Plant Species Evaluation Form

Eriophorum gracile W.D.J. Koch

SLENDER COTTONGRASS

Family: Cyperaceae (CNPS 2018) | **PLANTS Symbol:** ERGR8 (USDA 2018) | **Calif. Endemic:** No (CNPS 2018)

Synonyms/Other Names: *Eriophorum gracile* was published by Roth in an addendum to his *Catalecta Botanica*, citing collections and description by W.D.J. Koch (Koch 1798). Thus some sources (Tropicos 2018; Ball and Wujek 2002) consider the correct name to be *E. gracile* W.D.J. Koch ex Roth. The following synonyms have been applied to the Asian occurrences of this pan-boreal entity: *Eriophorum asiaticum* V.N. Vassil., *E. coreanum* Palla, *E. gracile* subsp. *asiaticum* Tolm., *E. gracile* subsp. *coreanum* Hultén, *E. gracile* var. *coreanum* Ohwi, *Scirpus ardea* T. Koyama, and *S. ardea* var. *coreanus* (Palla) T. Koyama (Tropicos 2018). Synonyms published for European and North American entities are: *E. gracile* var. *caurianum* Fernald, *E. gracile* var. *gracile*; *E. hoefftii* F. Nyl., *E. gracile* subsp. *hoefftii* (F. Nyl.) Nyman, and *E. gracile* var. *paucinervium* Engelm (The Plant List 2013). In addition, the name *Eriophorum gracile* Sm., published in 1812, is considered illegitimate (Tropicos 2018; The Plant List 2013).

Identification Issues: The inflorescences of *E. gracile*, at maturity, have a terminal tuft of long, snow-white hairs (persistent, modified perianth parts) that set this species apart from other wetland monocots in California. This tuft results from 10-25, smooth white bristles, 10-20 mm in length, arising from the base of each achene (Ball 2014). *Eriophorum gracile* is currently the only species of *Eriophorum* in California as the species formerly known as *Eriophorum criniger*, which was split into two species, *Calliscirpus criniger* (inhabiting wetlands in the Siskiyou and North Coast Mountains), and *C. brachythrix* (inhabiting wetlands in the Sierra Nevada) (Gilmour et al. 2013). These two *Calliscirpus* species also sport a distinctive tufted inflorescence, but it differs in being off-white and shorter, as it is composed of 6 or fewer, barbed bristles, 4-10 mm in length, arising from the base of each achene (Gilmour et al. 2013; Ball 2014).

Eleven species of *Eriophorum* occur across the boreal wetlands of North America (Ball and Wujek 2002), and the ranges of some dip well into the Pacific Northwest and the Rocky Mountain states, with a few, widely scattered occurrences in Utah, Colorado and New Mexico (CPNWH 2018; USDA 2018). Two species approach the California border, *E. angustifolium* in the Cascade Ranges in central Oregon, and *E. chamissonis* along the Oregon coast south to Coos County (Jaster et al. 2017). Although only *E. gracile* is documented to occur in California, occurrences of *Eriophorum* in California should be assessed for the presence of North American species other than *E. gracile*, as these species have often been confused where their ranges overlap (Decker et al. 2006).

Taxonomy:

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Species In Genus: Approximately 25 species. Etymology: Eriophorum: from Greek, meaning wool-bearing; gracile from Latin, meaning slender.

Genus Description – Habit: Perennial herb, erect. Stem: cylindric, solid. Leaf: basal and cauline; ligule present; blade +- scabrous on keel or angles. Inflorescence: 1, terminal, +/- umbel-like [head-like or spikelet 1]; inflorescence bracts 1 to several, leaf- or scale-like; spikelets several [1]; flower bracts spiraled, > 10, ovate, membranous, glabrous, tip entire. Flower: bisexual;

perianth bristles 10--25, >> fruit, generally > flower bracts, >> flower bracts in fruit, +- straight, barbs 0; stamens 3; style 3-branched. Fruit: 3-sided, +- flat.

Species Description – Habit: Plant 30--60 cm; rhizomes long. Stem: smooth. Leaf: 2--30 cm, 1--2 mm wide, blade distally 3-sided, smooth. Inflorescence: spikelets (1)2--5, 7--11 mm; flower bracts 3--4 mm. Flower: perianth bristles 10--20 mm, +- straight, +- white, barbs 0. Chromosomes: 2n=30, 38. Jepson eFlora Author: Peter W. Ball.

Status:

Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

State Listing	G-rank	S-rank	CRPR	R5 FSS	NFP SM	CA BLM
CA: Not listed NV: Not listed OR: Not listed	G5	CA: S4 NV: Not listed OR: Not listed	4.3	Not listed	Not listed	Not listed

SWAP:	NNHP:	NNPS:	ORBIC:	OCS:	IUCN:
Not listed	Not listed	Not listed	Not listed	Not listed	Not listed

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2018b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2018a; NatureServe 2018); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2018a; NatureServe 2018; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2018); R5 FSS=USDA Forest Service Region 5 Regional Forester Sensitive Plant Species List (USDA 2013); NFP SM=Forest Service and Bureau of Land Management Northwest Forest Plan Survey and Manage Species (USDA 2001); CA BLM=California Bureau of Land Management Designated Sensitive Species (BLM 2010); SWAP=California State Wildlife Action Plan Status (CDFW 2015); NNHP=Nevada Natural Heritage Program Status (NNHP 2017); NNPS=Nevada Native Plant Society Status (NNHP 2017); ORBIC=Oregon Biological Information Center Status (ORBIC 2016); OCS=Oregon Conservation Strategy Species (ODFW 2016); IUCN=International Union for Conservation of Nature Red List Status (IUCN 2017).

