5-YEAR REVIEW

Taraxacum californicum
(California taraxacum)

GENERAL INFORMATION

Species: *Taraxacum californicum* (California taraxacum), a plant species
Date listed under the Endangered Species Act: September 14, 1998
Federal Register citation: USFWS 1998 (63 FR 49006)
Classification: Endangered

BACKGROUND

Under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq*.), the U.S. Fish and Wildlife Service (USFWS), referred to as "we" in this document, maintain lists of endangered and threatened wildlife and plant species (referred to as the List) in the Code of Federal Regulations (CFR) at 50 CFR 17.11 (for wildlife) and 17.12 (for plants). Section 4(c)(2)(A) of the Act requires us to review each listed species' status at least once every 5 years.

Most recent status review: USFWS 2013. *Taraxacum californicum* (California taraxacum); 5-Year Review: Summary and Evaluation. Carlsbad Fish and Wildlife Office, Department of the Interior. 55 pp.

We initiated a status review for *Taraxacum californicum* in 2011. The review was finalized on August 23, 2013 and recommended no change in status.

Federal Register notice announcing this status review: USFWS 2020 (85 FR 4692); Endangered and Threatened Wildlife and Plants; Initiation of 5-year Status Reviews of 66 Species in California and Nevada; January 27, 2020. *Federal Register* 85:42692–4694.

On January 27, 2020, we published a *Federal Register* notice announcing initiation of the 5-year review of this species, and the opening of a 60-day comment period to receive information (USFWS 2020, pp. 4692–4694). We received no information about *Taraxacum californicum*.

ASSESMENT

Information acquired since the last status review

This 5-year review was conducted by the USFWS Carlsbad Fish and Wildlife Office. Data for this review were solicited from the public and interested parties through a Federal Register notice announcing this review on January 27, 2020 (USFWS 2020, entire). We also contacted State and Federal partners and species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

SUMMARY OF NEW INFORMATION SINCE 2013

Biology and distribution

Since 2013, no studies have examined *Taraxacum californicum* biology, life history, or genetics. We do have new information from site visits to 24 occurrences since 2013, including from the following survey efforts:

1. In 2013, the California Botanic Garden (formerly Rancho Santa Ana Botanic Garden) completed a flora of the Upper Santa Ana River watershed on the San Bernardino National Forest. The effort included survey for special status plant taxa (Fraga *et al.* 2011, p. 19). *Taraxacum californicum* was found at three meadows [Big Meadow, Mission Springs Meadow, and Wildhorse Meadows (Fraga *et al.* 2011, p. 36)].

2. In 2016, University of Redlands faculty and students surveyed part of Metcalf Meadows [California Natural Diversity Database (CNDDB) Element Occurrence (EO) 16] for rare plants. They did not find *T. californicum* (Hook 2017, unpaginated).

3. In 2020, U.S. Forest Service (USFS) botanists visited 21 *T. californicum*-occupied meadows and documented 406 plants among all meadows. They collected seed for *ex situ* conservation, and tissue for genetic studies (USFS 2020a, unpaginated).

Based on new information from State and Federal partners and the scientific literature, we revised the status of 26 occurrences from the 2013 5-year review, and we added 4 occurrences that were not in our 2013 occurrence table. Changes to occurrence status since 2013 are:

1. Thirteen occurrences were changed from “extant” to “presumed extant” because plants have not been observed there for over 10 years, although meadow habitat is still present.

2. Two occurrences (both at North Baldwin Meadow) were changed from “extant” to “possibly extirpated,” because plants have not been observed on-site for over 20 years

3. Two occurrences were changed from “extant” to “erroneous,” because both are incorrectly mapped in non-meadow habitat.

4. Four occurrences were not included in the 2013 occurrence table. Two of those occurrences are extant, one is extirpated, and one is erroneous.

5. One occurrence (Sugarloaf Meadow) was changed from “extirpated” to “possibly extirpated,” because meadow habitat is still present even though the occurrence has not been observed for over 20 years.

6. We did not use the “vague” status in 2021, so 4 occurrences were considered either “erroneous,” “possibly extirpated,” or “presumed extant.”

Based on those updates, there are 42 non-erroneous occurrences of *Taraxacum californicum* (Table 1), of which 17 are extant, 19 are presumed extant, 4 are possibly extirpated, and 2 are extirpated. The occurrence status updates show a decrease in the number of extant occurrences

between 2013 and 2021 (Table 1). Rangewide maximum abundance estimates from across occurrences (Table 2) indicate that fewer plants were found between 2001 and 2012 than between 2013 and 2021.

In summary, there are 42 occurrences of *Taraxacum californicum*. Monitoring for the species has occurred at 24 occurrences since 2013 (Table 1), providing new information about the species' presence and abundance. We also reassessed our 2013 occurrence status determinations and updated the status of 26 occurrences (Table 1, Table 3), based on new monitoring data, the date since last survey, and information from State and Federal partners.

We have no new information that changes our understanding of *Taraxacum californicum* biology or spatial distribution, and so that information in our 2013 review remains accurate.

Table 1. Summary of occurrence status change between 2008, 2013, and 2021.[1]

Occurrence status[2]	2008 count of status	2013 count of status	2021 count of status
Extant	34	32	17
Presumed extant	3	4	19
Possibly extirpated	NA	NA	4
Extirpated	1	2	2
Vague	4	4	NA
Erroneous	0	1	5
Total number of non-erroneous occurrences	**42**	**42**	**42**

[1] We did not use the "vague" status in 2021. Occurrences considered vague for past reviews were considered presumed extant, possibly extirpated, or erroneous in this review.
[2] We considered an occurrence "extant" if the occurrence has been observed within 10 years (since 2011). We considered an occurrence "presumed extant" if it has not been observed for over 10 years, but suitable habitat is present.

