Species: *Lewinskya holzingeri* (Renauld & Cardot) F. Lara, Garilleti & Goffinet, Holzinger's bristle moss

Photo Source: CalPhotos (2023). **Photo Credits:** Scot Loring

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 Holzinger's bristle moss.

Entity	Status	Status Definition
NatureServe CA[a]	G3G4 S2	G3: Vulnerable — At moderate risk of extinction or elimination due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. G4: Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declines or other factors. S2: Imperiled — Imperiled in the state 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. Range Rank — A numeric range rank (i.e., G3G4) is used to indicate the range of uncertainty about the exact status of this species.
California Rare Plant Rank[b]	1B.3	1B: Plants rare, threatened, or endangered in California and elsewhere. 0.3: Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known). Added to the CNPS *Inventory* on 03 June 2014; no subsequent change in status.
California State Listing[c]	Not listed	
USDA Forest Service[d]	Not listed	
USDI FWS[e]	Not listed	
USDI BLM[f]	Not listed	
NatureServe OR[g]	S1 HP List 3	S1: Critically imperiled in Oregon because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences. HP List 3: More information needed before status can be determined, but may be threatened or endangered in Oregon or throughout its range.

Oregon State Listing[h]	Not listed	
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.

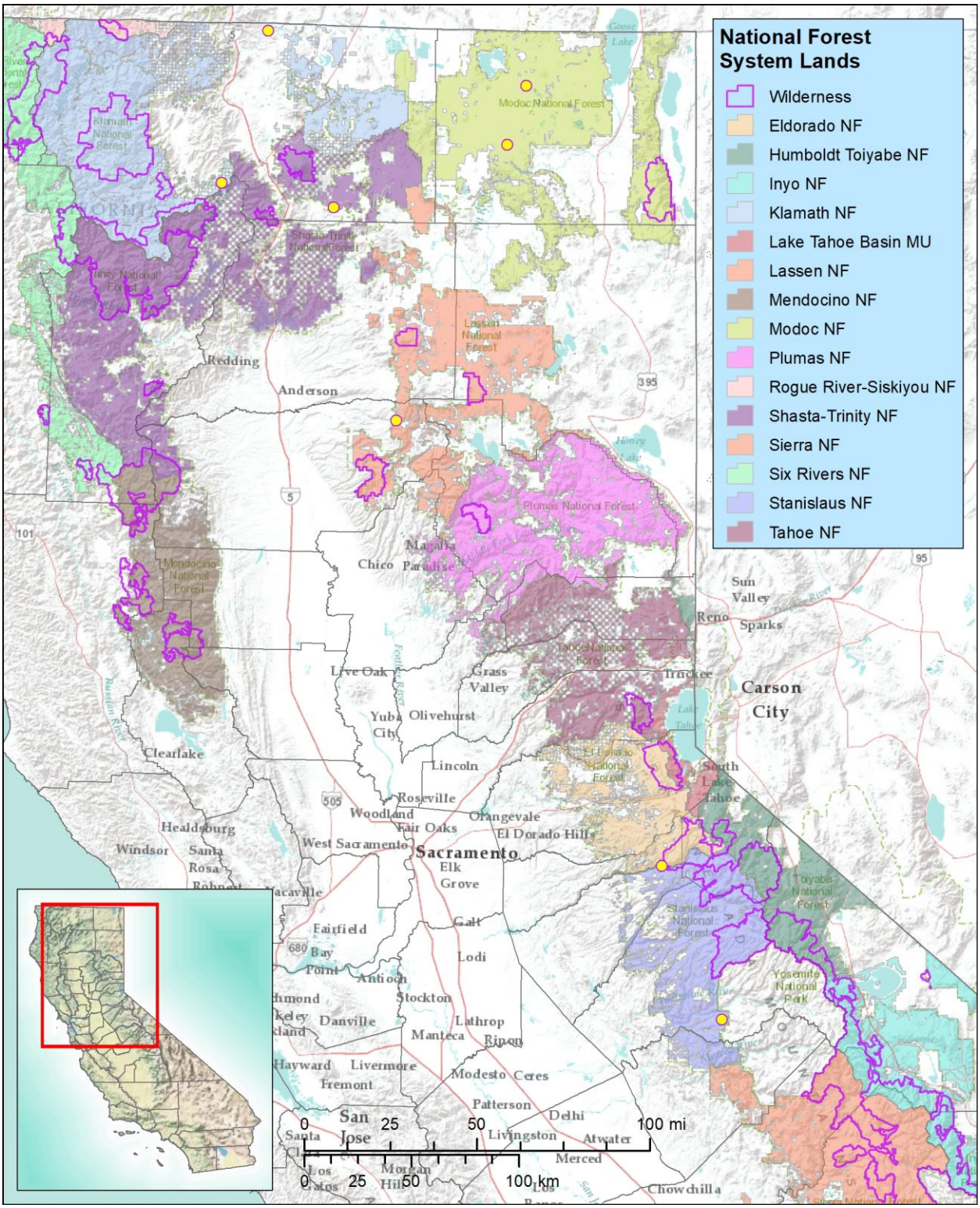
Distribution, abundance, and population trend on the planning unit[1]