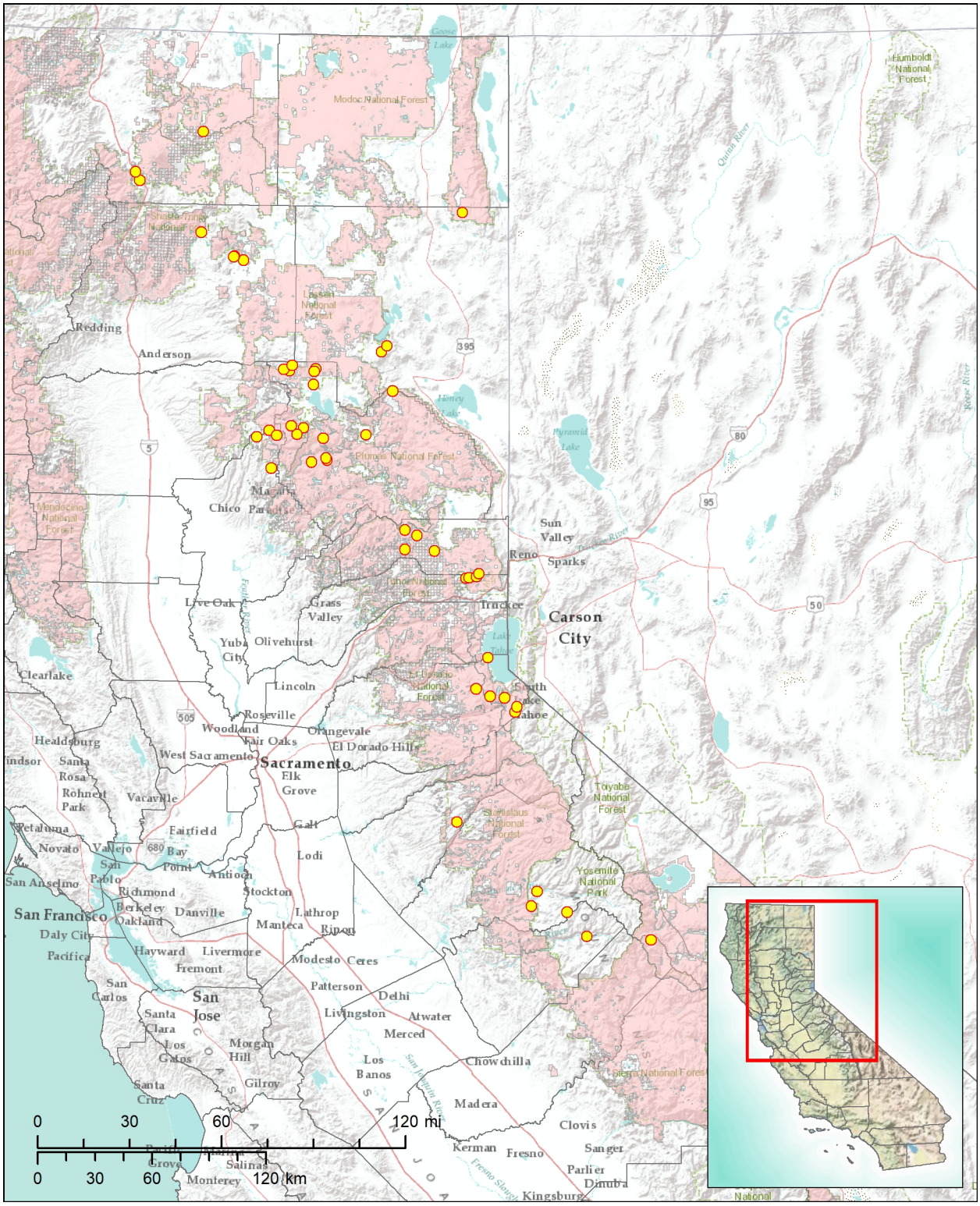
Eriophorum gracile was added to the CNPS Inventory in 2006 at California Rare Plant Rank 4.3, due to limited distribution in California (Lazar and Bittman 2006). Its rank remains as 4.3 at the time of this writing (CNPS 2018).

Distribution: *Eriophorum gracile* is circumboreal, occurring throughout much of the northern hemisphere, from Europe east through Siberia and Kazakhstan to the Amur and Primorskye regions of far eastern Russia, Kamchatka, Sakhalin, China, and Korea. In Europe, it occurs mainly in the north in Scandinavia, Ireland, and the U.K., south to Croatia and east to the Ukraine, reaching its southern limit along a line extending from the Pyrenees, through northern Italy to southern Bulgaria (Lansdown 2011).

In North America, *E. gracile* occurs in all provinces of Canada and in the northern half of the United States, north of approximately 40° latitude. In the U.S., it tends to occur in widely scattered, small populations (NatureServe 2018).

In California, *Eriophorum gracile* is found in the Warner Mountains, the Klamath Ranges, the Cascade Ranges, southwards to the montane northern and central Sierra Nevada (Ball 2014). Early records report a site in San Francisco, but this population is believed to be extirpated (Wood 2014).

This species has been stable taxonomically for a long time, and is easy to spot at maturity in summer, so its widely scattered distribution is largely a result of its requirement for habitat that is rare in California.



Sources: *Distribution*: Calflora 2017, CCH 2017, CNDDB 2018. *Layers*: USDA Forest Service, Pacific Southwest National Forests: CPAD 2016. California counties: CDF 2009. *Basemaps*: California inset map: © 2013 National Geographic Society, i-cubed (Esri 2017a). Main map: Esri, DeLorme, USGS, NPS (Esri 2012) and Esri, USGS, NOAA (Esri 2017b).

Locations within California:

Record numbers indicate sites that contain an individual, population, or groups of populations located within ¼ mile of each other, per the California Natural Diversity Database (CNDDB 2017) definition of Element Occurrences (EOs) in California. Official EO numbers for plants in California are determined solely by the CNDDB and are included within the Reference (Source) column for CNDDB data. Duplicate records from the same site are given the same record number and included in red. The Population Info column includes total number of individuals and total number and size of populations/sub-populations when provided. Elevations provided in meters from source have been converted to feet. If not provided in original source, Land Manager information was obtained using the California Protected Areas Database (CPAD 2016) and Quad information was obtained using 24K Quads, SDE Feature Class (CDFG 2013). All other information is directly from the Reference (Source) unless additional citation is given.

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	unmamed lake 0.3 air miles west of Mather; Stanislaus National Forest	Tuolumne	Courtright Reservoir (3711818)	CCH, Jan 2017 (YM-YOSE231649)	14-Jul-2008			Stanislaus NF	
2	Common in meadow at edge of stream below, Ruby Lake. (IPB 10/07)	Madera	Mt. Ritter (3711962)	CCH, Jan 2017 (SD134180)	10-Jul-1977			Inyo NF	9515
3	West end of Lost Lake.	Mariposa	Half Dome (3711965)	CCH, Jan 2017 (YM-YOSE118598)	12-Sep-2006			Yosemite NP	6145
3	West end of Lost Lake.	Mariposa	Half Dome (3711965)	CCH, Jan 2017 (UC1949620)	12-Sep-2006			Yosemite NP	6145
3	West end of Lost Lake.	Mariposa	Half Dome (3711965)	CCH, Jan 2017 (YM-YOSE118666)	12-Sep-2006			Yosemite NP	6145
4	c. 0.5 mi E of Siesta Lake by new Tioga Rd at head of branch of S Fork Tuolumne River	Tuolumne	Tamarack Flat (3711976)	CCH, Jan 2017 (SJSU12757)	2-Sep-1946			Yosemite NP	8200
5	South island of Swamp Lake	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (YM-YOSE118047)	13-Jul-2004			Yosemite NP	5018
5	South island of Swamp Lake	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (UC1862083)	13-Jul-2004			Yosemite NP	5018

