and genetic differences between the disjunct Sierran and Shasta populations of Cantelow's lewisia (M. Guilliams 2023, personal communication). For one of the Shasta occurrences (record #72 in Table 4), an observer has noted that the plants are atypical and may present a taxonomic problem (CNDDB 2023).

The reproductive biology of *Lewisia* section *Cotyledon* (including Cantelow's lewisia) has been studied by Hohn (1975). All members of this species-group offer floral rewards in the form of nectar and pollen and are pollinated by "generalist" insects, i.e., those that are likely to visit two or more flowering plant species during foraging trips. The flowers are protandrous (meaning that the anthers mature before the stigmas), yet the plants produce many seeds from selfing. Due to the tendency for insect pollinators to forage from one flower to another on an entire inflorescence before moving on, at least some of the seed set is from geitonogamous selfing (i.e., the fertilization of a flower by pollen from another flower on the same plant). Each fruiting capsule of Cantelow's lewisia contains one to three seeds each 1.2–1.5 mm long (JEPS 2023). The seeds are dispersed mechanically and mostly over a short distance as evidenced by the very localized population structure (Hohn 1975). Seed germination in the laboratory took place after soaking in distilled water for 24 hours, followed by placement in a moisture chamber and cold treatment at 5 or 10°C for three weeks. Within the first 3–4 weeks after germination, the caudex and taproot become thickened and corky. Seedlings may reach 3–4 inches in length (mostly below-ground) by the end of the first growing season. Growth of the basal rosette of leaves proceeds slowly, and vegetative development continues for two years or more before the plants become reproductively active. Demography and seedling survivorship in the wild are unknown and need to be studied.

At least six occurrences of Cantelow's lewisia (record #s 68, 70, 71, 74, 78, and 80) were in the area that was burned by the 2018 Hirz Fire near Shasta Lake in Shasta County (CNDDB 2023 including unprocessed CNDDB field survey forms). However, observers reported that the rocky sites inhabited by this species remained unburned or that the burn severity was low (L. Lindstrand III, personal communication). Fifteen occurrences on the Plumas NF lie within the footprint of the 2021 Dixie Fire (record #s 48–62), and additional field observations are needed to assess possible fire effects and make comparisons with unburned sites to the south.

Overview of ecological conditions for recovery, conservation, and viability[3] including Threats and Risk Factors

Cantelow's lewisia inhabits mossy, north-facing rock outcrops and is known from 81 occurrences, of which 60 are at least partially on National Forest land. Roughly half of the occurrences are historical, and additional field-work is needed in these sites (notably on the Plumas NF in areas affected by the 2021 Dixie Fire). All occurrences documented in the CNDDB (2023) are presumed extant, but it seems likely that some undocumented occurrences were extirpated by inundation at Shasta Lake (the Shasta Dam on the Sacramento River was completed in 1944). Forty-eight CNDDB occurrences have been assigned a site quality ranking of Excellent (21), Good (23), or Fair (4), and six of the potentially new occurrences are ranked as Good or Excellent (CNDDB 2023 including unprocessed CNDDB field-survey forms).

Of the possible threats, poaching (illegal horticultural collecting) is the most important or at least the most frequently mentioned (NRIS 2022, CNDDB 2023 including unprocessed CNDDB field-survey forms). Lewisias in general are sought after by growers and collectors (Mathew 1989). Evidence of poaching has already been documented for three occurrences of Cantelow's lewisia (record #s 12, 19, and 34), and the closely related *L. serrata* is listed on CITES Appendix 2 (CITES 2023). Other reported threats include gold mining and dredging (including associated activities like camping by miners and illegal trash dumping); recreational use (including foot traffic and trampling by hikers); road construction, widening and maintenance; logging activities; soil erosion (e.g., near roads, mining, or recreational activity); non-native plants (e.g., Scotch broom *Cytisus scoparius*); inundation by the proposed increase in height of Shasta Dam; construction of fuel breaks; and long-term drought associated with anthropogenic climate-change (NRIS 2022, CNDDB 2023 including unprocessed CNDDB field-survey forms). Most occurrences might also be threatened by inherent factors such as small population size (i.e., a single event with a large impact could conceivably affect all of the known individuals), as well as low reproductive output, limited seed dispersal ability, or high seedling mortality. Three *ex situ* seed accessions of Cantelow's lewisia are conserved at UC Santa Cruz (CaPR 2023).

Taxonomy[4]

Table 3 summarizes this species or subspecies/variety's name status in key literature.

