Notice of Petition

For action pursuant to Section 670.1, Title 14, California Code of Regulations and Division 3, Chapter 1.5, Article 2 of the California Fish and Game Code (Sections 2070 et seq.) relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED

Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*)

II. RECOMMENDED ACTION

Listing as threatened

This petition is to list the Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) as threatened pursuant to the California Endangered Species Act (California Fish and Game Code Sections 2050 et seq.: CESA). This petition demonstrates that the Red Bluff dwarf rush is eligible for and warrants listing under CESA based on the factors specified in the statute and its implementing regulations. A "threatened species" is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts ..." (California Fish and Game Code Section 2067).

The attached information supporting this petition provides sufficient information to demonstrate that the listing of Red Bluff dwarf rush as a threatened species under CESA clearly may be warranted, i.e., the amount of information presented would lead a reasonable person to conclude that there is a substantial possibility that listing could occur.

I respectfully request the Department of Fish and Wildlife and the Fish and Game Commission make such recommendations and findings pursuant to their respective authorities (California Fish and Game Code Sections 2073.5 and 2074.2).

III. AUTHOR OF PETITION

John C. Hunter, Ph.D.

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: Date: August 29, 2025

Supporting Information for Red Bluff Dwarf Rush (*Juncus leiospermus* var. *leiospermus*) Petition to the California Fish and Game Commission

Prepared by John C. Hunter, Ph.D.

August 29, 2025

Executive Summary

This document provides the scientific information required by California Fish and Game Code Section 2072.3 to demonstrate that adding Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) to the list of threatened species under the California Endangered Species Act (CESA) may be warranted.

Population Trend. Red Bluff dwarf rush is believed to have declined substantially and to have a downward trend because of loss and degradation of occupied habitat.

Range. The range of Red Bluff dwarf rush encompasses approximately 12,138 square kilometers (4,687 square miles) at 35–1,250 meters (115–4,100 feet) in elevation in Butte, Placer, Shasta, and Tehama counties. (However, the single disjunct occurrence of Red Bluff dwarf rush in Placer County may be a misidentification.)

Distribution. Within its range, Red Bluff dwarf rush has 62 documented occurrences (occupied sites) in the California Natural Diversity Database (CNDDB). Four of these occurrences are likely extirpated.

Abundance. Counts of plants have been recorded for 40 occurrences and range from one to more than 100,000 plants, with most occurrences having more than 1,000 plants in at least some years. The area of occupied habitat can also be a useful indicator of abundance and it is estimated to be less than 336 hectares (831 acres).[1]

Life History. Red Bluff dwarf rush is an annual grass-like plant in the Juncaceae (the rush family).

Kind of Habitat Necessary for Survival. Red Bluff dwarf rush grows primarily in vernal pools and grasslands, but also occurs in woodlands and meadows and seeps, typically in mesic and sparsely vegetated areas.

Factors Affecting the Ability to Survive and Reproduce. Twelve different threats to occurrences have been recorded in the CNDDB, and climate change is also a range-wide threat. The primary threats are from agricultural and developed land uses, invasive plants, and climate change.

Degree and Immediacy of Threat. Without protective measures, there is a moderate to high likelihood that Red Bluff dwarf rush will be extirpated from much of its range or become extinct because:

- Ongoing threats have already eliminated or substantially degraded approximately one-third of documented occurrences, threaten most occurrences, and the severity of some threats is increasing.
- More than half of the species' occurrences are small in area or fragmented, which increases their vulnerability to extirpation from random events and human actions.
- Most sites occupied by Red Bluff dwarf rush are unprotected and not managed for its conservation, which leaves the species highly vulnerable to extirpation at most sites.

Impact of Existing Management Efforts. To date, management of Red Bluff dwarf rush has been very limited. It has no legal protections that mandate contributions to its recovery or full mitigation of impacts, only a portion of its known occupied habitat has been preserved, more than half of its occurrences have not been recently surveyed, and research has not been conducted on its ecology.

Suggestions for Future Management. Suggestions for future management include listing Red Bluff dwarf rush as threatened under CESA and conserving its remaining occurrences. Fifteen suggestions are provided for future management actions.

References and a **detailed distribution map** are also provided.

[1] Estimate is the sum of (1) the acreage of specific occurrences and (2) the number of nonspecific occurrences multiplied by the average acreage of specific occurrences. This is an overestimate and includes some areas that are now in developed or agricultural land cover. Estimate does not include occurrences that have likely been extirpated.

The scientific information in the following sections demonstrates that adding Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) to the list of threatened species under the California Endangered Species Act (CESA) may be warranted.

Based on much of the same information, NatureServe, in collaboration with the California Department of Fish and Wildlife (CDFW) and the California Native Plant Society (CNPS), has concluded that Red Bluff dwarf rush is imperiled. Similarly, CNPS, in collaboration with CDFW, has concluded that it is rare or endangered and seriously threatened (CNPS 2025; CDFW 2024a).

NatureServe defines “Imperiled” (Global Conservation Status 2 [G2]) as being at high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors (NatureServe 2012a). NatureServe designates species as G2 based on a score calculated from variables whose values are determined in collaboration with CDFW and CNPS (NatureServe 2012b).

CNPS and CDFW define the rank of “rare or endangered” (California Rare Plant Rank [CRPR] 1B) as plant species which are rare, threatened, or endangered in California and elsewhere (CNPS 2024, CDFW 2024a). These plant species are rare throughout their range, with the majority, like Red Bluff dwarf rush, also being endemic to California. Most of the plant species that are CRPR 1B have declined significantly over the last century. CNPS has concluded that a subset of CRPR 1B plant species (rank 1B.1) is “seriously threatened in California” (the highest level of threat) because over 80 percent of their occurrences are threatened or the species otherwise has a high degree and immediacy of threat (CNPS 2024). CNPS uses staff botanists and a committee of agency, academic, other professional, and amateur botanists to assign and periodically reevaluate these rankings in collaboration with CDFW. Please note that CDFW identifies all CRPR 1B species as taxa that may meet the requirements for CESA listing (CDFW 2024a).

To make their conclusions, CNPS and NatureServe use the best available scientific information regarding population trend, range, distribution, abundance, life history, habitat, threats, and management efforts, much of which CDFW has compiled in the California Natural Diversity Database (CNDDB) (CDFW 2024b).

To provide sufficient scientific information to support this petition, a summary of the relevant information compiled, maintained, and distributed by CDFW, CNPS, and NatureServe is provided below; this information is augmented by information from:

- Datasets developed and maintained by the California Consortium of Herbaria (CCH), California Governor’s Office of Land Use and Climate Innovation, California Invasive Plant Council (Cal-IPC), GreenInfo Network (GIN), and U.S. Geological Survey (USGS)
- Aerial imagery
- Scientific and other technical literature
- Scientists and other knowledgeable individuals

Information regarding each topic required by California Fish and Game Code Section 2072.3 is provided in a separate section below in the same order as in the code.