Table 2. Summary of rangewide abundance estimates for *Taraxacum californicum*.

Year	Number of meadows with *Taraxacum californicum* detected	Number of plants[1]	Source
2000	16	Fewer than 925	USFS 2000, pp. 56–59; USFWS 2008, p. 20
2001–2012	12	8,340[2]	USFWS 2008, pp. 45–49
2013–2021	16	431[1]	CDFW 2021; USFS 2020a; USFS 2020b, entire

[1] The "number of plants" column indicates the highest number of plants recorded across all occurrences within the time period.
[2] For the highest plant counts from 2001 to 2012, a count from Bluff Lake in 2001 (7,474) accounts for 90 percent of plants.

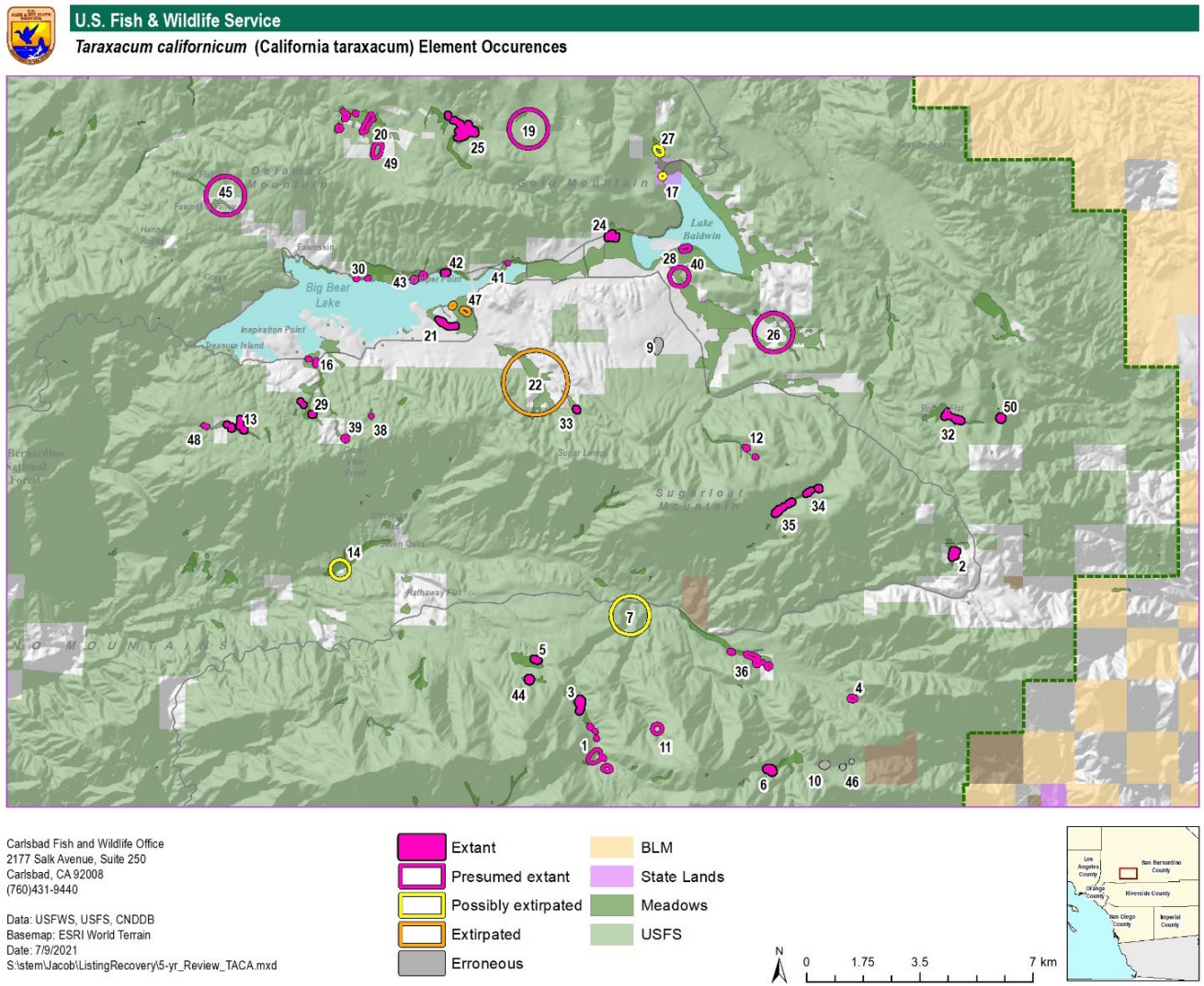

Figure 1. Map of *Taraxacum californicum* (California taraxacum) occurrences; showing occurrence status, CNDDB EO number, and land ownership.

Table 3. *Taraxacum californicum* (California taraxacum) occurrence table with changes in status since listing.

