



# Conservation Gap Analysis of Native U.S. Oaks

## Species profile: *Quercus dumosa*

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### SPECIES OF CONSERVATION CONCERN

#### CALIFORNIA

Channel Island endemics:  
*Quercus pacifica*, *Quercus tomentella*

Southern region:  
*Quercus cedrosensis*, ***Quercus dumosa***,  
*Quercus engelmannii*

Northern region and /  
or broad distribution:  
*Quercus lobata*, *Quercus parvula*,  
*Quercus sadleriana*

#### SOUTHWESTERN U.S.

Texas limited-range endemics  
*Quercus carmenensis*,  
*Quercus graciliformis*, *Quercus hinckleyi*,  
*Quercus robusta*, *Quercus tardifolia*

Concentrated in Arizona:  
*Quercus ajoensis*, *Quercus palmeri*,  
*Quercus toumeyii*

Broad distribution:  
*Quercus havardii*, *Quercus laceyi*

#### SOUTHEASTERN U.S.

State endemics:  
*Quercus acerifolia*, *Quercus boyntonii*

Concentrated in Florida:  
*Quercus chapmanii*, *Quercus inopina*,  
*Quercus pumila*

Broad distribution:  
*Quercus arkansana*, *Quercus austrina*,  
*Quercus georgiana*,  
*Quercus oglethorpensis*, *Quercus similis*

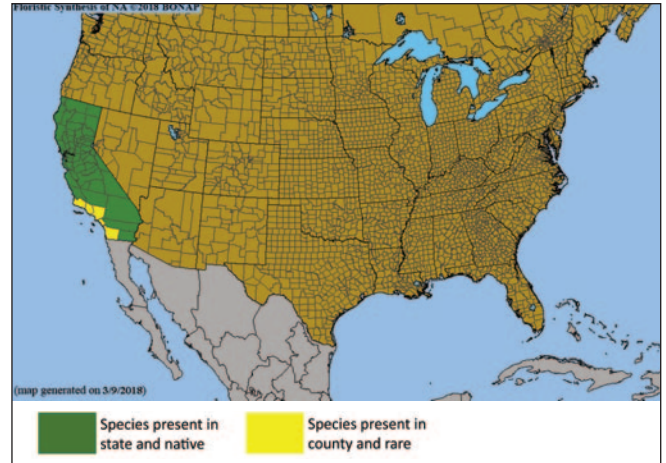


# Quercus dumosa Nutt.

Synonyms: IN/A Common Names: Coastal sage scrub oak, Nuttall's scrub oak

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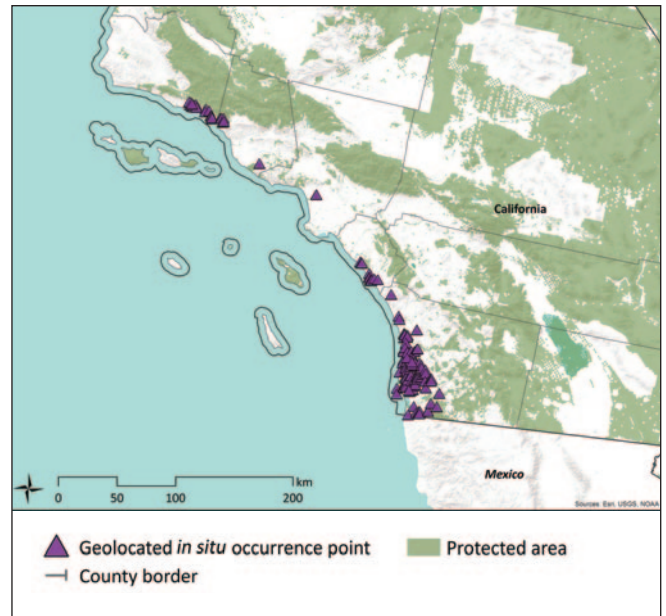
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**Figure 1.** County-level distribution map for the U.S. distribution of *Quercus dumosa*. Source: Biota of North America Program (BONAP).<sup>5</sup>