A. Population Trend

Information available from the CNDDB (CDFW 2024b) and land cover mapping (USGS 2021) indicates that Red Bluff dwarf rush has a decreasing population trend because of loss and degradation of occupied habitat at 29 or more of the 62 sites where the species has been observed (occurrences or occupied sites).[2,3]

CNDDB records that indicate a decrease include:

- Four occurrences where the species is extirpated or possibly extirpated (Occurrences 2, 5, 20, and 39)
- 12 occurrences where the species was not observed during the most recent site visit or where a decreasing population trend or poor or only fair population viability has been noted (Occurrences 1, 10, 27, 28, 31, 36–38, 40, 50, 51, and 65)[4]

Land cover mapping that indicates a decrease includes:

- Three occurrences where the species has likely been extirpated—the entire mapped area of these occurrences has been converted to agricultural and developed land cover (Occurrences 2, 20, and 39, all of which are classified as possibly extirpated or extirpated in the CNDDB.
- 16 occurrences with likely degradation or loss of habitat—these are precisely located (specific) occurrences, presumed extant in the CNDDB, that have a portion of their mapped area in agricultural or developed land cover (Occurrences 6, 13, 15, 21–25, 27, 28, 37, 43, 45, 48, 49, and 68). The portion of these occurrences in agricultural or developed land cover ranges from less than one percent to 81 percent, i.e., direct loss of from very little to most habitat. (In the CNDDB, three of these occurrences are noted as having poor viability, one of which also was not seen during the last site visit.)

In addition, degradation and loss of habitat at other occurrences may also contribute to the decreasing population trend. At these sites, degradation and loss of occupied habitat that is not documented by land cover mapping or in the CNDDB may be resulting from site-specific threats (e.g., incompatible grazing practices), range-wide threats (e.g., climate change), and nearby agricultural and developed land uses.

Furthermore, extensive, range-wide historical and ongoing human-caused changes to vernal pool landscapes and other vegetation types providing its habitat suggest that Red Bluff dwarf rush has

[2] An occurrence (also referred to as an element occurrence) is a specific location where a plant included in the CNDDB (a plant element) has been known to occur, and that has practical conservation value. In general, any location with an observation of the plant will be turned into an occurrence since the location a plant is found is also where reproduction and important life history events take place (CDFW 2020).
[3] USGS land cover mapping is more recent than most information in CNDDB and is described further in Section G, "Factors Affecting the Ability to Survive and Reproduce (Threats)."
[4] Viability is as noted in CNDDB's "Occurrence Rank" field (i.e., overall condition or viability). The occurrence rank fields are Unknown, Poor, Fair, Good, or Excellent, and are based on observed quality of habitat and condition of the population at that location.

had additional, undocumented habitat losses, population reductions, or both. These human-caused changes not only include conversion of natural lands to agricultural and developed land and disturbance by a greatly increased human population, but also the introduction of livestock and invasive plant species, and the alteration of hydrology (Burcham 1957, Fluet-Chouinard et al. 2023 [see Figure 3], Garone 2011, Minnich 2008, Seabloom et al. 2006). Most of these changes occurred before the distribution of Red Bluff dwarf rush was well documented and thus their impacts on Red Bluff dwarf rush are undocumented but were likely substantial. For example, vernal pool landscapes are the most important habitat for Red Bluff dwarf rush and an estimated 60–90 percent of vernal pool landscapes were lost in the 19th and 20th centuries (Solomeshch et al. 2007) and remaining vernal pool landscapes continue to be converted to agricultural and developed land uses (Holland 2011, Witham 2021).

B. Range

Red Bluff dwarf rush is a California endemic whose range encompasses portions of the Inner North Coast Ranges, Cascade Range Foothills, northern Sierra Nevada Foothills, northern Sacramento Valley, and Modoc Plateau (Zika 2015a). Its range comprises approximately 12,138 square kilometers (4,687 square miles) in Butte, Placer, Shasta, and Tehama counties at 35–1,250 meters (m) (115–4,100 feet [ft]) in elevation (CDFW 2024b, CNPS 2025).[5] However, the one disjunct occurrence in Placer County (Occurrence 10) may be a misidentification (CDFW 2024b), and if so, the species' range would be less extensive.

As calculated, this range is comparable to the "extent of occurrence" (EOO) that is used by the International Union for the Conservation of Nature (IUCN) as an indicator of extinction risk (IUCN 2024, Bachman et al. 2011).[6] The rationale for using EOO as an indicator of extinction risk is that many human-caused threats and natural events are more likely to cause similar effects at sites that are closer together than those further apart.

C. Distribution

Red Bluff dwarf rush is known from 62 occurrences that were documented between 1894 and 2015 (CDFW 2024b). Eight of these (13 percent) are "nonspecific" occurrences, whose location and boundaries are not precisely known.

Although Red Bluff dwarf rush grows in habitats that are of limited extent within the species' range, it is an inconspicuous plant, and likely occupies some additional, undocumented sites. These undocumented sites would likely be unprotected because most preserved sites have been surveyed for the species, and undocumented sites would likely be exposed to similar threats

[5] The extent of the species' range was calculated as the minimum convex polygon encompassing all occurrences documented in the CNDDB, including extirpated occurrences and occurrences with nonspecific locations.
[6] The IUCN consists of approximately 1,400 governmental and non-governmental organizations from more than 170 countries.

because most remaining vernal pool habitat is exposed to these threats (U.S. Fish and Wildlife Service [USFWS] 2005).

The species' distribution is mapped in Section L, "Detailed Distribution Map."

D. Abundance

The number of Red Bluff dwarf rush plants varies substantially among sites and years. During 1987–2006, counts of plants were recorded for 40 of the 59 occurrences that are presumed extant in the CNDDB (CDFW 2024b). These counts ranged from two to more than 100,000 plants with 10 occurrences having counts of only 2–100 plants recorded in at least one year (Occurrences 17, 21, 31, 36, 38, 40, 47–49, and 65).

At several occurrences, counts were recorded for more than one year, with the number of observed plants varying 18-fold or more among years. For example, at Occurrence 17, 50 plants were counted in 1991, none in 1998, and 900 in 2003. These differences primarily represent changes in the number of plants but also may reflect differences among observers and in the visibility of plants (e.g., counts made at the peak of flowering will typically be more complete than those made at other times).