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Unnamed (numbered meadow "14" in USFS files)	50	NA	NA	NA	Extant	Conserved (USFS)	2020 (46)	This occurrence was not included in our 2013 5-year review. It's presumed extant in CNDDB and USFS 2020 surveys found 46 plants, so the occurrence is extant	USFS 2020a, entire
Arrastre Meadow	19	Vague	Vague	Vague	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status	CDFW 2021, p. 17
Aspen Glen/Coldbrook Meadows	NA	Vague	Vague	Vague	Erroneous	Partially conserved (IERCD, USFS), Private	NA	There are no records of TACA from these meadows; CNDDB EO 16 is within Metcalf Meadow	CDFW 2021, p. 15
Belleville Meadow (Holcomb Valley area)	25	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (41)	No change in EO or conservation status	USFS 2020a, entire
Big Meadow	36	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	2013 (8), 2015 (0), 2016 (0), 2020 (0)	No change in conservation status since 2013. This occurrence was extant in 2013, when surveys by Fraga *et al*. found 8 plants. However, three subsequent visits have found 0 plants, so the occurrence is presumed extant. Fraga *et al.* 2011 reported that although plants co-occurred with *Taraxacum officinale*, they did not appear highly introgressed (p. 36)	CDFW 2021, p. 37; USFS 2020a, entire; USFS 2020b, entire; Fraga *et al.* 2011

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Bluff Lake Meadow	48	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	2016 (0)	We lumped EOs 13 and 48 in the 2013 5-year review, but we split them in this review because 1) they are separate occurrence in CNDDB, and 2) Bluff Lake Meadow and Bluff Meadow are separate (but adjacent) meadows as mapped by USFS	CDFW 2021, p. 48; USFS 2020
Bluff Meadow	13	Extant	Extant	Extant	Extant	Conserved (USFS, The Wildlands Conservancy)	2020 (135)	No change in EO or conservation status	USFS 2020b, entire
Bow Meadow	33	NA	Extant	Extant	Extant	Conserved (USFS)	2020 (1)	No change in EO or conservation status	USFS 2020b, entire
Broom Flat Meadow	32	NA	Extant	Extant	Extant	Conserved (USFS)	2015 (0), 2020 (3)	No change in EO or conservation status	USFS 2020a, entire; USFS 2020b, entire
China Gardens Meadow	47	Extant	Extant	Extirpated	Extirpated	Not conserved (Private)	NA	No change in EO or conservation status. Because occurrences 21 and 47 are in different meadows, we split them into different rows in the occurrence table	USFWS 2013, citing Eliason 2011
Cienega Seca Meadow	2	Extant	Extant	Extant	Extant	Deed restriction (Private)	7(2019), 14 (2020)	Although this meadow is privately-owned, The Wildlands Conservancy has a deed restriction over the meadow. The meadow was used as a cargo hoist spot and for water dipping during the 2015 Lake Fire (USFS 2015, p. 52).	USFS 2020a, entire; USFS 202b, entire

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Division Meadow (North shore of Big Bear Lake)	41	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status	CDFW 2021, p. 41
Eagle Point Meadow	21	Extant	Extant	Extant	Extant	Deed restriction (Private)	2014 (2), 2020 (67)	No change in EO or conservation status	USFS 2020a, entire; USFS 2020b, entire
East and West Observatory Meadows (North shore of Big Bear Lake)	30	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	2020 (0)	No change in EO or conservation status	CDFW 2021, p. , USFS 2020 data
Erwin Meadows	26	Presumed extant	Presumed extant	Presumed extant	Presumed extant	Not conserved (Private)	NA	No change in EO or conservation status. There is an open space easement over Parcel A, which encompasses parts of EO 26 and the Erwin Lake bottom (Kemper 1999, pp. 18, 20). There are also restrictions about operating motor vehicles (except for maintenance vehicles) on Parcel A (p. 20). All other parcels encompassing the occurrence are privately owned.	CDFW 2021, p. 25
Fawnskin Meadow	45	Vague	Vague	Vague	Presumed extant	Not conserved (Private)	NA	No change in conservation status. CNDDB considers this occurrence "presumed extant".	CDFW 2021, p. 45

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Fish Creek Meadows	6	Extant	Extant	Extant	Extant	Conserved (USFS)	32 (2020)	No change in EO or conservation status. This EO burned in the 2015 Lake Fire, but there were no effects from fire suppression activities, and meadow vegetation was recovering less than a month after the fire (USFS 2015, pp. 64–66).	USFS 2020b, entire
Green Spring Meadow	12	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status	CDFW 2021, p. 11
Heart Bar Creek	4	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status. This EO was included in the Big Meadow occurrence in 2013.	CDFW 2021, p. 4
Hitchcock Meadow (Holcomb Valley)	20	Extant	Extant	Extant	Presumed extant	Partially conserved (USFS, Private)	2012 (0), 2020 (0)	No change in EO or conservation status.	CDFW 2021, p. 18; USFS 2020a, entire; USFS 202b, entire
Hitchcock Meadow (Holcomb Valley)	49	Extant	Extant	Extant	Presumed extant	Not conserved (Private)	NA	No change in EO or conservation status.	CDFW 2021, p. 49