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
5	South island in Swamp Lake, west of Hetch Hetchy	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (GH424386)	10-Jul-1938			Yosemite NP	
5	e. Hetch Hetchy dam (Swamp Lakes, just s. of Miguel Meadows); Yosemite Nat'l Park, Swamp Lakes	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (UC1100694)	22-Jul-1937			Yosemite NP	
5	w. Hetch Hetchy dam (south island in Swamp Lake); Yosemite Nat'l Park, Swamp Lake	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (UC632750)	10-Jul-1938			Yosemite NP	5200
5	SWAMP LAKE RESEARCH RESERVE. SOUTH ISLAND. SWAMP LAKE	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (YM-YOSE65577)	10-Jul-1938			Yosemite NP	
5	SOUTH ISLAND OF SWAMP LAKE	Tuolumne	Lake Eleanor (3711987)	CCH, Jan 2017 (YM-YOSE118048)	13-Jul-2004			Yosemite NP	5018
5	SWAMP LAKE, floating peat islands	Tuolumne	Lake Eleanor (3711987)	CNDDB unprocessed observation COL04F0012	13-Jul-2004	88 flowering stalks	None	Yosemite NP	5018
6	Big Trees	Calaveras	Dorrington (3812033)	CCH, Jan 2017 (GH424383)	1-Jan-1865			Calaveras Big Trees SP	
7	Grass Lake Research Natural Area Eldorado National Forest	El Dorado	Freel Peak (3811978)	Calflora, May 2017 (ce394)	1-Jan-1991	1+ individuals		Lake Tahoe Basin Management Unit	7707

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
7	Grass Lake, Luthur Pass, south border of the main meadow	El Dorado	Freel Peak (3811978)	Calflora, May 2017 (gr1971)	1-Jul-1974	1+ individuals		Lake Tahoe Basin Management Unit	7710
7	Luther Pass, edge of Grass Lake.	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (CAS351297)	26-Jul-1936			Lake Tahoe Basin Management Unit	7000
7	Luther Pass road, near Grass Lake.	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (CAS857962)	13-Aug-1967			Lake Tahoe Basin Management Unit	7700
7	Sierra Nevada sphagnum bog; ; Freel Peak 7.5'Q	Alpine	Freel Peak (3811978)	CCH, Jan 2017 (CLARK-A1045-1172)	3-Sep-1977			Lake Tahoe Basin Management Unit	7700
7	Grass Lake near Luther Pass; Grass lake	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (JEPS19989)	23-Aug-1918			Lake Tahoe Basin Management Unit	7800
7	foot of Luther Pass (Grass Lake); Grass Lake	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (JEPS73219)	15-Jul-1971			Lake Tahoe Basin Management Unit	7200
7	Grass Lake at Luthers Pass.	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (RSA286239)	31-Jul-1974			Lake Tahoe Basin Management Unit	7753
7	Sierra Nevada Mtns. Grass Lake, west of Luther Pass	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (UCR15423)	1-Sep-1977			Lake Tahoe Basin Management Unit	7653

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
7	1.7 mi. n.w. Luther Pass (on Hwy. 89, Grass Lake); Grass Lake	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (JEPS78080)	25-Jul-1972			Lake Tahoe Basin Management Unit	7500
7	Floating bog mat near open water of Grass Lake, S of Hwy 89, ca. 1/2 mi W of Luther pass	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (CAS577405)	7-Sep-1969			Lake Tahoe Basin Management Unit	7600
7	1.7 mi. n.w. Luther Pass (on Hwy. 89, Grass Lake); Grass Lake	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (JEPS78081)	25-Jul-1972			Lake Tahoe Basin Management Unit	7500
7	Grass Lake, S of Hwy. 89, about 0.5 mile W of Luther Pass	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (RSA252374)	7-Sep-1969			Lake Tahoe Basin Management Unit	7602
7	Grass Lake: Just N of Luther Pass.	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (RSA364204)	23-Aug-1975			Lake Tahoe Basin Management Unit	7703
8	El Dorado County: Smaller fen above and south of Hell Hole Fen, Lake Tahoe Basin Management Unit. Collected in vegetation plot #0519_SO_705_124_8_F1 of the CNPS/Forest Service fen vegetation project	El Dorado	Freel Peak (3811978)	CCH, Jan 2017 (UCD118788)	22-Sep-2010			Lake Tahoe Basin Management Unit	8350

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
9	El Dorado County. SW corner of Tahoe Basin. Washoe Meadows State Park. Southernmost reach of large fen system near old quarry area. Opening in pine-fir forest	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD148457)	27-May-2014			Washoe Meadows SP	6321
9	El Dorado County. SW corner of Tahoe Basin. Washoe Meadows State Park. Fen system of park. Present from northern edge to southern edge of system. Seen also summer of 2007	El Dorado	Echo Lake (3812071)	CNDDB unprocessed observation DEA14F0002	27-May-2014	175 individuals	Park will be building golf course nearby	Washoe Meadows SP	6321
9	Washoe Meadows SP	El Dorado	Echo Lake (3812071)	Calflora, May 2017 (casp138)	1-Jan-1989	1+ individuals		Washoe Meadows SP	6319
9	Washoe Meadows SP	El Dorado	Echo Lake (3812071)	Calflora, May 2017 (casp138)	1-Jan-1989	1+ individuals		Washoe Meadows SP	6319
9	El Dorado County: Southwestern corner of the Tahoe Basin. Washoe Meadows State Park. Near Grizzly Mountain Road in Meyers. Along trail with sewer manholes that travels from Grizzly Mountain Road to dry meadow	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD148153)	26-May-2014			Washoe Meadows SP	6351

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
9	El Dorado County. SW corner of Tahoe Basin. Washoe Meadows State Park. Southernmost reach of large fen system near old quarry area. Opening in pine-fir forest	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD148457)	27-May-2014			Washoe Meadows SP	6321
9	El Dorado County. SW corner of Tahoe Basin. Washoe Meadows State Park. Second fen opening to the north of southernmost fen (extension of main fen). Opening in pine-fir forest	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD148459)	27-May-2014			Washoe Meadows SP	6343
9	El Dorado County: Washoe Meadows State Park. North of Upper Truckee River and Lake Valley State Recreation Area. Fen located west and upslope of old quarry area	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD55432)	19-Jul-2006			Washoe Meadows SP	6343
9	El Dorado County: Washoe Meadows State Park. Northern edge of fen system, S side of trail	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (UCD72952)	25-Aug-2007			Washoe Meadows SP	6369