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.

Table 2. Known occurrence frequency of Holzinger's bristle moss 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
Eldorado:	6	1	-	-	1	19-Jan-2002	1
Klamath:	4	1	-	1	-	17-Jun-2004	1
Lassen:	8	-	1	1	-	11-Sep-2020	1
Modoc:	2, 3	1	1	-	2	27-Sep-1992	2
Shasta-Trinity:	5	1	-	1	-	22-Mar-2007	1
Stanislaus:	7	1	-	-	1	18-May-2002	1
Totals:	N/A	5	2	3	4	N/A	7

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



Sources: *Distribution*: CBH (2023), CCH2 (2023), CNDDB (2023). *Baselayers*: 2013 National Geographic Society, i-cubed, Esri, Garmin, NOAA, NPS, USGS.

Holzinger's bristle moss was last updated in the CNDDB on 15 September 2014 (CNDDB 2023), and therefore all Calflora, CCH, and/or NRIS records prior to this date are assumed to have already been reviewed and entered into the CNDDB for this plant. Accordingly, only records from Calflora, CCH, and/or NRIS reported after this date have been reviewed for potential new or updated occurrence information and are included in Table 4 in Appendix 1 as applicable.

Holzinger's bristle moss is endemic to the drier, interior parts of the northwestern United States in Washington, Oregon, California, Idaho, and Wyoming (Exeter et al. 2016, CBH 2023, CPNWH 2023, NatureServe 2023). The species was first reported from California by Norris and Shevock (2004a) and is currently known from eight occurrences in widely scattered locations of the High Cascade Range (CaRH), Modoc Plateau (MP), eastern Klamath Ranges (KR), and northern and central High Sierra Nevada (nSNH, cSNH) bioregions of Siskiyou, Modoc, Tehama, Amador, and Tuolumne counties (CBH 2023, CCH2 2023, CNDDB 2023).

Seven (88%) of the Californian occurrences are on U.S. Forest Service land, including the Modoc NF (2 occurrences), Klamath NF (1), Shasta-Trinity NF (1), Lassen NF (1), Eldorado NF (1), and Stanislaus NF (1) (Table 2). No occurrences are in federally designated Wilderness Areas. The eighth occurrence is on private land near Iron Gate Reservoir in Siskiyou County. Four (50%) of the Californian occurrences are recent (observed within the past 20 years), and the other four are historical.

All records of this species in California are based on herbarium collections, and population data are completely lacking.

At the bottom of Table 4, there are three rows (highlighted in pink) representing CCH2 (2023) records not included in this distribution analysis; these records lack location data and cannot be georeferenced. Also highlighted in pink is one CNDDB (2023) record from Sequoia National Park (southern High Sierra Nevada of Tulare Co.), based on the collection *Shevock 15643* (UC). The CBH (2023) database indicates that this collection was later identified as a different species (*Lewinskya rupestris*) by Dale Vitt (a moss expert at Southern Illinois University and author of the relevant treatment for the *Flora of North America* [Vitt 2014]). The Sequoia NP record based on *Shevock 15643* should thus be evaluated for deletion from the CNDDB. Of the eight Californian records of Holzinger's bristle moss, six are currently included in the CNDDB (2023). The two non-CNDDB records (#s 3, 8) would seem to represent new occurrences, as they are located 18 to 64 miles from the nearest CNDDB occurrence. These two records should be evaluated for addition to the CNDDB.