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Horse Meadow	5	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (3)	No change in EO or conservation status. Meadow edges and some small spots within the meadow burned during the 2015 Lake Fire, but vegetation was regenerating during return visits 1 to 2 weeks later, and there were only minor, short term effects to the meadow from suppression activities (USFS 2015, pp. 55–56)	USFS 2015, pp. 55–56; USFS 2020b, entire
Juniper Point Meadow (North shore of Big Bear Lake)	43	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	2020 (0)	No change in EO or conservation status	CDFW 2021, p. 43; USFS 2020b, entire
Lost Creek Meadow [formerly: Unnamed Meadow (E of Southfork Meadow)]	11	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	2020 (0)	This EO considered extant in 2013 but is now presumed extant, following 2020 surveys in which no plants were found	CDFW 2021, p. 10; USFS 2020b, entire
Merriman Meadows (Merriman/Red Ant Meadows)1,2	39	NA	Extant	Presumed extant	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status	CDFW 2021, p. 39
Metcalf Meadow (north occurrence)	16	Extant	Presumed extant	Extant	Presumed extant	Partially conserved (SBLT), Private	2016 (0), 2020 (0)	Since 2013, this meadow has been acquired by the San Bernardino Mountains Land Trust using Section 6 funding, so it is now conserved.	CDFW 2021, p. 15; Hooks 2017

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Metcalf Meadow (south occurrence)	29	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (4)	No change in EO or conservation status	USFS 2020b, entire
Minnelusa Meadow (North Shore Meadows)	42	Extant	Extant	Extant	Extant	Not conserved (BBMWD)	NA	No change in EO or conservation status	CDFW 2021, p. 42
Mission Meadow area [formerly: Unnamed Meadow (E of Fish Creek Meadow)]	10	Extant	Extant	Extant	Erroneous	Conserved (USFS)	NA	We determined that this occurrence is erroneous based on communication with USFS. Mission Meadow is the only habitat in the area.	Eliason 2021, pers. comm.
Mission Meadow area [formerly: Unnamed Meadow (E of Fish Creek Meadow)]	46	Extant	Extant	Extant	Erroneous	Conserved (USFS)	2016 (0)	No plants found in 2016 survey by USFS. We determined that this occurrence is erroneous based on USFWS assessment and communication with the USFS. Mission Meadow is the only habitat in the area	USFS 2020a, entire; Eliason 2021, pers. comm.
Mission Meadow area [formerly: Unnamed Meadow (E of Fish Crk Meadow)]	NA	Extant	Extant	Extant	Extant	Conserved (USFS)	NA	Fraga *et al.* 2011 (p. 36) reported 20 plants co-occurring with *Taraxacum officinale*, but plants did not appear highly introgressed	Eliason 2021, pers. comm.; Fraga *et al.* 2011, p. 36

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
NA	9	NA	NA	NA	Erroneous	Not conserved (Private)	NA	This record is erroneous. According to CNDDB, the record is based on USFS 2008 digital data, but the record is not in the USFS database. The area is described as pebble plain in CNDDB. The areas is developed and no meadow habitat exists on aerial imagery.	CDFW 2021, p. 8
North Baldwin Meadow	27	Extant	Extant	Extant	Possibly extirpated	Conserved (USFS)	2020 (0)	This occurrence was combined with EO 17 in our 2013 review because both occurrences are in North Baldwin Meadow. We separated the occurrences for this review. This occurrence was considered extant in 2013, but we consider it possibly extirpated for this review. Meadow habitat is still present in the area, but *T. californicum* has not been observed at the site for over 20 years.	Krantz 2021, pers. comm; USFS 2020b, entire
North Baldwin Meadow	17	Extant	Extant	Extant	Possibly extirpated	Conserved (California Department of Fish and Wildlife [CDFW])	NA	This occurrence was combined with EO 27 in our 2013 review because both occurrences are in North Baldwin Meadow. We separated the occurrences for this review. This occurrence was considered extant in 2013, but we consider it possibly extirpated for this review. Meadow habitat is still present in the area, but *T. californicum* has not been observed at the site for over 20 years.	Krantz 2021, pers. comm.

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Pan Hot Springs Meadow	24	Extant	Extant	Extant	Extant	Partially conserved (Parts of the meadow are deed restricted)	2020 (5)	No change in EO or conservation status. Part of the meadow was acquired by the San Manuel Band of Serrano Mission Indians.	USFS 2020b, entire
Rathburn Meadow	22	NA	NA	NA	Extirpated	Not conserved (Private)	NA	Not included in the 2013 occurrence table	CDFW 2021, p. 21
Red Ant Meadows (Merriman/Red Ant Meadows)1,2	38	NA	Extant	Presumed extant	Presumed extant	Conserved (USFS)	NA	No change in EO or conservation status	CDFW 2021, p. 38
San y Meadow	44	NA	NA	NA	Extant	Conserved (USFS)	2020 (49)	No change in EO or conservation status. In the occurrence table for the 2013 5-year review, we lumped this occurrence with Horse Meadow (EO 5).	USFS 2020b, entire
Seven Oaks Meadow	14	Vague	Vague	Vague	Possibly extirpated	Partially conserved (Parts of meadow are developed)	NA	Fraga *et al*. 2011 (p. 36) described this occurrence as probably extirpated due to habitat modification	Fraga *et al*. 2011, p. 36
Shay Meadow	40	NA	Extant	Extant	Presumed extant	Conserved (USFS)	2020 (0)	This occurrence was considered extant in 2013. Because plants have not been observed over 10 years (0 plants were found in 2020 surveys), the species is presumed extant.	CDFW 2021, p. 40