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
10	Grass Lake	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (JEPS73218)	16-Jul-1970			Lake Tahoe Basin Management Unit	7200
10	Edge of Grass Lake.	El Dorado	Echo Lake (3812071)	CCH, Jan 2017 (RSA100755)	26-Jul-1936			Lake Tahoe Basin Management Unit	
11	1/2 mi W of Crystal Basin Ranger Station	El Dorado	Rockbound Valley (3812082)	CCH, Jan 2017 (CAS653861)	26-Jun-1977			Eldorado NF	4900
12	El Dorado County. Tahoe Basin. Sugar Pine Point State Park. In fen just south and down slope of General Creek group-camp campground area	El Dorado	Meeks Bay (3912011)	CCH, Jan 2017 (UCD148465)	27-May-2014			Ed Z'Berg Sugar Pine Point SP	6317
12	El Dorado County: Lake Tahoe Basin. Sugar Pine Point State Park. On W side of Hwy. 89, just south of General Creek Campground. In open fen near southern edge	El Dorado	Meeks Bay (3912011)	CCH, Jan 2017 (UCD125140)	26-Jul-2012			Ed Z'Berg Sugar Pine Point SP	6325

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12	El Dorado County: Lake Tahoe Basin. Sugar Pine Point State Park. On W side of Hwy. 89, just south of General Creek Campground campsite #94. In western and southern part of fen. Fen visited in 2012, 2014 and 2015	El Dorado	Meeks Bay (3912011)	CNDDB unprocessed observation DEA14F0003	27-May-2014	100's of fruiting stalks	This fen is drying out. Site adjacent to campsites.	State Parks	6317
13	1 mi. w. U.C. Trout Lab. (12 mi. n. of Truckee, Sage Hen Creek); Sierra Nevada, Sage Hen Creek	Nevada	Independence Lake (3912043)	CCH, Jan 2017 (UC1106326)	13-Jul-1958			Tahoe NF	6500
14	Sagehen Creek Field Station. Mason's Bog	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (SCFS403)	7-Aug-1968			Tahoe NF	6500
14	Sagehen Creek, near University of Calif. Station	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (CAS835455)	29-Aug-1966			Tahoe NF	6300
14	Upper bog, Sage Hen Creek, Univ of CA Trout Laboratory.	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (CAS857961)	15-Jul-1957			Tahoe NF	6500
14	Sagehen Creek Field Station. Hanging bog on S side of SH Ck, ca. 300 yds SW of fish obsv bldg	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (SCFS404)	22-Jul-1967			Tahoe NF	6300
14	Sagehen Creek Field Station. Mason's Bog	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (SCFS405)	7-Aug-1968			Tahoe NF	6500

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
14	0.25 W of main bldg of Univ of California Sagehen Creek Field Station on Sagehen Creek 12 mi N of Truckee	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (SJSU8140)	8-Jul-1965			Tahoe NF	6500
14	U.C. Trout Lab., Sage Hen Creek, upper bog Sage Hen Creek, U.C. Trout Lab.	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (UC1187145)	15-Jul-1957			Tahoe NF	6500
14	meadow opposite U.C. Trout Lab. (Sage Hen Creek); Sierra Nevada, Sage Hen Creek	Nevada	Hobart Mills (3912042)	CCH, Jan 2017 (UC965495)	16-Aug-1952			Tahoe NF	6500
15	Sagehen Creek Trail Tahoe National Forest	Nevada	Hobart Mills (3912042)	Calflora, May 2017 (ce241)	1-Jan-1990	1+ individuals		Tahoe NF	6076
16	Sagehen Creek UC Reserves	Sierra	Hobart Mills (3912042)	Calflora, May 2017 (gr8338)	1-Jan-1973	1+ individuals		Tahoe NF	5978
16	Sagehen Creek UC Reserves	Sierra	Hobart Mills (3912042)	Calflora, May 2017 (gr8338)	1-Jan-1973	1+ individuals		Tahoe NF	5978
16	Sagehen Creek UC Reserves	Sierra	Hobart Mills (3912042)	Calflora, May 2017 (gr8338)	1-Jan-1973	1+ individuals		Tahoe NF	5978
17	MAIDEN VALLEY; ca. 5 air miles SW of Sierraville	Sierra	Sattley (3912054)	Calflora, May 2017 (xr168517)	24-Aug-2006	1+ individuals			7507
17	MAIDEN VALLEY; watershed Middle Fork Feather River (ca. 5 air miles SW of Sierraville)	Sierra	Sattley (3912054)	CCH, Jan 2017 (JEPS109901)	24-Aug-2006				7150

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
18	Sierra Co. & c.	Sierra	Sierra City (3912056)	CCH, Jan 2017 (GH424384)	1-Jan-1875				
19	2 mi. e. Bassett Station (Pioneer Rd. Station); N. Fork Yuba R., Pioneer Rd. Station	Sierra	Clio (3912065)	CCH, Jan 2017 (JEPS19988)	2-Aug-1909			Tahoe NF	5600
20	Lush Meadows	Sierra	Gold Lake (3912066)	CCH, Jan 2017 (CAS103998)	31-Jul-1918				
21	Keyser Creek; boggy fen with patterened ground	Butte	Kimshew Point (3912184)	Calflora, May 2017 (xr168595)	17-Aug-2006	1+ individuals			5026
21	Keyser Creek; West Branch Feather River watershed; boggy fen with patterned ground	Butte	Kimshew Point (3912184)	CCH, Jan 2017 (JEPS109906)	17-Aug-2006				5000
22	Northern High Sierra Nevada. North edge of the fen above the middle of the Grassy Lakes, about 0.8 km northeast of Three Lakes	Plumas	Bucks Lake (3912182)	CCH, Jan 2017 (CHSC92143)	11-Sep-2005			Plumas NF	6220
23	1.1 km NE of Maple Flat (at head of an upper northern branch of Spanish Creek); Northern High Sierra Nevada	Plumas	Meadow Valley (3912181)	CCH, Jan 2017 (UC1748292)	7-Jul-2000			Plumas NF	5279

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24	Northern High Sierra Nevada. Seepy springy mossy drainage bottom at head of an upper northern branch of Spanish Creek, about 1.1 km northeast of Maple Flat	Plumas	Meadow Valley (3912181)	CCH, Jan 2017 (CHSC78747)	7-Jul-2000			Plumas NF	5279
25	Indian Valley, Big Meadows	Plumas	Crescent Mills (4012018)	CCH, Jan 2017 (UC334116)	31-Aug-1874				
26	Chico Meadows. Northern Sierra Nevada, n. of Forest Ranch, 5 miles w. of Hwy 32 off Humboldt Road to Butte Meadows and ca. 3 miles n. to Chico Meadow (Camp Lassen, BSC) on Scout Road. Plant growing in wet portion of Chico Meadow above pond	Butte	Butte Meadows (4012115)	CCH, Jan 2017 (CHSC95179)	5-Jun-2005				4200
26	Northern Sierra Nevada. Chico Meadows, 1 mile north of Butte Meadows on rd 26N09 in the Boy Scout Camp, Camp Lassen. In mdw just north of the lake	Butte	Butte Meadows (4012115)	CCH, Jan 2017 (CHSC84884)	29-Jun-2003				4200