## DISTRIBUTION AND ECOLOGY

Until recently, the name *Quercus dumosa* referred to many species of shrubby white oaks (Sect. *Quercus*) in California, U.S., including species now known as *Q. berberidifolia*, *Q. durata*, *Q. john-tuckeri*, *Q. cornelius-mulleri*, *Q. pacifica*, *Q. macdonaldii*, and *Q. turbinella*. Most of these species are distributed throughout southern California, and though they have close geographical proximity, occurrence in mixed stands is uncommon. *Quercus dumosa* endured many taxonomic shifts until about 2012. *Quercus berberidifolia* was the last species frequently labeled *Q. dumosa*, and therefore represents the majority of misidentified herbarium specimens today.<sup>1</sup> The currently accepted species description limits *Q. dumosa*, or Coastal sage scrub oak, to “scraggly shrubs with short petioles, cordate leaf bases, erect curly trichomes on the abaxial leaf surface, and narrow acute acorns that occur at low elevations almost always within sight of the ocean.”<sup>2</sup> *Quercus dumosa* is known to occur within Orange, Santa Barbara, and San Diego counties in southern California, and extends slightly into Baja California, Mexico. It is very habitat-specific and is found in chaparral communities on coastal bluffs, hillsides, canyons, and mesas, where it usually dominates or codominates. This evergreen shrub thrives in very sandy soil, establishing an extensive root network, and typically reaching between one and three meters in height.<sup>3,4</sup> However, heights to five meters have been observed in canyon bottoms of San Diego County (A. Meyer pers. comm., 2018).



**Figure 2.** Documented *in situ* occurrence points for the U.S. distribution of *Quercus dumosa*. Protected areas layer from U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).<sup>6</sup>

## VULNERABILITY OF WILD POPULATIONS

**Table 1.** Scoring matrix identifying the most severe demographic issues affecting *Quercus dumosa*. Cells are highlighted when the species meets the respective vulnerability threshold for each demographic indicator. Average vulnerability score is calculated using only those demographic indicators with sufficient data (i.e., excluding unknown indicators).

| Demographic indicators                                       | Level of vulnerability              |  |   |  |   |                     | Score |
|--|-------------------------------------|--|---|--|---|---------------------|-------|
|  | Emergency<br>Score = 40             | High<br>Score = 20   | Moderate<br>Score = 10  | Low<br>Score = 5   | None<br>Score = 0   | Unknown<br>No score |       |
| Population size  | < 50                                | < 250  | < 2,500   | < 10,000   | > 10,000  | Unknown             | 10    |
| Range/endemism   | Extremely small range or 1 location | E00 < 100 km <sup>2</sup> or A00 < 10 km <sup>2</sup> or 2-4 locations | E00 < 5,000 km <sup>2</sup> or A00 < 500 km <sup>2</sup> or 5-9 locations | E00 < 20,000 km <sup>2</sup> or A00 < 2,000 km <sup>2</sup> or 10+ locations | E00 > 20,000 km <sup>2</sup> or A00 > 2,000 km <sup>2</sup> | Unknown             | 10    |
| Population decline   | Extreme                             | >= 80% decline   | >= 50% decline  | >= 30% decline   | None  | Unknown             | 10    |
| Fragmentation  | Severe fragmentation                | Isolated populations   | Somewhat isolated populations   | Relatively connected populations   | Connected populations                                       | Unknown             | 20    |
| Regeneration/recruitment                                     | No regeneration or recruitment      | Decline of >50% predicted in next generation                           | Insufficient to maintain current population size                          | Sufficient to maintain current population size                               | Sufficient to increase population size                      | Unknown             | 10    |
| Genetic variation/integrity                                  | Extremely low                       | Low  | Medium  | High   | Very high   | Unknown             | 5     |
| Average vulnerability score                                  |                                     |  |   |  |   |                     | 10.8  |
| Rank relative to all U.S. oak species of concern (out of 19) |                                     |  |   |  |   |                     | 8     |