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Shay Meadow	28	Presumed extant	Presumed extant	Presumed extant	Presumed extant	Not conserved (Private)	NA	No change in EO or conservation status	CDFW 2021, p. 27
Southfork Meadows	1	Extant	Extant	Extant	Presumed extant	Conserved (USFS)	NA	We considered the occurrence extant in 2013, but we consider it presumed extant in this review because plants have not been observed for over 10 years. Although South Fork Meadows burned during the Lake Fire, no suppression-related activities occurred at this meadow (USFS 2015, pp. 60–61).	CDFW 2021, p. 1; USFS 2015, pp. 60–61
Southfork Meadows	3	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (6)	No change in EO or conservation status. Although South Fork Meadows burned during the Lake Fire, no suppression-related activities occurred at this meadow (USFS 2015, pp. 60–61).	USFS 2020b, entire; USFS 2015, pp. 60–61
Sugarloaf Meadow	7	NA	Extirpated	Extirpated	Possibly extirpated	Conserved (USFS)	NA	We considered this EO extirpated in 2008 and 2011. CDFW considers it presumed extant. The EO is based on two collections: 1) Benson 1947 (“South Fork of the Santa Ana River,east of Barton Flat”) and Munz 1942 (“wet meadow, south base of Sugarloaf Mtn, 6800 ft elevation”) (CCH 2021, entire). In 2013 and in this review, we attribute this EO to Sugarloaf Meadow. Because habitat is still present, this EO is possibly extirpated rather than extirpated, even though the occurrence has not been observed for over 20 years.	CDFW 2021, p. 7, CCH 2021, entire

Meadow name	2021 CNDDB EO number	Status at listing	2008 status	2013 status	2021 status	2021 conservation status	Counts since 2013 [year, (count)]	Change between 2013 and 2021	Reference
Unnamed Meadow (west of Shay Meadow in town of Sugarloaf)	NA	NA	NA	Erroneous	Erroneous	NA	NA	No change in EO status	USFWS 2013, p. 13
Wildhorse Meadows	34	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (25 plants between CNDDB EOs 34 and 35)	No change in EO or conservation status	USFS 2020b, entire
Wildhorse Meadows	35	Extant	Extant	Extant	Extant	Conserved (USFS)	2020 (25 plants between CNDDB EOs 34 and 35)	No change in EO or conservation status	USFS 2020b, entire

Threats

Our 2013 5-year review discussed Factor A threats (present or threatened destruction, modification, or curtailment of habitat or range) to *Taraxacum californicum* from: 1) altered hydrology, 2) urbanization, 3) roads and unauthorized off-highway vehicle (OHV) use, 4) developed and dispersed recreation, 5) mining activities, 6) grazing, and 7) competition with other plant species (USFWS 2013, pp. 11–18). The review discussed Factor E threats (other natural or manmade factors affecting a species' continued existence) from 1) hybridization, 2) limited numbers of plants, 3) fire suppression measures, and 4) climate change and drought.

This section summarizes new information about threats to *Taraxacum californicum* since 2013. We have new information about the threats of: 1) development, 2) altered hydrology, 3) off-highway vehicles, 4) fire suppression, 5) nonnative plants, and 6) climate change. Below, we also discuss a 2019 biological opinion (USFWS 2019, entire) issued to the USFS, which addresses potential effects of USFS activities on *T. californicum*.

Development

In 2008 and 2013, we considered urbanization a threat to *Taraxacum californicum* in the Big Bear area (USFWS 2008, pp. 10–11; USFWS 2013, pp. 12–13). Since 2013, one *T. californicum* EO has received an elevated level of conservation.

In 2015, the majority of north and south Metcalf Meadow (encompassing CNDDB EO 16) was acquired with section 6 funding, and is no longer at risk from development. The acquisition by the San Bernardino Mountains Land Trust conserved 17.1 acres (ac) (6.9 hectares (ha)) of habitat in perpetuity (San Bernardino County 2015, unpaginated).

Due to the acquisition of Metcalf Meadow, the threat of development at CNDDB EO 16 has been partially ameliorated, but portions of the occurrence are still vulnerable to development. We do not have any reports of development in *Taraxacum californicum* habitat since the 2013 5-year review.

Altered hydrology

In 2008 and 2013, we considered altered hydrology a threat to *Taraxacum californicum* (USFWS 2008, p. 10; USFWS 2013, pp. 11–12). This section summarizes new information about hydrology in Big Bear Valley from a 2012 USGS report, which was not considered in our 2013 5-year review.

The Big Bear area (i.e., the Big Bear Lake and Baldwin Lake surface water drainage basins, encompassing Big Bear Valley and Baldwin Lake) relies on water supply from springs on the edge of the ground-water basin, and from wells drilled into the ground-water basin (USGS 2012, p. 105). Local water agencies have constructed new wells to help meet increased water demand (USGS 2012, p. 105).

USGS (2012, pp. 15–22) used satellite-based remote-sensing techniques and well monitoring data to study land subsidence in the Baldwin Lake and Big Bear sub-basins. Between 1992 and 2005, they reported both land-surface subsidence and uplift for an area between Big Bear and

Baldwin Lakes—encompassing Pan Hot Springs Meadow—but it was unclear whether the amount of deformation in this area was elastic or inelastic (USGS 2012, p. 22). For the Sugarloaf area—encompassing parts of Erwin Meadow—USGS reported both subsidence and uplift between 1993 and 2005; the results suggested that deformations in this area were elastic (recoverable) (USGS 2012, p. 22).