Because recent, range-wide, multi-year monitoring of Red Bluff dwarf rush has not been conducted, a rigorous estimate of the total number of plants cannot be made. In general, however, the size of annual plant populations can be difficult to estimate because of seasonal and interannual fluctuations in numbers.

In contrast, the area of occupied habitat is less problematic to estimate and can be a useful indicator of abundance. The mapped area of CNDDB occurrences represents the maximum extent of occupied habitat because (1) it encompasses all occupied habitat that has been documented, and (2) only a portion of it is occupied.[7] For Red Bluff dwarf rush, specific occurrences (which have precisely mapped locations) have an average size of approximately 6 hectares (14 acres) and a range of <1–52 hectares (<1–127 acres), with nearly half having an area of approximately 2 hectares (5 acres) or less (CDFW 2024b).[8] Assuming that "nonspecific occurrences" (which have only

[7] There are both ecological and methodological reasons why the species does not occupy the entire mapped area of an occurrence. Species only occupy areas to which their seed disperse and that are suitable for germination, growth, and survival, and for rare species such areas may account for only a small portion of an "occupied" site. Also, in CNDDB, even specific occurrences include areas of nonhabitat. For example, many specific occurrences are point locations buffered by 80 m (262 ft), and the resulting 2-hectare (5-acre) area is usually much larger than the area occupied by the species. Furthermore, occupied sites documented in CNDDB often have not been visited by a botanist for more than 20 or 20 years (or even longer), and during that time interval, habitat loss may have occurred.

[8] Occurrences with a mapped area less than approximately 2 hectares (5 acres) are 2, 15, 17–21, 23–25, 31, 36, 38, 40, 41, 44, 47, 49–51, 56, 57, 60, 61, 63, and 64–66. Occurrences 2 and 20 have likely been extirpated.

imprecisely mapped locations) are of comparable size, the total extent of habitat occupied by Red Bluff dwarf rush would be less than 336 hectares (831 acres).[9]

As calculated, area of occupied habitat is similar to "area of occupancy" (AOO) that is used by the IUCN as an indicator of extinction risk (IUCN 2024).[10] The rationale for using AOO as an indicator of extinction risk is that species occupying more or larger areas are less likely to have all occupied areas affected by a specific threat than a species occupying fewer, smaller areas. Also, there is a generally positive relationship between AOO and population size.

E. Life History

This section provides the species' nomenclature, a description of its morphology, and a summary of available relevant information on its reproduction and growth.

Nomenclature and Taxonomy

The Jepson eFlora currently recognizes *Juncus leiospermus* F.J. Herm. var. *leiospermus* as the scientific name of Red Bluff dwarf rush (Jepson Flora Project 2024).

Species Description

Red Bluff dwarf rush is in the Juncaceae (the rush family). Below is a description of its morphology based on the treatment of the taxa in the Jepson eFlora (Zika 2015a).

- Habit— Red Bluff dwarf rush, is a small annual plant that grows in dense tufts (cespitose). The plant exhibits a color range from pale to reddish-brown, depending on its developmental stage and environmental conditions.
- Stem—the stems are slender and emerge from the dense tufts, supporting the inflorescences and flowers. The overall appearance of the plant is compact and tufted, characteristic of many rush species.
- Leaf—while specific details on the leaves are not provided in the source description, as with many Juncus species, the leaves are likely reduced, basal, and inconspicuous compared to the stems and flowers.
- Inflorescence and Flower—the inflorescence consists of 2 to 7 flowers per stem. Each flower is bisexual (containing both male and female reproductive organs) and radially symmetrical (having circular symmetry). The sepals and petals are similar in appearance, persistent (remaining on the plant after flowering), and scale-like. In some instances, the petals may be slightly longer than the sepals.

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[9] Specifically, the combined area was estimated for occurrences not likely to be extirpated using the mapped area of specific occurrences and assuming that the area of each nonspecific occurrence was equal to the average area of specific occurrences (extant and extirpated).
[10] IUCN guidelines are to calculate AOO using presence in cells of a grid of 4 kilometer^2 (1.5 mile^2) cells, which is a coarser scale than used here (IUCN 2024).

  - Stamens—there are 3 to 5 stamens per flower, with filaments much shorter than or equal to the length of the anthers.
  - Pistil—there is a single pistil, with a superior ovary (positioned above the attachment of other floral parts) and a three-parted stigma.
- Fruit—the fruit is a capsule that is loculicidal (splitting open when mature to release the seeds). The capsule is either spherical or oblong in shape and generally larger than the perianth (the combined sepals and petals). The fruit is the same color as the perianth and contains 3 to 5 chambers.
- Seed—the seeds are numerous, ovoid (egg-shaped), and measure 0.03 to 0.04 cm (0.012–0.016 inches) in length. The seeds are not striate (do not have fine lines) and may have minute appendages or occasionally one prominent appendage

Similar Species

Red Bluff dwarf rush is one of two varieties of *Juncus leiospermus*. The other is *Juncus leiospermus* var. *ahartii* (Ahart's rush). The most noticeable difference between these two varieties is that Ahart's rush has only one (or sometimes two) flowers per stem whereas Red Bluff dwarf rush has two to four (and sometimes up to seven) flowers per stem (Zika 2015b).

Reproduction and Growth

As noted above, Red Bluff dwarf rush is an annual grass-like plant. It blooms during March–June (CNPS 2025) and is wind pollinated. The dispersal mechanisms, seed dormancy and germination, growth, and habitat associations of Red Bluff dwarf rush have not been studied.

F. Kind of Habitat Necessary for Survival

Although nearly two-thirds of its occurrences are in vernal pool landscapes (i.e., grasslands containing vernal pools and swales), meadows and seeps, and mesic areas in woodlands and grassland also provide habitat for Red Bluff dwarf rush (CDFW 2024b, CNPS 2025). In these vegetation types, it grows on vernally mesic substrates and typically in sparsely vegetated areas with loose soil (e.g., areas disturbed by gophers) (Witham, Pers. Comm. 2025). Most co-occurring species are annual plants characteristic of vernal pools such as Great Valley popcornflower (*Plagiobothrys stipitatus*), whitehead navarretia (*Navarretia leucocephala*), and woolly-marbles (*Psilocarphus brevissimus*).