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

Holzinger's bristle moss is an acrocarpous, costate moss in tufts 0.5–3 cm tall and with ovate-lanceolate leaves (Vitt 2014, Exeter et al. 2016). It belongs to the family Orthotrichaceae, which has undergone extensive taxonomic revision during the past two decades, leading to

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

rearrangement at the generic level. The Californian plants currently recognized as *Lewinskya holzingeri* were previously treated in the genus *Orthotrichum*, one of the largest genera of mosses but proven to be heterogeneous through molecular and morphological studies (Goffinet et al. 1998, 2004; Sawicki et al. 2009, 2017; Plášek & al. 2015, 2016; Lara et al. 2016; Draper et al. 2021, 2022). Other generic names for *Lewinskya* that appear in the recent taxonomic literature include *Dorcadion* and *Dorcadionella*, but the former is illegitimate (Lara et al. 2016), and the latter is a junior synonym having been published seven days later than *Lewinskya* (Tropicos 2023). In California, *Lewinskya* includes 10 species having a monoicous sexual condition and capsules with superficial stomata (including *L. affinis*, *L. bolanderi*, *L. holzingeri*, *L. laevigata*, *L. praemorsa*, *L. pylaisii*, *L. rupestris*, *L. speciosa*, *L. spjutii*, and *L. striata*) (Norris and Shevock 2004a, 2004b; Lara et al. 2016; Plášek & al. 2015, 2016). *Lewinskya holzingeri* is similar to *L. laevigata* and *L. rupestris* but differs by its smooth leaf cells, lack of an endostome, naked (vs. hairy) calyptra, bulging alar cells, and broader, more obtuse leaves (Vitt 1991, Exeter et al. 2016). It differs from *Orthotrichum rivulare*, a species of similar habitats, by having stomates superficial (vs. immersed) and capsules exserted, cylindric, and lightly ribbed (vs. emergent to immersed, oblong-obovate, and strongly 8-ribbed) (Vitt 1991, Exeter et al. 2016).

Holzinger's bristle moss generally inhabits seasonally wet rocks along streams in cismontane woodland, lower and upper montane coniferous forest, and pinyon and juniper woodland; the elevational range is from 2,300 to 6,100 feet (Vitt 1991, Exeter et al. 2016, CBH 2023, CCH2 2023, CNDDB 2023). Substrates are mapped as Cenozoic volcanics, Mesozoic granite, or Mesozoic mafic and ultramafic rocks (CDC 2015). At the Amador County occurrence (record #6), the species was atypically found growing on moist limbs of *Quercus chrysolepis*, but all other known occurrences in California are on rocks. Noted plant associates include trees *Abies*, *Alnus rhombifolia*, *Calocedrus*, *Fraxinus*, *Juniperus*, *Pinus*, *Pseudotsuga*, *Quercus garryana*, and *Tsuga mertensiana*; and shrubs *Arctostaphylos* and *Artemisia* (CBH 2023, CCH2 2023, CNDDB 2023).

The sexual condition of Holzinger's bristle moss is gonioautoicous (Vitt 2014), meaning that the archegonia and antheridia are borne on the same plant, and the antheridia are bud-like in the axil of an archegonial branch. Intragametophytic selfing increases the probability of reproductive success but also leads to homozygous sporophytes producing genetically identical spores (except for meiotic errors and post-zygotic mutations; Haig 2016).

Unlike vascular plants, mosses lack well-developed water-conducting tissues and must absorb most or all their water and nutrients through their leaves (Norris 2003). They also have a remarkable ability to tolerate desiccation, which may help to explain their persistence over the last 400 million years (Proctor 2000, Oliver et al. 2005, Liu et al. 2019).

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

Holzinger's bristle moss is a rare endemic of the drier, interior part of the western United States where it usually inhabits seasonally wet rocks along streams in montane coniferous forest. The species remains poorly known in California, and none of the six occurrences in the CNDDB (2023) has been assigned a site quality ranking. The overall distribution is very spotty with about 20 known occurrences (NatureServe 2023). It is considered rare in Oregon (Exeter et al. 2016) and critically imperiled (S1) in Idaho but is unranked (SNR) in Washington and Wyoming (NatureServe 2023).

Site-specific threats to this species are undocumented (CNDDB 2023). Any hydrologic changes (e.g., due to water diversion) would likely be detrimental, but the species may be able to tolerate extended periods of drought (e.g., associated with long-term climate change). Mosses in California are often found in small and highly localized populations, making them vulnerable to extirpation; in many cases, natural recolonization from such losses would be extremely unlikely since available spore or plant fragments are so far away (Shevock 2003).