The 2012 USGS report provides new information about land subsidence or uplift near some *Taraxacum californicum*-occupied meadows, but we do not have new information about altered hydrology at specific occurrences, or about impacts to the species. Therefore, the new information in USGS (2012) does not alter the conclusions of our 2008 and 2013 5-factor analyses (USFWS 2008, p. 10; USFWS 2013, pp. 11–12).

Off-highway vehicles

We have two reports of unauthorized OHV use in *Taraxacum californicum* habitat since 2013. Both incidents occurred at Metcalf Meadow (CNDDB EO 16).

1. In 2017, unauthorized OHV use caused damaged to Metcalf Meadow. During saturated conditions in April 2017, two vehicles trespassed into Metcalf Meadow (Hook 2017, unpaginated). A subsequent damage assessment indicated severe damage and ruts over about 2.97 ac (1.2 ha) of the meadow (Hook 2017, unpaginated).

2. Damage to Metcalf Meadow was also noted in 2018 (Krantz 2018, pers. comm.). The area has been fenced since that time (Krantz 2018, pers. comm.).

At the Baldwin Lake Ecological Reserve (CNDDB EO 17), California Department of Fish and Wildlife (CDFW) staff observed no evidence of OHV trespass or damage during surveys between 2015 and 2017 (CDFW 2018, p. 16). However, because of the damaged fence line along Highway 18, the meadow area is considered vulnerable to unauthorized OHV use (CDFW 2018, p. 7).

Fire suppression measures

In the 2013 5-year review, we discussed fuel zone maintenance and effects to *Taraxacum californicum* individuals (USFWS 2013, pp. 27–28). This section describes fire suppression activities and coordination since 2013.

In 2015, the Lake Fire burned approximately 31,359 acres (ac) [12,691 hectares (ha)] in the San Bernardino Mountains (USFS 2015, p. 2). USFS initiated emergency section 7 consultation with us, and prepared a Biological Assessment (USFS 2015, entire). Four occupied meadows were either burned by the fire, or were affected by suppression activities, or both (USFS 2015, pp. 7, 52, 55–56, 61–62, 64–66, 68). The areas burned and suppression activities were:

1. Cienega Seca (CNDDB EO 2) was used as a helispot for personnel and cargo transport, and for water dipping. Some trampling and compaction of meadow vegetation occurred due to suppression activities (USFS 2015, p. 52).

2. At Horse Meadow (CNDDB EO 5), meadow edges and some small spots in the meadow burned, but vegetation was regenerating during return visits 1 to 2 weeks later. There were minor, short term effects to the meadow from suppression activities (USFS 2015, pp. 55–56).

3. South Fork Meadows (CNDDB EOs 1 and 3) burned during the Lake Fire, but no suppression-related activities occurred at this meadow (USFS 2015, pp. 61–62).

4. Fish Creek Meadows (CNDDB EO 6) burned during the Lake Fire, no suppression-related activities occurred at this meadow (USFS 2015, pp. 64–66).

In 2016, CDFW and USFWS staff and local stakeholders met with local fire officials to identify areas with state and federally listed plants, with a focus on Metcalf Meadow (Brandt 2016, pers. comm.; Brandt 2017, pers. comm.).

Finally, in 2017, the Holcomb Fire burned 1,503 ac (608 ha) in the San Bernardino Mountains northeast of Baldwin Lake (USFS 2017, p. 6). The fire did not burn any areas occupied by *Taraxacum californicum*, but did burn 5.21 acres of *T. californicum* critical habitat (USFS 2017, pp. 23–24). USFS initiated emergency section 7 consultation with us for 11 species, including *T. californicum* (USFS 2017, p. 3). USFS determined that:

1. Fire suppression activities did not affect any mapped *Taraxacum californicum* occurrences, and post-fire Burned Area Emergency Response (BAER) treatments (i.e., fencing) were expected to be beneficial (USFS 2017, pp. 23, 28).

2. Fire suppression activities (hand and dozer line) and suppression repair did affect *Taraxacum californicum* critical habitat. BAER treatments were expected to be beneficial because they reduce incursions and allow vegetation recovery (USFS 2017, pp. 23, 28).

During 2019 Eagle Point surveys, CDFW botanists communicated with a local resident, who informed surveyors that annual mowing—within about a 20-foot buffer of surrounding homes—occurs around the perimeter of the meadow (Burton 2019, unpaginated). We do not have reports of whether mowing has directly affected *Taraxacum californicum* plants.

Nonnative plants

In 2013, we discussed competition with other plant species—including native and nonnative plants—as a threat to *Taraxacum californicum* (USFWS 2013, pp. 17–18). Since 2013, we've received new information about nonnative plants at the Baldwin Lake Ecological Reserve.

Over 3 years of monitoring at the Reserve, CDFW identified three nonnative species: *Bromus tectorum* (cheatgrass), *Ranunculus testiculatus* (curveseed butterwort), and *Lepidium perfoliatum* (clasping pepperweed). They recommended that nonnative plant invasions be further monitored, and that weed removal efforts be implemented (CDFW 2018, pp. 5, 16).

Taraxacum californicum has not been observed at North Baldwin Meadow since 2000, so it is unclear whether nonnative plants at the Reserve are impacting *T. californicum* individuals. We have no new information about nonnative species at other *T. californicum* occurrences.

Climate change

The term "climate change" refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2013, p. 1450). Downscaled projections under several future climate scenarios are available for the southern California mountains, including across the range of *Taraxacum californicum*.