G. Factors Affecting the Ability to Survive and Reproduce (Threats)

This section describes the factors (threats) resulting from human actions that have been, or likely will be, substantially reducing the survival and reproduction of Red Bluff dwarf rush, primarily by degrading or eliminating occupied habitat.[11] Prominent range-wide threats include conversion of habitat to agricultural or developed uses, climate change, and the spread of invasive species. Each of these threats is described in a separate section below. They are not, however, the only threats affecting Red Bluff dwarf rush. Botanists have also observed other threats at specific sites that are recorded in the CNDDB (CDFW 2024b). In total, the CNDDB reports 12 different threats affecting occurrences:

- Agriculture—elimination of habitat or other adverse impacts due to agricultural development or agriculture-related activities (five occurrences)
- Altered flood/tidal/hydrological regime—alteration of the pre-existing hydrology or water flow (one occurrence)
- Dam/inundation—elimination or alteration of habitat due to the construction of a dam or berm (two occurrences)
- Development—construction of houses, businesses, and other developed land uses (22 occurrences, four of which have likely been extirpated)
- Foot traffic/trampling—trampling or disturbance by human or animal foot traffic (one occurrence)
- Grazing—incompatible grazing by livestock (ten occurrences)
- Logging—extensive removal of trees (three occurrences)
- Mining—degradation of habitat by mining activities (one occurrence)
- Off-road vehicle (ORV) activity—damage associated with motorized vehicles going off designated roads (nine occurrences)
- Other—removal of vegetation and soil by heavy equipment to create or maintain a fire break (one occurrence)
- Road/trail construction/maintenance—construction or maintenance of roads or trails (two occurrences, both of which have likely been extirpated)
- Vandalism/dumping—damage to plants or their associated habitat by vandalism or trash dumping (one occurrence)

Collectively, these threats affect the majority of sites occupied by the species, with the CNDDB documenting one or more of these threats at 61 percent of occurrences (66 percent if likely extirpated occurrences are excluded) (CDFW 2024b).

[11] Numerous factors affect the ability of a plant to reproduce, grow, and survive, including interactions with pollinators, dispersal agents, seed predators, diseases, herbivores, and fungal symbiotes; availability of habitats with suitable conditions and sufficient resources; and events such as fires that can cause mortality but also provide opportunities for establishment and growth. This section focuses on those factors resulting from human actions that have been, or likely will be, substantially reducing reproduction and survival.

When considering these data, it is important to acknowledge that the CNDDB does not fully document the threats affecting occurrences. First, threat observations have not been provided for every documented occurrence; for example, the only documentation for some sites is the label of an herbarium specimen with little or no site information. Second, threat observations are not necessarily comprehensive and are not based on a systematic assessment. Third, many CNDDB occurrence records are now decades old: only 40 percent of CNDDB records for Red Bluff dwarf rush occurrences contain threat information from the last 20 years (CDFW 2024b).[12] Therefore, threats are likely underreported in CNDDB records and may have changed at some occurrences, particularly unprotected ones, since they were last visited.

Agricultural and Developed Land Uses

Expansion of agricultural and developed land uses is a major threat to Red Bluff dwarf rush, not only because these land uses have been directly eliminating habitat, but also because they have been fragmenting and increasing threats to the remaining habitat. In fact, many types of threats listed in the CNDDB are caused primarily by nearby agricultural and developed land uses (e.g., biocides, erosion/runoff, and vandalism/dumping). Occurrences fragmented by (and those near) agricultural and developed land uses are likely being impacted through any of several mechanisms (Collinge 2009, Honnay et al. 2005, Aquilar et al. 2019, Hansen et al. 2005, Ramalho et al. 2014).

Agricultural and developed land uses have had substantial impacts on Red Bluff dwarf rush that have not been fully reported in the CNDDB. First, extensive conversion of natural vegetation to agricultural and developed uses occurred before extensive documentation of the distribution of Red Bluff dwarf rush, and thus the impacts of that land cover conversion are undocumented. Second, land cover mapping that is more recent than CNDDB mapping documents agricultural or developed land uses within the boundaries of 16 specific occurrences of Red Bluff dwarf rush that in the CNDDB are presumed to be extant and two that in the CNDDB are “possibly extirpated” (Table 1) (CDFW 2024b, USGS 2021). Agricultural and developed land uses are also within 100 m (328 ft) of another nine occurrences and development is identified in the CNDDB as a threat to another occurrence. In sum, agriculture and development have been causing loss and degradation of occupied habitat at approximately half of the sites where habitat occupied by Red Bluff dwarf rush has been precisely located (specific occurrences). Furthermore, this loss and degradation will likely continue to increase, as evidenced by more than one-third of specific occurrences of Red Bluff dwarf rush being located on sites that are partially or entirely zoned for commercial, industrial, or residential land uses (Table 1) (California Governor’s Office of Land Use and Climate Innovation 2025).

At sites where the location of occupied habitat is only imprecisely known (nonspecific occurrences), the impacts of agriculture and development on occupied habitat are uncertain but may have affected multiple sites.

In addition, most vernal pool landscapes that may have provided habitat for undocumented occurrences have been converted to agricultural and developed land uses (Solomeshch et al. 2007) and the remaining vernal pool landscapes that may still provide habitat for undocumented

[12] Based on the “Site Date” field of the CNDDB; excludes occurrences that likely have been extirpated.

occurrences continue to be converted to agricultural and developed land uses. Ongoing losses within the range of Red Bluff dwarf rush have been documented by Holland (2011) and Witham (2021).

Table 1. Loss and Degradation of Habitat Occupied by Red Bluff Dwarf Rush Caused by Agricultural and Developed Land Uses

	Agricultural-Developed Land[1]		
Occurrence Precision / CNDDB No.[2]	**Percentage of Occurrence Area (%)[3, 4]**	**Within 100 m of Occupied Habitat?**	**Notes**
Specific			
1	—	Y	Occurrence rank (viability) "fair"; development a threat in the CNDDB (1998)
2	100	Y	"Possibly Extirpated" in the CNDDB
3	—	N	Zoned exurban residential (in part)
6	5	Y	—
7	—	N	—
13	2	Y	—
15	22	Y	Development a threat in the CNDDB (1992)
16	—	Y	Agriculture a threat in the CNDDB
17	—	N	—
18	—	N	—
19	—	N	—
20	100	Y	"Possibly Extirpated" in the CNDDB
21	17	Y	Development a threat in the CNDDB; zoned commercial
22	29	Y	Development a threat in the CNDDB; zoned industrial, urban and suburban residential, and commercial and public facilities
23	20	Y	Development a threat in the CNDDB; zoned exurban and rural residential
24	24	Y	Development a threat in the CNDDB; zoned industrial
25	65	Y	Development a threat in the CNDDB; zoned industrial
27	22	Y	Occurrence rank (viability) "poor"; agriculture a threat in the CNDDB
28	81	Y	Not seen during last site visit; occurrence rank (viability) "poor"; agriculture a threat in the CNDDB
29	—	N	—
30	—	N	—
31	—	N	Not seen during last site visit; occurrence rank (viability) "fair"
32	—	N	—
33	—	Y	Along road
35	—	N	Zoned exurban residential (in part)
36	—	Y	Occurrence rank (viability) "fair"
37	8	Y	Occurrence rank (viability) "poor"; population trend "decreasing"; in 1990s, constructed impoundment eliminated approximately half of occupied habitat