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26	Chico Meadows, ca. 1 mi n of Butte Meadows. Marshy seep near the edge of the "swimming hole" at the Boy Scout Camp	Butte	Butte Meadows (4012115)	CCH, Jan 2017 (CHSC42688)	1-Sep-1987				4200
27	In a bog, in the west edge of a large meadow and bog, about 20 yards east of the poor dirt road, about 100 yards south of the cabin, about 3/4 mile (air) northwest of Jonesville, about 5 miles (air) northeast of Butte Meadows	Butte	Jonesville (4012114)	CCH, Jan 2017 (CHSC94347)	16-Jul-2006			Lassen NF	5148
27	In a bog, in the west edge of a large meadow and bog, about 20 yards east of the poor dirt road, about 100 yards south of the cabin, about 3/4 mile (air) northwest of Jonesville, about 5 miles (air) northeast of Butte Meadows	Butte	Jonesville (4012114)	CCH, Jan 2017 (JEPS110205)	16-Jul-2006			Lassen NF	5148
27	Large marshy meadow on the W side of Willow Creek near the Tehama County boundary, ca. 1 mi NW of Jonesville	Butte	Jonesville (4012114)	CCH, Jan 2017 (CHSC63429)	22-Jun-1994			Lassen NF	5050

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
28	Big Springs on the west side of Humbug Valley, ca. 7 miles (air) east-northeast of Humbug Summit, ca. 12 miles (air) south of Chester. Within the fenced enclosure at the springs	Plumas	Humbug Valley (4012123)	CCH, Jan 2017 (CHSC54499)	30-Jul-1991				4300
28	ca. 6 mi. (air) e.-n.e. Humbug Summit (ca. 12 mi. (air) s. of Chester, Big Springs, w. side of Humbug Valley, bog within fenced enclosure at springs); Humbug Valley, Big Springs	Plumas	Almanor (4012122)	CCH, Jan 2017 (UC1586458)	30-Jul-1991				4300
28	Big Springs, Humbug Valley	Plumas	Humbug Valley (4012123)	CNDDB unprocessed observation BOV13F0017	8/7/2013	None	Site heavily grazed; hoof punches, channelization	Lassen NF	4400
29	Lake Almanor, mouth of Mud Creek debouchment into the upper arm of the lake	Plumas	Chester (4012132)	Calflora, May 2017 (gr9082)	15-Aug-2004	1+ individuals			4518
29	Lake Almanor, mouth of Mud Creek at its debouchment into the upper arm of the lake	Plumas	Chester (4012132)	CCH, Jan 2017 (JEPS109895)	15-Aug-2004				4520

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
29	Last Chance Marsh at the N end of Lake Almanor, just S of Last Chance Campground on Forest Rd. 28N11. High Cascade Range	Plumas	Chester (4012132)	CCH, Jan 2017 (CHSC66648)	15-Jul-1996				4500
29	at n. end of Lake Almanor (Last Chance Marsh, just s. of Last Chance Campground on Forest Rd. 28N11); High Cascade Range, Last Chance Marsh	Plumas	Chester (4012132)	CCH, Jan 2017 (JEPS88532)	15-Jul-1996				4500
30	Willow L, 9 mi NW of Chester -- Lassen NF	Plumas	Mt. Harkness (4012143)	Calflora, May 2017 (wb1194-1404)	8-Jul-2010	1+ individuals		Lassen NF	5427
30	Willow Lk	Plumas	Mt. Harkness (4012143)	Calflora, May 2017 (jgr926)	25-Jul-2004	1+ individuals		Lassen NF	5427
30	Willow Lake located se of Drakesbad just s of the boundary of Lassen Volcanic National Park	Plumas	Mt. Harkness (4012143)	CCH, Jan 2017 (CHSC44259)	19-Jul-1988			Lassen NF	5500
31	Lassen Volcanic National Park. Little Willow Lake located on the south border of the park, ca. 2.5 miles (air) south-southeast of Drakesbad	Plumas	Reading Peak (4012144)	CCH, Jan 2017 (CHSC54425)	17-Jul-1991			Lassen Volcanic NP	6000
31	Lassen National Park, Little Willow Lake,	Plumas	Reading Peak (4012144)	Calflora, May 2017 (gr9083)	10-Aug-1990	1+ individuals		Lassen Volcanic NP	6030

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
31	Lassen National Park, Little Willow Lake,	Plumas	Reading Peak (4012144)	Calflora, May 2017 (gr9083)	10-Aug-1990	1+ individuals		Lassen Volcanic NP	6030
32	Lassen Volcanic National Park. Corner of park on S side of Warner Valley Rd. between Lee and Kelly camps	Plumas	Mt. Harkness (4012143)	CCH, Jan 2017 (CHSC58181)	18-Jun-1992			Lassen Volcanic NP	5240
33	Susanville, 4 miles below Eagle Lake.	Lassen	Roop Mountain (4012047)	CCH, Jan 2017 (POM111648)	30-Jun-1897				5000
34	Papoose Meadows located ca. 0.5 mi E of Eagle Lake Rd. (A1) and 2.5 mi S of Eagle Lake. Modoc Plateau	Lassen	Pikes Point (4012057)	CCH, Jan 2017 (CHSC66273)	24-Jun-1996			Lassen NF	5360
34	Papoose Meadows, 0.5 mi. E of Eagle Lake Rd. (A1) and 2.5 mi. S of Eagle Lake, Modoc Plateau	Lassen	Pikes Point (4012057)	CCH, Jan 2017 (HSC97608)	24-Jun-1996			Lassen NF	5361
34	2.5 mi. s. Eagle Lake (ca. 0.5 mi. e. of Eagle Lake Rd. (A1), e. side Papoose Meadows, Modoc Plateau); Modoc Plateau, Papoose Meadows	Lassen	Pikes Point (4012057)	CCH, Jan 2017 (JEPS96132)	24-Jun-1996			Lassen NF	5360
35	Goose Valley	Shasta	Burney (4012186)	CCH, Jan 2017 (UC839658)	11-Jul-1912				
36	Goose Valley	Shasta	Burney (4012186)	CCH, Jan 2017 (CAS103999)	11-Jul-1912				