Taxonomy[4]

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

Table 3. Name status of Holzinger's bristle moss.

Entity	Name Status
CNDDB and CNPS	*Lewinskya holzingeri* (Renauld & Cardot) F. Lara, Garilleti & Goffinet
Norris and Shevock (2004a, 2004b)	*Orthotrichum holzingeri* Renauld & Cardot in Holzinger
California Moss eFlora	*Orthotrichum holzingeri* Renauld & Cardot in Holzinger
Flora of North America	*Orthotrichum holzingeri* Renault [sic[& Cardot
USDA NRCS[a] PLANTS	*Orthotrichum holzingeri* Renauld & Cardot
[a] Natural Resources Conservation Service [NRCS 2023]	

Synonymy: *Orthotrichum holzingeri* Renauld & Cardot, *Dorcadionella holzingeri* (Renauld & Cardot) Plášek, Sawicki & Ochyra (Tropicos 2023)

California Moss eFlora link:
https://ucjeps.berkeley.edu/CA_moss_eflora/moss_eflora_display_sql.php?name=Orthotrichum%20holzingeri

Type locality: Idaho, Nez Perce County, Lewiston, *Sandberg 1155* (holotype not seen but presumably in US; isotypes in NY, P) (Renauld and Cardot in Holzinger 1895, JSTOR 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.

Key literature

Exeter, R. L., J. Harpel, and D. Wagner. 2016. *Rare Bryophytes of Oregon.* USDI Bureau of Land Management, Salem District, Salem, OR. ISBN-13: 978-0-9791310^-2. 378 p.

Lara, F., R. Garilleti, B. Goffinet, I. Draper, R. Medina, B. Vigalondo, and V. Mazimpaka. 2016. *Lewinskya*, a new genus to accommodate the phaneroporous and monoicous taxa of *Orthotrichum* (Bryophyta, Orthotrichaceae). *Cryptogamie, Bryologie* 37 (4): 361–382.

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Reviewer(s) and Date:

Adam J. Searcy, California Native Plant Society, Rare Plant Scientific Coordinator, 24 July 2023; Ellen A. Dean, California Native Plant Society, Rare Plant Botanist, 27 July 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 Holzinger's bristle moss within California (NRIS, CNDDB, Calflora/CCH databases).

Duplicate records from the same site are given the same record number and are included in red. Rows containing questionable records are highlighted in pink.

Rec. #	Locality	County	Quad	Ref. (Source)	Date Last Obs'd	Population Info	Threats	Land Mgr.	Elev. (ft.)
1	ALONG JENNY CREEK ABOVE PICNIC AREA WHERE CREEK ENTERS IRONGATE RESERVOIR.	Siskiyou	Iron Gate Reservoir (4112284)	CNDDB, May 2023 (EO 7)	20-Oct-2004	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2004 LENZ COLLECTION.		PVT	2337
2	ALONG FOREST SERVICE ROAD 46 AT BOLES CREEK SOUTHEAST OF CLEAR LAKE, MODOC NATIONAL FOREST.	Modoc	Pothole Valley (4112078)	CNDDB, May 2023 (EO 4)	27-Sep-1992	BASED ON TWO 1992 NORRIS COLLECTIONS.		USFS-MODOC NF	4800
2	On fairly moist, diffusely lit rocks at streamhead in old and large forest of Juniperus along Forest Service Rd. 46 at Boles Creek southeast of Clear Lake, Modoc National Forest.	Modoc	Pothole Valley (4112078)	CBH, May 2023 (UC1722813)	27-Sep-1992			Modoc NF	4592