Table 1. Loss and Degradation of Habitat Occupied by Red Bluff Dwarf Rush Caused by Agricultural and Developed Land Uses

	Agricultural-Developed Land[1]		
Occurrence Precision / CNDDB No.[2]	**Percentage of Occurrence Area (%)[3, 4]**	**Within 100 m of Occupied Habitat?**	**Notes**
38	—	N	Occurrence rank (viability) “fair”
40	—	Y	Occurrence rank (viability) “fair”; zoned suburban residential
41	—	Y	Portion of occurrence disked or graded in late 1990s; zoned exurban residential (in part)
43	<1	Y	Zoned urban and suburban residential
44	—	N	—
45	5	Y	Zoned residential
47	—	N	Site has been disked or farmed in two or more years during 2013–2025; development a threat in the CNDDB; zoned industrial
48	12	Y	Development a threat in the CNDDB; zoned exurban residential
49	32	Y	Zoned commercial and public facilities
50	—	N	Occurrence rank (viability) “fair”; development a threat in the CNDDB; zoned suburban residential
51	—	Y	Occurrence rank (viability) “fair”; development a threat in the CNDDB; zoned suburban and exurban residential
52	—	N	—
53	—	N	—
55	—	N	—
56	—	N	—
57	—	N	—
58	—	N	—
59	—	N	—
60	—	N	—
61	—	N	—
62	—	N	—
63	—	N	—
64	—	N	—
65	—	Y	Occurrence rank (viability) “fair”; development a threat in the CNDDB; zoned exurban residential
66	—	N	—
67	—	Y	Development a threat in the CNDDB; zoned exurban residential (in part)
68	12	Y	—
Nonspecific			—
4	—	N	—
5	26	U	“Possibly Extirpated” in the CNDDB
9	3	U	Zoned exurban residential and rural residential (in par)
10	15	U	Not seen during last site visit; potentially a misidentification; development a threat in the CNDDB; zoned industrial

Table 1. Loss and Degradation of Habitat Occupied by Red Bluff Dwarf Rush Caused by Agricultural and Developed Land Uses

	Agricultural-Developed Land[1]		
Occurrence Precision / CNDDB No.[2]	Percentage of Occurrence Area (%)[3, 4]	Within 100 m of Occupied Habitat?	Notes
12	17	U	Zoned exurban residential (in part)
39	100	Y	“Extirpated” in the CNDDB
42	13	U	—
46	<1	U	Zoned exurban residential

Sources: CDFW 2024b, California Governor’s Office of Land Use and Climate Innovation 2025, Google Earth 2025, USGS 2021

Key: CNDDB = California Natural Diversity Database, m = meters, N = no, No. = number, U = unknown, Y = yes

Notes:

[1] – Based on the 2021 National Land Cover Database (USGS 2021), which was developed from 2016 imagery.

[2] – CNDDB occurrence numbers are not necessarily sequential.

[3] – Most mapping of CNDDB occurrences predates 2016, and thus, does not account for recent changes in land cover within occurrence boundaries. When mapped, specific occurrences contain little or no agricultural or developed land uses, the primary exception being roads. When mapped, nonspecific occurrences often include agricultural or developed land uses because nonspecific occurrences do not represent the precise location of occupied habitat, but rather a larger area within which the location of occupied habitat is not precisely known.

[4] – Because of the level of precision of occurrence and land cover mapping, errors in land cover classification, and more recent changes in land cover, the extent of land cover conversion may be over or underrepresented at individual occurrences.

Climate Change

Climate change directly and indirectly threatens Red Bluff dwarf rush by altering growing conditions, water availability, and frequency and intensity of disturbances, and by altering interactions of the plant with pollinators, dispersers, fungal symbionts, seed predators, herbivores, and competitors.[13] These consequences of climate change may also magnify the impacts of other threats.

The magnitude of climate change impacts on Red Bluff dwarf rush is uncertain but may be substantial, particularly because of the species’ limited range, rarity, habitat specificity, and distribution in relatively small and isolated areas that will be exposed to dramatic changes. In an assessment of the vulnerability of 156 rare plant species, Anacker et al. (2013) classified Red Bluff dwarf rush as potentially stable to moderately vulnerable to climate change.[14] Also, vernal pools, the most important habitat for Red Bluff dwarf rush, are inherently sensitive to temperature and the timing and amount of precipitation (Pyke 2004, 2005). For this reason (and because of moderate to high exposure to climate change), the California Landscape Conservation Partnership (2017) concluded that vernal pool and swale habitats are moderately to highly vulnerable to climate change.[15] Similarly, in a state-wide assessment of the vulnerability of vegetation to climate change,

[13] CNDDB does not include climate change in its standardized list of types of threats, and therefore, in CNDDB, climate change is not identified as a threat to any species.

[14] “Vulnerability” to climate change is a product of exposure and sensitivity to changes in climate.

[15] The Central Valley Landscape Conservation Partnership included more than 40 non-governmental agencies and state and federal agencies, including the California Department of Fish and Wildlife.

Thorne et al. (2016) concluded that the vegetation types providing habitat for Red Bluff dwarf rush have a moderate to moderate-high vulnerability to climate change (Thorne et al. 2016).[16]

Invasive Species

Invasive plant species were not identified as a threat to Red Bluff dwarf rush in CNDDB records for specific occupied sites. However, invasive species are likely a significant, range-wide threat. First, nonnative, invasive species are already widespread and abundant in the grasslands and seasonal wetlands of vernal pool landscapes (Gerhardt and Collinge 2003, USFWS 2005, Cal-IPC 2025) and in other vegetation providing habitat for Red Bluff dwarf rush. Some of these species, such as rye grass (*Festuca perennis*), wall barley (*Hordeum murinum*), and hyssop loosestrife (*Lythrum hyssopifolia*), already co-occur with Red Bluff dwarf rush (CCH 2024, CDFW 2024b). Second, several dozen invasive species that substantially impact ecosystem processes and vegetation are spreading in the range of Red Bluff dwarf rush in the vegetation types that provide its habitat (Cal-IPC 2025).[17] Not only can infestations of these invasive species extirpate Red Bluff dwarf rush from sites by their direct effects on conditions or resources, but also by reducing its population size and thus making Red Bluff dwarf rush more vulnerable to extirpation from other causes (Seabloom et al. 2006, Gilbert and Levine 2013).