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
36	Goose Valley	Shasta	Burney (4012186)	CCH, Jan 2017 (GH424385)	11-Jul-1912				
37	Kosk Creek, unnamed pond in unnamed tributary (vicinity of Lofton placename on USGS map)	Shasta	Big Bend (4112118)	CCH, Jan 2017 (JEPS109803)	18-May-2007				1980
38	Modoc National Forest, Blue Lake Ranch	Lassen	Jess Valley (4112023)	CCH, Jan 2017 (HSC95298)	29-Jun-1997			Modoc NF	6463
38	Blue Lake Ranch; Modoc National Forest.	Lassen	Jess Valley (4112023)	CCH, Jan 2017 (CDA38977)	29-Jun-1997			Modoc NF	6463
38	Modoc National Forest. Blue Lake Ranch	Lassen	Jess Valley (4112023)	CCH, Jan 2017 (CHSC96443)	28-Jun-1997			Modoc NF	6463
38	Modoc National Forest, Blue Lake Ranch	Lassen	Jess Valley (4112023)	CCH, Jan 2017 (HSC95194)	28-Jun-1997			Modoc NF	6463
38	Blue Lake, Modoc Natl. Forest	Modoc	Jess Valley (4112023)	CCH, Jan 2017 (HSC45971)	9-Aug-1973			Modoc NF	6001
39	18th. crossing of Sacramento R. below Sisson	Siskiyou	City Of Mount Shasta (4112233)	CCH, Jan 2017 (UC535932)	28-May-1895				
40	near Sisson	Siskiyou	City Of Mount Shasta (4112233)	CCH, Jan 2017 (JEPS19990)	31-Aug-1894				

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
41	Kosk Creek, unnamed pond in Baker Creek watershed; Pit River watershed (vicinity of Lofton placename on USGS map)	Shasta	Tennant (4112158)	CCH, Jan 2017 (CHSC98387)	17-May-2007			Klamath NF	1980
42	About 0.9 mile NW of Butte Creek House, can be reached from Butte Creek foot trail, by walking south from the end of Road 26N27B or by crossing Butte Creek from Road 27N11U.	Butte	Jonesville (4012114)	CNDDB (2018) unprocessed observation JUM17F0004	10-Oct-2017	200 genets	None noted	Lassen NF	5300
43	Grace Fen, approximately 1 mile N of Peacock Point. Immediately west of Road 26N64, on tributary of Grizzly Creek.	Plumas	Belden	CNDDB (2018) unprocessed observation KEL15F0004	16-Jul-2015	5	None	Lassen NF	5400

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
44	Savanna Fen; About a mile NNE of Little Grizzly Campground, between Roads 26N06C1 & 27N11D, along east side of corridor carrying head of Grizzly Creek.	Plumas	Humbug Valley (4012123)	CNDDB (2018) unprocessed observation LEP07F0009	27-Aug-2007	136 at least	cattle punching seems largely confined to drier, northerly part of meadow and track between upper and lower shelf in southerly part; overuse by cattle, loggin, fire, recreational damage	Lassen NF	5900
45	Lower level of split-level fen, ca 1/2 mile east of wet meadow at foot of Pelican Point Trail	Plumas	Belden	CNDDB (2018) unprocessed observation LEP08F0012	31-Aug-2008	ca 1000	Cirsium vulgare sparsely scattered through area	Lassen NF	4900
46	Fen complex about a mile south of Hay Meadow, Jct. of Rds 30N36 and 32N10. Is 9 or 10 miles north of Hwy 36 at Lake Almanor.	Plumas	Red Cinder	CNDDB (2018) unprocessed observation LEP10F0017	26-Aug-2010	25 estimated	None	Lassen NF	6300

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
47	Eagle Lake District of Lassen NF, east of Diamond Ridge, at headwaters of Gold Run Creek. From Gold Run Rd./204 jctn near forest border go east on 28N64 to where it crosses Gold Run Creek at Gilman Basin. Go downstream on north side of creek to aspen stand with peatland area.	Plumas	Diamond Mountain	CNDDB (2018) unprocessed observation MOR16F0020	5-Jun-2016	1000 ramets	None	Lassen NF	6600
48	Slalom Fen, between Mud and Dillon Creeks, ca 2.25 air miles SSW of Hay Meadows Trailhead. From Hwy 36, follow roads 32N10 and 30N72 to Mud Creek. Just beyond creek, take Road 30N18a a mile or so to where it turns eastward across creek, abut 1/2 mile further there is unnamed road SE (right) to fen, which is NE of Mud Creek drainage.	Plumas	Red Cinder	CNDDB (2018) unprocessed observation LEP11F0040	16-Oct-2011	100 estimated	Large animal (ungulate?) evidence in and around fen	Lassen NF	6350

Distribution on National Forest System (NFS) Lands:

(Please see Reference column of Locations table above for references pertaining to Record Numbers indicated on NFS lands.)

National Forest System (NFS) lands	Record #s (from Locations table above)	CNDDB EOs	Non-CNDDB Records	Recent (seen in past 20 yrs.)	Historic (not seen in past 20 yrs.)	Most Recent Obs.	EOs/ Recs. (5 mile buffer)	Total Records on NFS lands
Angeles:	-	-	-	-	-	-	-	0
Cleveland:	-	-	-	-	-	-	-	0
Eldorado:	11	0	1	0	1	26-Jun-1977	5	1
Inyo:	2	0	1	0	1	10-Jul-1977	-	1
Klamath:	41	0	1	1	0	17-May-2007	-	1
Lake Tahoe Basin MU:	7, 8, 10	0	3	1	2	22-Sep-2010	3	3
Lassen:	27, 30, 34, 42, 43, 44, 45, 46, 47, 48	0	10	9	1	10-Oct-2017	9	10
Los Padres:	-	-	-	-	-	-	-	0
Mendocino:	-	-	-	-	-	-	-	0
Modoc:	38	-	1	-	1	29-Jun-1997	-	1
Plumas:	22, 23, 24	0	3	3	0	11-Sep-2005	5	3
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	-	-	-	-	-	-	5	0
Sierra:	-	-	-	-	-	-	1	0
Six Rivers:	-	-	-	-	-	-	-	0
Stanislaus:	1	0	1	1	0	14-Jul-2008	2	1
Tahoe:	13, 14, 15, 16, 19	0	5	0	5	1-Jan-1990	4	5
Totals:	N/A	0	26	15	11	N/A	34	26

Demographic and Population Trends: There are 48 documented occurrences of *E. gracile* in California, compiled from unprocessed observation forms submitted to CNDDB (2018), specimen data in Consortium of California Herbaria (CCH 2017), and Calflora observations (CalFlora 2017). Seventy percent (70%) of these occurrences are on protected lands. Twenty-six (26) occur on USFS lands: ten occur on the Lassen NF, five on the Tahoe NF, three on the Lake Tahoe Basin Management Unit, three on the Plumas NF, and one each on the El Dorado, Klamath, Stanislaus, Inyo, and Modoc NFs. Of the remaining occurrences, there are five on National Park lands, three on State Park lands, and 14 are of unspecified ownership. New populations are still being found, with at least 12 new locations found within the past 20 years,

mainly as a result of targeted surveys of wetlands on the Lassen and Sierra National Forests. On the Sierra National Forest, despite a lack of herbarium records, *E. gracile* is thought to not be particularly rare (Clines pers. comm. 2018). In contrast, ten occurrences have not been observed for over 100 years (although for most of these records, vague location information, rather than extirpation, may be the culprit), and another five not observed for over 50 years. Ten sites have had repeated observations over a span or a decade or more, implying they are large and/or stable, although none have robust enough census information to detect a trend.