Table 3. Name status of Cantelow's lewisia.

Entity	Name Status
CNDDB and CNPS	*Lewisia cantelovii* J.T. Howell
Jepson eFlora	*Lewisia cantelovii* J.T. Howell
Jepson Manual (1993)	*Lewisia cantelovii* J.T. Howell
Flora of North America	*Lewisia cantelovii* J. T. Howell
USDA NRCS[a] PLANTS	*Lewisia cantelovii* J.T. Howell

[a] Natural Resources Conservation Service [NRCS 2023]

[3] 1909.12 Chapter 10, Section 12.53, components 7, 9, 10, 11 and 12, as appropriate.
[4] 1909.12, Chapter 10, Section 12.53, component 1.

Synonymy: *Lewisia cantelowii* [orthographic variant; original spelling is *cantelovii*] (JEPS 2023)

Jepson eFlora link (JEPS 2023):
https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=30825

Type locality: California, Plumas County, *Mr. and Mrs. H. C. Cantelow* (holotype CAS-294735) (Howell 1942).

Key literature

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Persons Contacted

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Author(s) and Date:

R. Douglas Stone, California Native Plant Society, Associate Rare Plant Botanist, 26 October 2023

Reviewer(s) and Date:

Adam J. Searcy, California Native Plant Society, Rare Plant Scientific Coordinator, 22 September 2023; Ellen A. Dean, California Native Plant Society, Rare Plant Botanist, 21 September 2023; Julie Ann Kierstead, USDA Forest Service Region 5 (retired), 25 September 2023

Formatting: Form is set up as 508 compliant. Please use the "styles" if further formatting is necessary.

Purpose: This is to maintain the best available science on a species that could be used by the Forest Service in a variety of functions. Specifically, there would be additional steps and evaluations to determine whether or not this species would be considered a Species of Conservation Concern under the 2012 Planning Rule or a Sensitive Species under the 1982 Planning Rule.

Appendix 1: Known Occurrences

Table 4. Known occurrences of Cantelow's lewisia within California (NRIS, CNDDB, Calflora/CCH databases).

TABLE REDACTED FOR CONSERVATION PURPOSES.

Appendix 2: Additional Considerations at the Forest Level

<This section, including the next 5 subheadings, would be filled out by **Forest Service botanists**.>

<Forest Name>

Geographic distribution within the Forest

A. Scarce or isolated
B. Patchy or gaps
C. Contiguous

<Select a geographic distribution rank and provide references or cite 'specialist expertise, <name>' where appropriate.>

Abundance of the species on the Forest

A. Rare – current abundance is low enough that stochastic and other factors could lead to potential imperilment.
B. Uncommon – current abundance is large enough that demographic stochasticity is not likely to lead to rapid local extinction, but, in combination with highly variable environmental factors, could pose a threat.
C. Common – current abundance is large enough that species persistence is not threatened by demographic stochasticity in combination with environmental variation.
D. Insufficient information to draw inferences about criterion.

<Select a species abundance rank and provide references or cite 'specialist expertise, <name>' where appropriate.>

Population trend on the Forest

A. Significant downward or suspected downward population trend.
B. Stable population.
C. Upward population trend.
D. Insufficient information to draw inferences about criterion.

<Select a population trend rank and provide references or cite 'specialist expertise, <name>' where appropriate.>

Habitat trend on the Forest

A. Decline in habitat quality or quantity.
B. Stable amounts of suitable or potential habitat, relatively unchanged habitat quality.
C. Improving habitat quality or increasing amounts of suitable or potential habitat.
D. Insufficient information to draw inferences about criterion.

<Select a habitat trend rank and provide references or cite 'specialist expertise, <name>'where appropriate.>

Vulnerability of habitat on the Forest

A. Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as drought, climate change, high intensity wildfire and wildfire suppression disturbances, loss of natural openings due to historical wildfire suppression, nonnative invasive species, water impoundments and diversions, and recreation, etc.
B. Habitat modification is likely to result in ecological patterns similar to the range of historical conditions, but is being impacted by modern stressors.
C. Habitat resilient, changes are similar in frequency and intensity to those expected from NRV, and modern stressors not significant.
D. Insufficient information to draw inferences about criterion.

<Select a habitat vulnerability rank and provide references or cite 'specialist expertise, <name>'where appropriate.>

Additional Forest specific information related to the SCC determination

<This section is provided for Forest botanists to add additional Forest specific information that is not captured in the section above, if necessary. Provide a narrative description here of the additional relevant information. State "No additional information" if this section is not used.>