Invasive grasses are widespread and abundant in vernal pool landscapes, including vernal pools that provide habitat for Red Bluff dwarf rush. Their impacts on the abundance and diversity of vernal pool species are substantial and greater where livestock grazing has ceased, such as where agricultural and developed land uses have fragmented landscapes (Marty 2005, Micheals et al. 2022). (However, habitat for Red Bluff dwarf rush is damaged by moderate to high levels of cattle grazing because trampling by cattle compacts the loose soil favored by Red Bluff dwarf rush.)

H. Degree and Immediacy of Threat

Without additional management actions, there is a moderate to high likelihood that Red Bluff dwarf rush will be extirpated from much of its range or become extinct because:

- Ongoing threats have already been impacting or eliminating some occurrences of Red Bluff dwarf rush, most occurrences are threatened, and the severity of some threats is increasing.

- Many Red Bluff dwarf rush occurrences are small or fragmented, which increases their vulnerability to extirpation from random events and human actions.

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[16] Habitat types recorded in the CNPS Rare Plant Inventory are categories in the Holland vegetation classification and were matched to the corresponding categories in Thorne et al. 2016 using Holland 1986 and Sawyer et al. 2009, Appendix 3, The National Vegetation Classification Hierarchy as Applied to California Vegetation. “Moderate-high” vulnerability is used as a synonym of “mid-high” vulnerability in Thorne et al. 2016.

[17] The Cal-IPC Invasive Plant Inventory (Cal-IPC 2025) was reviewed for invasive plants in the same Jepson subregion(s) where Ferris’ milk-vetch occurs with a “high” or “moderate” impact rating that affect general vegetation types that may provide habitat for Red Bluff dwarf rush.

- Most sites occupied by Red Bluff dwarf rush are unprotected and not managed for conservation of this species, which leaves the species highly vulnerable to extirpation at most sites.

Each of these three reasons is described further in a separate section below.

Ongoing and Increasing Threats

As described previously, multiple threats have been affecting most Red Bluff dwarf rush occurrences in the CNDDB. These threats have already eliminated or degraded habitat at many of these occurrences:

- Four occurrences have likely been extirpated because:
  - they are classified as extirpated or possibly extirpated in the CNDDB, or
  - their entire mapped area has been converted to agricultural or developed land cover (Table 1) (CDFW 2024b, USGS 2021).
- Eighteen specific occurrences have likely been substantially degraded because a portion of their mapped area is in agricultural or developed land cover, or they have been disked or cultivated in more than one year since the occurrence was documented (Table 1) (CDFW 2024b, Google Earth 2025a, USGS 2021). The portion of these occurrences in agricultural or developed land cover ranges from less than one percent to 81 percent, i.e., from very little to most habitat directly lost.

Also, the viability of other occurrences may have been reduced by the effects of nearby agricultural or developed land uses, other site-specific threats (e.g., incompatible grazing practices), invasive plants, and climate change. CNDDB records suggest reduced viability for these occurrences, at nine of which the species was not observed during the most recent site visit or poor or only fair population viability has been noted (Table 1).[18]

In sum, approximately one-third of Red Bluff dwarf rush occurrences have already been eliminated or substantially degraded by the threats described in Section G, “Factors Affecting Ability to Survive and Reproduce (Threats),” and these threats are still impacting most remaining occurrences.[19] Furthermore, impacts from climate change, invasive species, and conversion of habitat to agricultural and developed land uses are likely to increase.

Small Size of Occupied Sites

Species existing at sites that are small in area and have few individuals are more vulnerable to extinction than species that occupy larger areas and have larger population sizes. Occupied sites

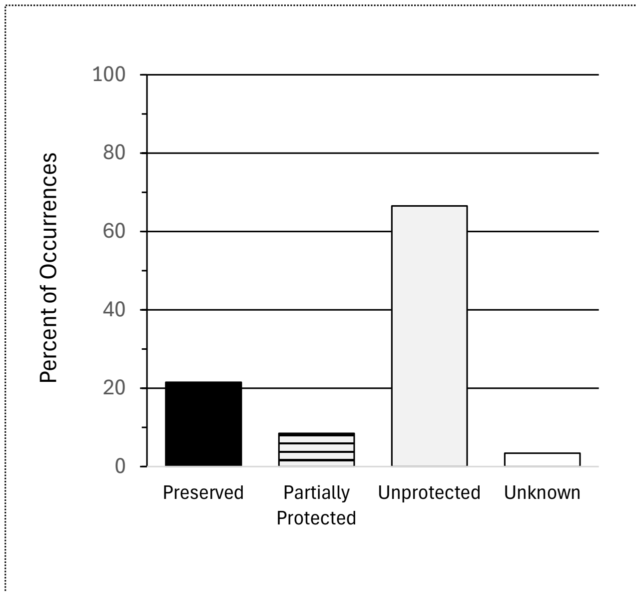
[18] Viability as noted in CNDDB’s “Occurrence Rank” field (i.e., overall condition or viability), whose categories are Unknown, Poor, Fair, Good, or Excellent. Based on observed quality of habitat and condition of the population at that location.
[19] Occurrences are considered substantially degraded if a specific occurrence and a portion of its mapped area is in agricultural or developed land cover.

that are smaller in area and have fewer individuals are more vulnerable to extirpation by random events and human actions (e.g., Matthies et al. 2004, Vörös et al. 2025).

Although Red Bluff dwarf rush's distribution has 62 occurrences (four of which have likely been extirpated), more than half of these are small or fragmented (some of which also contain relatively few individuals).[20] (See Table 1 and Section D, "Abundance.") Therefore, Red Bluff dwarf rush occurrences are highly vulnerable to extirpation from site-specific random events and human actions.

Lack of Protection and Management

Most occurrences of Red Bluff dwarf rush are unprotected. Figure 1 displays the percentages of occurrences presumed extant in the CNDDB that are preserved, partially protected (i.e., on public lands managed for multiple uses), unprotected, and have unknown protection status.[21] Sixty seven percent of occurrences of Red Bluff dwarf rush are unprotected and thus highly vulnerable (CDFW 2024b, GIN 2024a, b; Figure 1). In contrast, only 30 percent of occurrences are preserved or partially protected. At unprotected sites (and at partially protected ones), ongoing threats are rarely addressed and management actions to conserve species are rarely implemented. Consequently, unprotected occurrences of Red Bluff dwarf rush are highly vulnerable to extirpation, and because most of its occurrences are unprotected, the species is highly vulnerable to extinction.



Source: CDFW 2024b, GIN 2024a, b

Figure 1. Protection of Occurrences Presumed Extant

[20] These are Occurrences 6, 13, 15, 17–19, 21–25, 27, 28, 31, 36–38, 40, 41, 43–45, 47–49, 56, 57, 60, 61, 63–66, and 68. Sites with 100 or fewer individuals were considered to contain "relatively few" individuals; sites less than or equal to approximately 2 hectares were considered small; and specific occurrences with agricultural or developed land uses in their mapped area were considered fragmented.