Duplicate records from the same site are given the same record number and are included in red. Rows containing questionable records are highlighted in pink.									
Rec. #	**Locality**	**County**	**Quad**	**Ref. (Source)**	**Date Last Obs'd**	**Population Info**	**Threats**	**Land Mgr.**	**Elev. (ft.)**
3	On moist, diffusely lit rocks at headwaters of rivulet in flat and poorly drained area with Pinus ponderosa, Juniperus and Artemisia along Hwy. 139 at Biles Road about 13 miles northwest of Canby,	Modoc	Knobcone Butte (4112151)	CCH2, June 2023 (UC1649719)	22-Apr-1984			Modoc NF	5084 ft
4	ALONG TRAIL AROUND KANGAROO LAKE, KLAMATH NATIONAL FOREST.	Siskiyou	Scott Mountain (4112236)	CNDDB, May 2023 (EO 6)	17-Jun-2004	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2004 NORRIS COLLECTION.		USFS-KLAMATH NF	6100
4	On moist, diffusely lit granite boulder in forest of Pinus concolor, Abies grandis, Tsuga mertensiana, Pinus monticola and Abies concolor with open scrubland over granitic outcrops along trail around Kangaroo Lake, Klamath National Forest.	Siskiyou	Scott Mountain (4112236)	CBH, May 2023 (UC1627675)	17-Jun-2004			Klamath NF	5904

Duplicate records from the same site are given the same record number and are included in red. Rows containing questionable records are highlighted in pink.									
Rec. #	**Locality**	**County**	**Quad**	**Ref. (Source)**	**Date Last Obs'd**	**Population Info**	**Threats**	**Land Mgr.**	**Elev. (ft.)**
5	NEAR BASE OF MIDDLE FALLS OF THE MCCLOUD RIVER, APPROXIMATELY 6.6 AIR MILES EAST OF MCCLOUD, SHASTA-TRINITY NF.	Siskiyou	Lake McCloud (4112221)	CNDDB, May 2023 (EO 5)	22-Mar-2007	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2007 LENZ COLLECTION.		USFS-SHASTA-TRINITY NF	3345
6	NORTH SHORE OF SALT SPRINGS RESERVOIR, EL DORADO NATIONAL FOREST.	Amador | Calaveras	Calaveras Dome (3812042) | Bear River Reservoir (3812052)	CNDDB, May 2023 (EO 3)	19-Jan-2002	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2002 NORRIS COLLECTION.		USFS-ELDORADO NF	3940
6	On moist, diffusely lit limbs of Quercus in woodland of Quercus chrysolepis with Pinus ponderosa and Arctostaphylos north shore of Salt Spring Reservoir, Eldorado National Forest.	Amador	Calaveras Dome (3812042) | Bear River Reservoir (3812052)	CBH, May 2023 (UC1767902)	19-Jan-2002			Eldorado NF	3936
7	ALONG MIDDLE FORK OF THE TUOLUMNE RIVER AT MIDDLEFORK CAMPGROUND.	Tuolumne	Ackerson Mtn. (3711977)	CNDDB, May 2023 (EO 2)	18-May-2002	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 2002 NORRIS COLLECTION.		USFS-STANISLAUS NF	4400

Duplicate records from the same site are given the same record number and are included in red. Rows containing questionable records are highlighted in pink.									
Rec. #	**Locality**	**County**	**Quad**	**Ref. (Source)**	**Date Last Obs'd**	**Population Info**	**Threats**	**Land Mgr.**	**Elev. (ft.)**
7	On frequently submerged, sunny boulder in stream in forest of Pinus ponderosa, Calocedrus and Pseudotsuga along Middle Fork of the Tuolumne River at Middle Fork Campground.	Tuolumne	Ackerson Mtn. (3711977)	CBH, May 2023 (UC1774463)	18-May-2002			Stanislaus NF	3280
8	Along [South Fork] Battle Creek north of Cold Creek Butte in middle of creek on top of large boulder.	Tehama	Lyonsville (4012136)	CBH, May 2023 (CAS 686181)	11-Sep-2020			Lassen NF	4623 ft
	MARBLE FORK KAWEAH RIVER AT JUNCTION WITH LITTLE DEER CREEK, ALONG CRYSTAL CAVE ROAD 1.7 MILES FROM GENERALS HIGHWAY.	Tulare	Giant Forest (3611857)	CNDDB, May 2023 (EO 1)	29-May-1997	ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS A 1997 SHEVOCK COLLECTION.		NPS-SEQUOIA /KINGS CYN NP	5200
				CCH2, June 2023 (UC1708911)					

Duplicate records from the same site are given the same record number and are included in red. Rows containing questionable records are highlighted in pink.									
Rec. #	**Locality**	**County**	**Quad**	**Ref. (Source)**	**Date Last Obs'd**	**Population Info**	**Threats**	**Land Mgr.**	**Elev. (ft.)**
				CCH2, June 2023 (UC1766503)					
				CCH2, June 2023 (UC1771612)					

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.>