Temperature changes

The San Bernardino Mountains have already experienced a warming trend from 1951 to 2006 (PRISM Group 2007, pp. 2–10; Hall *et al.* 2018, p. 9). Cal-Adapt models project increases in annual average maximum and minimum temperatures in the 21st century, compared to observed historical temperatures (Table 4). Between 2070 and 2099, annual average maximum temperatures are projected to increase by 5.98 degrees Fahrenheit (F) [3.32 degrees Celsius (C)] under RCP 4.5, and by 8.77 degrees F (4.87 degrees C) under RCP 8.5 (CEC 2019, unpaginated) (Table 4). The frequency, duration, and intensity of heat waves is also expected to increase (Hall *et al.* 2018, p. 12; Kalansky *et al.* 2018, p. 21).

Precipitation changes

Climate change has already altered, and will continue to alter, the water cycle. Changes in the water cycle include: 1) changes in precipitation patterns and intensity; 2) changes in the incidence of drought; 3) widespread melting of snow and ice; 4) increasing evaporation; and 5) changes in soil moisture and runoff (USCGRP 2009, p. 41).

Precipitation in southern California is highly variable from year to year (Kalansky *et al*. 2018, p. 24; Hall *et al.* 2018, p. 12). Models of future precipitation generally project small mean changes relative to historical variability, and the overall direction of future precipitation is unclear (Hall *et al.* 2018, p. 13). Models project increases in extreme precipitation frequency and intensity (Polade *et al.* 2017, p. 7; Swain *et al.* 2018, p. 428), including increases in the frequency of atmospheric-river storms, which deliver intense precipitation and can cause severe flooding (Dettinger 2011, p. 519). However, droughts are also projected to become more frequent and intense, and will be exacerbated by higher temperatures (Kalansky *et al.* 2018, p. 25).

In Big Bear Valley (San Bernardino Mountains), average annual precipitation ranges from about 18 to 35 inches. Due to a rain shadow effect, precipitation generally decreases from west to east across the valley (USGS 2012, p. 4). Therefore, the effects of changing precipitation amount and timing will also likely differ at a relatively small scale in the San Bernardino Mountains.

Table 4. Projected annual average maximum and minimum temperatures for the range of *Taraxacum californicum* in the San Bernardino Mountains.[1]

Climate variable	Year range	RCP 4.5 projected annual average temperature (degrees F ± standard deviation)	RCP 8.5 projected annual average temperature (degrees F ± standard deviation)
Maximum temperature	1950–2005 (historical)	63.29 ± 1.32 °F	63.29 ± 1.32 °F
Maximum temperature	2040–2069	67.97 ± 1.46 °F	69.47 ± 1.71 °F
Maximum temperature	2070–2099	69.27 ± 1.23 °F	72.06 ± 1.76 °F
Minimum temperature	1950–2005 (historical)	33.93 ± 1.01 °F	33.93 ± 1.01 °F
Minimum temperature	2040–2069	38.38 ± 1.13 °F	39.77 ± 1.68 °F
Minimum temperature	2070–2099	39.49 ± 0.99 °F	43.11 ± 1.78 °F

[1] The values are the average of projections from four priority models (MIROC5, CanESM2, HadGEM2-ES, and ENRM-CM5) over a mid-century time period (2040–2069) and an end-of-century time period (2070–2099). Data from Cal-Adapt (CEC 2019, unpaginated).

Snowpack changes

Warming trends have already driven declines in mountain snowpack across the western United States (Mote *et al.* 2018, p. 4). Snowpack is affected by temperature and precipitation. In a warmer climate, a higher proportion of precipitation is expected to fall as rain rather than snow, and snowpack is expected to melt earlier and more quickly (Viers *et al.* 2013; Dettinger *et al.* 2018, p. 21). Snow lines are also expected to rise (Dettinger *et al.* 2018, p. 21).

Sun *et al.* (2016) used downscaled general circulation models under two scenarios to predict future snowfall and snowpack in the southern California mountains. Their models included the San Bernardino, San Jacinto, and Los Angeles County Mountains. They projected that under RCP 8.5, midcentury mean snowfall would be 30 percent lower than baseline snowfall, and that snowfall loss would be greatest at lower and mid-elevations (Sun *et al.* 2016, pp. 106–107). Projections of timing of snow-free date (i.e., how much earlier snow melts compared to baseline) differed depending on the model used, but on average, the snow-free date occurred 16 days earlier (Sun *et al.* 2016, p. 108).

In addition to the projections of Sun *et al.* (2016, entire), projected changes in snow water equivalence (the amount of water contained in snowpack) are available from Cal-Adapt. For the range of *Taraxacum californicum* in the San Bernardino Mountains, Cal-Adapt models project reductions in snow water equivalence in the 21st century compared with historical baseline (CEC 2019, unpaginated) (Table 5).

Table 5. Projected February snow water equivalence (SWE) for the range of *Taraxacum californicum* in the San Bernardino Mountains.[1]

Year range	RCP 4.5 (inches ± standard deviation) projected February SWE	RCP 8.5 (inches ± standard deviation) projected February SWE
1950–2005 (observed)	2.69 ± 2.94	2.69 ± 2.94
2040–2069	1.69 ± 2.25	1.54 ± 2.25
2070–2099	1.40 ± 1.87	0.93 ± 1.20

[1] The values are the average of projections from four priority models (MIROC5, CanESM2, HadGEM2-ES, and ENRM-CM5) over a mid-century time period (2040–2069) and an end-of-century time period (2070–2099). Data from Cal-Adapt (CEC 2019, unpaginated).