[21] This is based on USGS Gap Analysis Project (GAP) codes for conservation status as mapped by GIN with "preserved" corresponding to GAP Codes 1 and 2 (areas permanently protected from conversion of natural land cover and managed for biodiversity), "partially protected" corresponding to GAP Code 3 (areas permanently protected from conversion of natural land cover but managed for multiple uses, which may include resource extraction), and "unprotected" corresponding to GAP Code 4 (GIN 2024a, b; USGS No Date). Specific occurrences mapped in two status categories were proportionally assigned to both categories. Nonspecific occurrences were considered to have unknown status unless their entire mapped area was in only one status category. Occurrences that have likely been extirpated were not included.

I. Impact of Existing Management Efforts

To date, management of Red Bluff dwarf rush has been very limited, has not sufficiently addressed the threats described in Section G, "Factors Affecting the Ability to Survive and Reproduce (Threats)," and consequently has not resulted in significant conservation of the species. Below, this management is summarized by general type of action: legal protection, preservation and seed banking, management and monitoring, restoration, and surveys and research.

Legal Protection

Red Bluff dwarf rush has no legal protections that mandate avoidance or full mitigation of impacts, consultations with regulatory agencies, or contributions to the species' recovery. It is not listed under CESA or the federal Endangered Species Act (FESA).

Red Bluff dwarf rush is, however, covered by a CESA and FESA-related conservation plan: the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan* (SJMSCP), which is a habitat conservation plan (HCP) (San Joaquin Council of Governments 2000).[22] This plan contains measures to avoid and minimize impacts to potential habitat, allows for temporary disturbance and permanent loss of some potential habitat, and mitigates that loss through preservation and management of habitat in perpetuity. Although covered by this plan, Red Bluff dwarf rush has not been documented in the plan area, and the plan area is south of the species' documented range.

Because CDFW has designated Red Bluff dwarf rush a CRPR 1B.1 species, it should be treated as a special-status species during environmental review under the California Environmental Quality Act (CEQA) (i.e., as a species that may meet the requirements for CESA listing [CDFW 2024a]). Although CEQA requires lead agencies to adopt feasible avoidance, minimization, and mitigation measures to reduce impacts of nonexempt projects, it does not require that impacts on special-status species be avoided, fully mitigated, or even reduced to a less-than-significant level (if impacts are considered significant and unavoidable).

Similarly, the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) have designated Red Bluff dwarf rush a sensitive species. Therefore, impacts on it should be considered during environmental review under the National Environmental Policy Act (NEPA), which may result in reduced impacts from actions by BLM and USFS.

Preservation and Seed Banking

Some occurrences of Red Bluff dwarf rush have been preserved: approximately 22 percent of occurrences are on land managed for biodiversity (i.e., preserved) and 8 percent are on land managed for multiple uses (i.e., partially protected) (GIN 2024a, b). However, the majority of sites occupied by Red Bluff dwarf rush remain unpreserved.

[22] HCPs allow take of species with impacts mitigated to the maximum extent practicable. All covered species are treated as if they were federally listed. Unlike NCCPs, HCPs are not mandated to contribute to the recovery of species.

Seeds of Red Bluff dwarf rush have not been collected and placed in long-term storage at a seed-banking facility (CNPS 2025, California Plant Rescue 2025).

Management and Monitoring

As described above, most occurrences of Red Bluff dwarf rush are on land that is not managed for biodiversity. However, some are on land that is managed for biodiversity or for multiple uses (CDFW 2024b, GIN 2024a, b):

- North Table Mountain Ecological Reserve managed by CDFW (Occurrences 52, 53, 55–59, 61, and 63)
- Clover Creek Preserve (an open space park) managed by the City of Redding (Occurrence 49)
- Several sites under conservation easements and managed by various government agencies and non-government organizations (Occurrences 36, 41 [in part], and 60).
- Lassen National Forest managed for multiple uses by USFS (Occurrence 3, [in part] and 29–32)
- Lands managed for multiple uses by BLM (27 and 35 [both in part])

On these lands, managers seek to maintain habitats and routinely implement measures to avoid and minimize impacts on them (for example see CDFW 2006). Habitats also may be enhanced or restored, but such actions are contingent on funding that typically is not available.

Managers also frequently monitor habitats or even species to guide their actions. However, at none of the sites occupied by Red Bluff dwarf rush is systematic, formal monitoring of the species being conducted.[23]

Restoration

Efforts have not been made to restore or create habitat specifically to expand or reestablish Red Bluff dwarf rush occurrences.[24] However, in recent decades, as part of mitigation to offset the destruction of natural vernal pools by projects, many project proponents have created vernal pools (Witham 2021) some of which could potentially provide habitat for Red Bluff dwarf rush. The acreage of vernal pools being created, however, is much less than the acreage of natural vernal pools lost to agriculture and development (Witham 2021).

Surveys and Research

Surveys have not been conducted to confirm the continued existence of Red Bluff dwarf rush at all previously documented sites, more than half of which have not been surveyed by a botanist during the past 20 years (CDFW 2024b, CNPS 2025). Surveys also have not been conducted to more

[23] Based on a review of publicly available information.
[24] Based on a review of publicly available information.

precisely map the location of the six nonspecific occurrences that are presumed extant, the locations of which have not been precisely documented.

Furthermore, range-wide surveys of potential habitat have not been conducted to determine if additional, undocumented populations exist. (However, within the species' range, many localized botanical surveys have been conducted [e.g., for planning and permitting of specific projects].)

Research has not been conducted on the species' genetic diversity, pollination, dispersal, establishment, growth, mortality, interactions with other species, population dynamics, habitat requirements, or other aspects of its ecology.[25] Consequently, understanding of the species' ecology is based primarily on observations by botanists and understanding of the ecology of related and similar species.

J. Suggestions for Future Management

Successful conservation of Red Bluff dwarf rush requires additional legal protection, preservation and seed banking, management and monitoring, restoration, and surveys and research. Many of these actions are described in USFWS' *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005), and suggestions for each of these general types of management actions are provided below.

Legal Protection

- List the species under CESA and prepare a recovery plan pursuant to California Fish and Game Code Section 2079.1.
- Include Red Bluff dwarf rush as a focal species in any regional conservation investment strategy (RCIS) and as a covered species in any NCCP developed within its range.

Preservation and Seed Banking

- Preserve occupied sites in perpetuity with an emphasis on sites with the largest, most intact areas of habitat containing the largest populations of the species.
- Collect seed and place it in long-term storage at a seed-banking facility associated with the Center for Plant Conservation.