Population size was estimated at nine sites, and where stated the count was of number of fruiting stalks, which may differ greatly from the number of genetic individuals in this sward-forming species. Flowering ramet numbers were estimated at or over 1,000 in two populations, between 100 and 200 in four sites and fewer than 100 in five (CNDDB 2018). The rhizomatous, colonial growth of *E. gracile* makes discerning individuals in the field impossible, so numbers of reproductive ramets are typically used for counts, which would reflect the reproductive output of the site more than the number of individuals, as a given population could be composed of a single large clone (Barr 1996).

Site quality was listed as Excellent for two observations, Good for ten, and Fair for one site (CNDDB 2018).

The California pattern of distribution is mirrored eastward: *E. gracile* occurs in widely scattered, small populations, tending to be more frequent in southern Canada and the northern tier of United States and rare in the more southerly states. Hence it varies in threat rating from state to state: SX (presumed extirpated, 1 state), S1 (critically imperiled, 9 states), S2 (imperiled, 3 states), S3 (vulnerable, 2 states), or S4 (apparently secure, 2 states); the other 10 states where it is found have not ranked this species (SNR) (NatureServe 2018). For example, in USFS Region 2 (Rocky Mountains), 25% of sites have been deemed historical and likely extirpated due to habitat alteration (Decker et al. 2006). Decker et al. conclude that this pattern of loss of the widely scattered western U.S. populations will not endanger the persistence of the species but could result in a contraction of its known range and could reduce the diversity of the species as a whole. In Pennsylvania, Barr (1996) states that *E. gracile* had been found at four new sites since 1988, but reported extirpated at 22 historical sites, where it is classified as endangered, with similar patterns in adjacent states.

In Europe, *E. gracile* is considered to be stable in the northern part of its range, but in decline in a large part of the southern portion of its range, partly due to the degradation of its wetland habitat throughout the region. *Eriophorum gracile* is thought to be declining due to both wetland drainage and eutrophication, the former leading to loss of suitable habitat and the latter to aggressive succession, which excludes it. *Eriophorum gracile* is classed as Regionally Extinct in Croatia, Endangered in Norway, Denmark, and Switzerland, Vulnerable in Estonia, and Near Threatened in the UK (Lansdown 2011).

It should be noted that *E. gracile* is a slow-growing colonial perennial, so its population numbers are/are not expected to fluctuate. Although its flowers are not easily detected, *E. gracile* is highly detectable during summer and fall, when the distinctive snow-white cotton tops of its seed heads are visible above the low-stature habitat it prefers until fall rains dampen or winds disperse them (Decker et al. 2006).

Life History: *Eriophorum gracile* is a perennial graminoid that reproduces both sexually by seed and vegetatively from long, creeping rhizomes (Ball and Wujek 2002). Like most other species in the Cyperaceae, *E. gracile* is monoecious, having separate male and female flowers on the same plant, and is wind-pollinated (Decker et al. 2006). It blooms from May to September (CNPS 2018). *Eriophorum* forms leaves throughout the growing season, and leaves formed at

the end of the growing season resume growth the following spring, whereas leaves formed in the spring die in the fall of the same year, and leaves formed in the summer die the following summer. Individual ramets form few leaves per year, usually only 2-3 (Backeus 1985). This slow growth is considered a strategy for survival in nutrient-poor environments, and the plant is inferred to be therefore relatively stress-tolerant once established, and extremely long-lived in its stable preferred habitat (Decker et al. 2006).

Although there is evidence of a persistent seed bank in some *Eriophorum* species, the longevity of *E. gracile* seeds has not been investigated (Decker et al. 2006). *Eriophorum gracile* appears to produce few viable seed relative to other *Eriophorum* species, notably so in isolated populations that may be composed of a single genetic individual, although it has not been determined if this species is an outcrosser (Barr 1996).

Diversity: Phylogenetic analyses of Cyperaceae place *Eriophorum* species as a monophyletic but terminal grouping within the genus *Scirpus*. Phylogenetic support for subsuming *Eriophorum* into *Scirpus* to create a monophyletic *Scirpus* is only weakly supported with the data published to date, so this taxonomic debate remains unresolved (Gilmour et al. 2015).

With an interruptedly circumboreal distribution, it is not surprising that subspecies and varieties have been proposed during the two centuries of *E. gracile*'s existence. None are currently recognized, and North American populations are currently considered to be conspecific with European and Asian populations (Tropicos 2018; The Plant List 2013). However, Ball and Wujek (2002) assert that differences in achene micromorphology and isozyme data call for the intercontinental infraspecies relationships to be investigated more thoroughly.

Early California and Oregon specimens of *E. gracile* were placed in a separate variety, *E. gracile* var. *caurianum*, based on their lighter color inflorescence scales and larger achenes than was typical of the collections at the time (Fernald 1905). This variety name was not applied in California because additional California material was thought to be too variable to assign to a single variety (Mason 1957). Currently all varieties and subspecies previously proposed are considered synonyms (Tropicos 2018).

Within-population genetic diversity of *E. gracile* was studied using isozyme alleles in a single, isolated population at the southern limit of the species' range in Pennsylvania. No within-population genetic variation was found. The fact that two isozyme alleles were fixed in the heterozygous state implied the entire site was occupied by a single clone (Barr 1996). Barr (1996) speculates that the lack of genetic diversity found at the Pennsylvania population may also have affected its fecundity, as only 116 of 2,517 flowers examined produced viable seed, producing only an average of 4.3 viable seeds per plant. Gene flow is considered possible between populations within a mile or two of each other (Decker et al. 2006), so widely scattered populations at the southern edge of the *E. gracile* range, particularly if this species has self-incompatibility mechanisms, may be inviable as source populations for seed dispersal (Barr 1996).