Snowpack provides groundwater recharge and streamflow to montane meadows (Viers *et al.* 2013, p. 11), and both factors could be affected by earlier runoff and reductions in snowpack. Precipitation in the form of rain runs off much more quickly than snow, and these increased but intermittent stream flows could alter meadow channel morphology and affect streambank stability (Viers *et al.* 2013, p. 11).

Potential effects of climate change on *Taraxacum californicum*

The effects of climate change on *Taraxacum californicum* and its habitat have not been directly studied. However, the projected abiotic pressures resulting from climate change—increased temperature, changes in precipitation, and reduced snowpack and earlier runoff—could alter the hydrology of meadow habitat occupied by *T. californicum*. Changing hydrology could cause shifts in plant communities (Debinski *et al.* 2010, entire), and make meadows more vulnerable to other impacts.

In Big Bear Valley (San Bernardino Mountains), total precipitation decreases from west to east across the valley (USGS 2012, p. 4), and the percentage of total precipitation as snowfall also varies depending on location within the valley (USGS 2012, p. 74). Therefore, the effects of future precipitation and snowpack changes will likely vary by meadow. However, changing precipitation type, amount, and timing could impact individual *Taraxacum californicum* at all life stages by reducing the amount of water available for germination, growth, and reproduction.

Climate change summary and conclusion

For this 5-year review, we discussed projections from Sun *et al.* (2016, entire), reports from California's Fourth Climate Change Assessment (Hall *et al.* 2018, entire; Kalansky *et al.* 2018, entire; Pierce *et al.* 2018, entire), and data from CalAdapt (CEC 2019, unpaginated). These models provide projections of future temperature, precipitation, and snowpack in the southern California mountains under two emissions scenarios (RCP 4.5 and 8.5).

Since 2013, new climate projections are available for the range of *Taraxacum californicum*, but we do not have new information about the potential effects of those changes to the species.

Increasing temperatures, combined with greater precipitation extremes and earlier runoff, could cause drier conditions in montane meadow habitat, potentially decreasing *T. californicum* population resiliency.

Consultation on ongoing USFS activities

In 2019, we issued a biological opinion for the ongoing activities affecting 12 mountain plant species on the San Bernardino National Forest, including *Taraxacum californicum* (USFWS 2019, entire). We discussed the general effects of nine USFS management programs on listed plants (USFWS 2019, pp. 18–26), and specific effects to *T. californicum* (USFWS 2019, pp. 87–92).

We determined that the implementation of the USFS Revised Land Resource Management Plan (USFS 2006, entire) was not likely to jeopardize the continued existence of *Taraxacum californicum* (USFWS 2019, p. 92). We reached that conclusion because:

1. USFS has developed a Meadow Habitat Management Guide, which describes specific management strategies to promote recovery of montane meadow plants, and is consistent with the recovery plan for *T. californicum*.

2. USFS will avoid and minimize impacts from management activities (USFWS 2019, p. 92). To avoid and minimize those impacts, the biological opinion incorporated multiple protective measures (USFWS 2019, pp. 9–12), in addition to measures already being implemented by USFS (USFWS 2019, Enclosure).

Summary of threats

Since the 2013 5-year review, we received new information about ongoing threats at 12 *Taraxacum californicum* occurrences. The new information relates to the threats of 1) development, 2) altered hydrology, 3) fire suppression, 4) nonnative plants, and 5) climate change. However, the new information does not alter the analysis or conclusions of our 2013 5-year review.

CONCLUSION

In the 2013 5-year review, we recommended no status change for *Taraxacum californicum.* Since 2013, we've received new survey and monitoring information, as well as some new information about threats to *T. californicum*. We updated the status of 26 occurrences based on the new information. There are currently 42 occurrences of *T. californicum* (Table 1) with 17 extant, 19 presumed extant, 4 possibly extirpated, and 2 extirpated. Between 2013 and 2021, the maximum count of plants across all occurrences was 459 (Table 1).

The new information and updated occurrence status, plant abundance, and threats does not substantially alter the species' status or the results of our 5-factor analysis in the 2013 5-year review. Therefore, we conclude that *Taraxacum californicum* remains a federally endangered species.

RECOMMENDATIONS FOR FUTURE ACTIONS

1. Continue to collect additional seed from *Taraxacum californicum* occurrences to expand the *ex-situ* conservation seed bank at the California Botanic Garden (formerly Rancho Santa Ana Botanic Garden).

2. Study *Taraxacum californicum* population genetics, including levels of genetic diversity and differentiation within and among occurrences, and levels of inbreeding, relatedness, and ploidy. This information will allow us to assess levels of current genetic diversity and gene flow, assess whether genetic management is needed, and assess appropriate seed sources for potential future reintroduction or augmentation activities.

3. Develop a propagation protocol for *Taraxacum californicum* to support potential future augmentation or reintroduction activities.

4. Coordinate with landowners to identify opportunities for conservation on private lands. Work with private landowners, local governments, and conservation organizations to conserve, manage, and enhance habitat for *Taraxacum californicum.*

5. Continue to monitor *Taraxacum californicum* occurrences to update occurrence status, size, and threats. That information can be used to identify high-priority occurrences for management or areas for restoration.

6. Monitor meadow hydrological conditions and identify opportunities for meadow restoration.

7. Identify opportunities for *Taraxacum californicum* augmentation to meadows where occurrence size is small.

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