Management and Monitoring

- Develop and implement site-specific management plans for ensuring the long-term viability of Red Bluff dwarf rush populations. These plans should include practices for monitoring, criteria for evaluating management, and potential management actions.
- Manage extant populations to prevent the spread of invasive species and to eradicate existing infestations.

[25] Based on a review of publicly available information.

- Implement grazing practices that are compatible with or contribute to persistence of Red Bluff dwarf rush.
- Implement measures to prevent recreational activities from impacting occupied habitat (e.g., reroute trails).
- Coordinate and share information among organizations working to conserve Red Bluff dwarf rush, including CDFW and CNPS.
- Coordinate with and support private landowners implementing conservation practices in occupied habitat (e.g., compatible grazing practices).

Restoration

- Restore occupied habitat that has been degraded by past impacts (e.g., revegetating areas damaged by ORVs).
- Establish additional populations at sites with suitable habitat, with a preference given to sites that will be provided with long-term protection and targeted monitoring and management of the species.

Surveys and Research

- Conduct surveys to improve data on distribution and abundance, including surveys to confirm persistence of historical occurrences, document the location of nonspecific occurrences, and search potentially suitable habitat for additional, undocumented populations of Red Bluff dwarf rush.
- Document genetic diversity in and among occupied sites to inform conservation.
- Investigate the species' ecology to inform conservation and management (e.g., habitat associations, dispersal, and seedbank dynamics).

K. Availability and Sources of Information

This document is based on available sources of information (i.e., publications and publicly distributed data) and communications with experts. This section provides a reference for each of these sources of information.

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L. Detailed Distribution Map

Figure 2 provides a detailed map of the distribution of Red Bluff dwarf rush that displays:

- Locations where the species has been documented, labelled with their CNDDB occurrence numbers
- Natural, agricultural, and developed land cover

Please note that the species may occur at unknown, undocumented sites that are not displayed on this map.

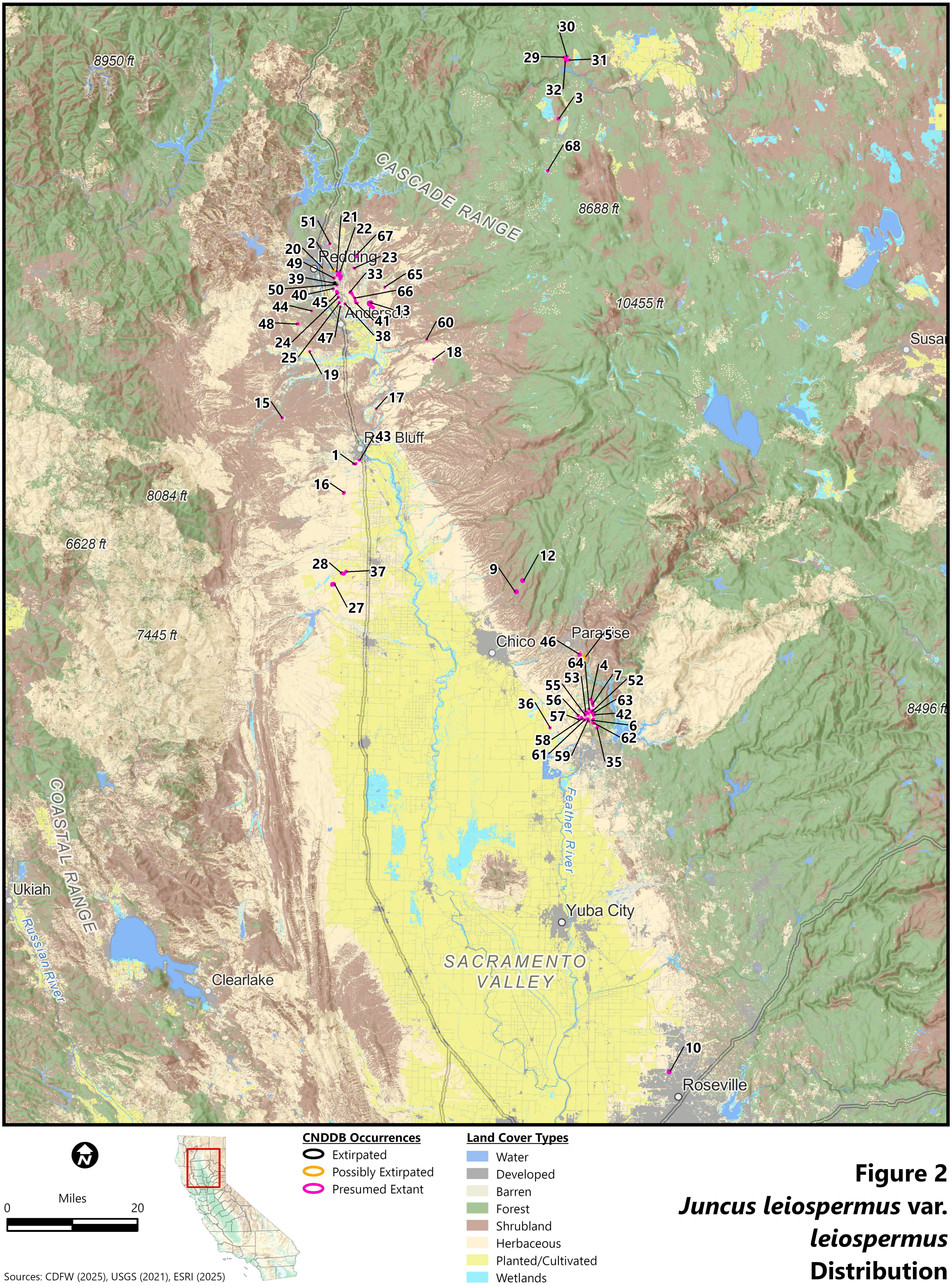

Figure 2
Juncus leiospermus* var. *leiospermus
Distribution

Sources: CDFW (2025), USGS (2021), ESRI (2025)

Abbreviations and Acronyms

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AOO	area of occupancy
BLM	Bureau of Land Management
Cal-IPC	California Invasive Plant Council
CCH	California Consortium of Herbaria
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeters
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRPR	California Rare Plant Rank
EOO	extent of occurrence
FESA	federal Endangered Species Act
ft	feet
G2	Global Conservation Status Rank 2, Imperiled
GAP	Gap Analysis Project
GIN	GreenInfo Network
HCP	habitat conservation plan
m	meters
NCCP	natural community conservation plan
NEPA	National Environmental Policy Act
ORV	Off-road vehicle
RCIS	regional conservation investment strategy
USFS	U.S. Forest Service
USGS	U.S. Geological Survey