Habitat: Globally, *Eriophorum gracile* is found in cool temperate, alpine, and arctic regions. Its habitat is montane to alpine wetlands with peaty soils and poor drainage that are supported by groundwater discharge or snowmelt and where vegetation is dominated by graminoids and forbs (Ball and Wujek 2002).

Where it occurs in the mountainous regions of Colorado, Wyoming, and the Sandhills region of north-central Nebraska and southern South Dakota, it is typically found in fens and subalpine wet meadows ranging from 590 meters (eastern Sandhills) to 3,475 meters (Colorado). *Eriophorum gracile* is typically found on flat areas or gentle slopes, but it may also occur on sub-

irrigated sites with slopes up to 10 percent. In alpine locations, wet meadows are typically small depressions located below late-melting snow patches or on snowbeds. Soils of this system may be mineral or organic but have hydric soil characteristics (Decker et al 2006).

In California, *E. gracile* is known from fens, seeps, and meadows with saturated soils and thick accumulations of peat (e.g. muck), or on floating peat mats of ponds and lakes within the upper montane coniferous forest between 1,280 and 2,900 meters (CNPS 2018). Within these habitat types, *E. gracile* appears to occupy a specialized niche, prefering "base-rich" or "rich" fens, a minerotrophic habitat, where nutrients are in somewhat higher abundance due to flow of minerogeneous groundwater or the proximity of a body of open or flowing water, and where the pH is typically neutral to moderately acidic (Backeus 1985). It is therefore typically found in a small portion of the area of the fens and wetlands within which it occurs. For example, *E. gracile* has been found in Lake Tahoe Basin area in a rare vegetation type, *Carex limosa-Menyanthes trifoliata* Association, which tends to cover a very small area (Sykes et al. 2011). Common associates reported in CNDDB (2018) are: *Aster alpigenus, Carex echinata, C. limosa, C. lasiocarpa, Drosera rotundifolia, Eleocharis pauciflora, E. macrostachya, Meesia triquetra, Menyanthes trifoliata, Sphagnum* spp., *Utricularia minor*, and *Vaccinium uliginosum* (CPNWH 2018; CCH 2018).

Habitat Status or Trend: In Europe, the balance of species communities of rich fens has been found to be particularly sensitive to acid rain and to atmospheric nitrogen deposition, and the decline of *E. gracile* occurrences at the margins of its range in Europe is partly attributed to this (NatureServe 2018). Specifically, increased nitrogen deposition in rich fens causes taller graminoids to increase, with decline of subordinate plant species, such as *Eriophorum* species (Bobbink et al. 1998). This phenomenon is moderated if other macronutrients, such as phosphorus, are limiting, or if sufficient carbonate-containing groundwater is present to maintain near-neutrality, but is exacerbated if deposition also includes sulphur compounds, which are acidifying (Bobbink et al. 1998; Limpens et al. 2004). Shifts in flora composition in rich fens may be led by shifts towards acid-tolerant *Sphagnum* species which themselves can acidify the fen, or by reduction of mineral groundwater flow (van Breemen 1995). For example, *E. gracile* disappeared from a fen surveyed in Sweden over 50 years, during which time the fen remained intact, with the primary change being that the pH became more acidic. The average pH of the plots with *E. gracile* at the start of the study was 6.2 and all plots in this pH range had dropped between pH 0.2 and 2.0 during the 50-year span of the study (Gunnarsson et al. 2000).

The drying effect of climate change could similarly result in shifts in vegetation dominance in wetlands, or loss of small wetlands, eventually leading to local extirpation of *E. gracile*. In a global climate change study, Chapin and Shaver (1996) manipulated light, temperature, nutrients, and length of growing season in simulating global environmental change for common upland tundra plants in the Alaskan Arctic, including a related species, *E. vaginatum*. The results of this experiment suggest that warming eventually will promote the growth of birch at the expense of sedges, forbs, and other short-stature species.

Because *E. gracile* populations in much of North America occur in rare, small islands of suitable habitat, they will be less able to disperse to more suitable conditions nearby as their habitat deteriorates. The semi-arid landscape of California makes these systems especially vulnerable to regional climatic warming and drying (Sykes et al. 2011).

Capacity for the Species to Disperse: E. gracile reproduces both sexually by seed and vegetatively from long, creeping rhizomes. The seeds are 1.5-3 mm long, narrowly obovoid achenes (Ball and Wujek 2002). The distinctive, long hairs attached to the achenes are modified perianth parts that are thought to assist in wind and water dispersal (Decker et al. 2006; Burrows

1975). Reproduction of *Eriophorum* species is reported to be primarily by vegetative growth (Decker et al. 2006; Barr 1996). In one Pennsylvania occurrence studied, *E. gracile* produced very few viable seeds, relative to the co-occurring *E. virginianum*, suggesting that either marginal populations have inbreeding viability problems, or that this species has low rates of sexual reproduction (Barr 1996). Seedling recruitment is also thought to be low, due to the lack of suitable open sites for germination (Decker et al. 2006). Small openings in dense bog vegetation, such as hoof prints, appear to be generally insufficient for significant seedling recruitment to occur in *Eriophorum* (Stammel and Kiehl 2004).

A wind pollination syndrome requires the production of large amounts of pollen; this is the only possible vector for gene exchange among disjunct populations of *E. gracile* (Decker et al. 2006). Even if pollen is occasionally exchanged among *E. gracile* occurrences, its limited viability would make successful long-distance pollination a rare event (Decker et al. 2006).

Threats: The potential threats to *E. gracile* in California are, in general: development, hydrological alterations, grazing and trampling (CNPS 2018). These are similar to the probable threats cited for *E. gracile* in the Rocky Mountain and Sand Hills regions: hydrologic alterations, grazing, motorized vehicle use, peat mining, invasive species, and global climate change (Decker et al. 2006). In Europe, the main threats are considered to be destruction of wetlands via drainage, and eutrophication with consequent acceleration of wetland succession (Lansdown 2011). Specific threats listed in the occurrence reports are: livestock grazing with associated hoof-punching and channelization of water moving through fen: three sites; generalized drying of the fen, possibly due to adjacent campground location: one site; a golf course slated to be built nearby (hydrological alteration and increased nutrient load): one site; and invasive species (*Cirsium vulgare* present in low numbers): one site (CNDDB 2018).

In summary, the small, isolated occurrences of *E. gracile* result from its highly specific habitat requirements that are extremely unusual in California. *Eriophorum gracile* appears to be a slow-growing low-nutrient site specialist with ability to persist long-term on a site, but it is not a good disperser. An increasing suite of habitat threats consequently decreases the probability of its long-term persistence on its few known sites around the region.

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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.

Additional Considerations at the Forest Level: Habitat amount and juxtaposition of both the species and habitat locations.