## THREATS TO WILD POPULATIONS

### High Impact Threats

**Human use of landscape — residential/commercial development, mining, and/or roads:** Human development along the coast is likely still the most impactful threat to *Q. dumosa*, and has left very little habitat intact. Southern California's desirable coastal real estate is continuing to undergo conversion from chaparral to housing, though it is unlikely that whole subpopulation(s) will quickly disappear entirely, due to unfavorable areas of distribution and/or protections recently put in place. Past misclassification of other *Quercus* species as *Q. dumosa* also likely hindered possible conservation during times of rapid coastline development since the rarity of this species had not yet been realized.<sup>3</sup>

### Moderate Impact Threats

**Human modification of natural systems — disturbance regime modification, pollution, and/or eradication:** Altered fire regimes, due to both human influence and climate change impacts, are believed to be of some threat. Rigorous resprouting after fire protects *Q. dumosa* from complete wildfire destruction, but the species seldom recruits seedlings for ten to 20 years following a fire event. This means that long fire-free periods are necessary for substantial reproduction.<sup>7</sup>

**Climate change — habitat shifting, drought, temperature extremes, and/or flooding:** Using the PCM climate change scenario, suitable habitat area for *Q. dumosa* is estimated to decline by 59%, in comparison to the modeled species distribution within the current climate.<sup>8</sup>

### Low Impact Threats

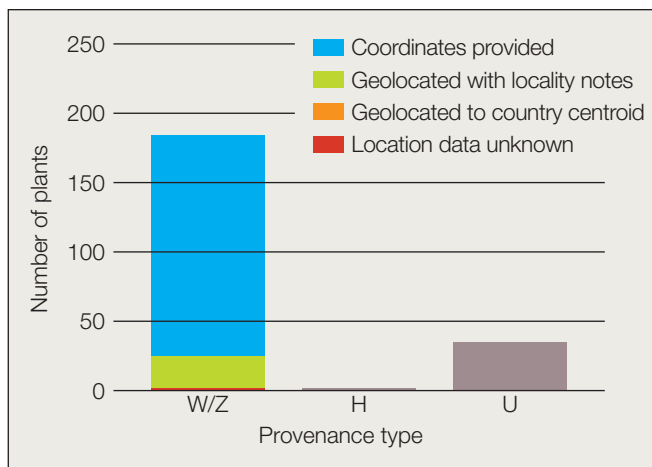
**Genetic material loss — inbreeding and/or introgression:** The low elevation and dry habitat occupied by *Q. dumosa* generally protects it from hybridization with other similar white oak species, but some putative hybrids are known with *Q. engelmannii* and *Q. lobata*. Some introgression has also been observed where populations of *Q. berberidifolia* border *Q. dumosa* populations.<sup>2</sup>

## CONSERVATION ACTIVITIES

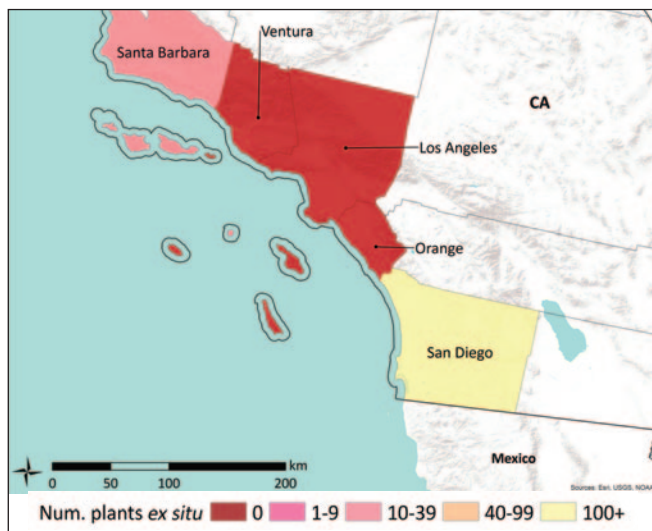
In 2017 *Quercus* accessions data were requested from *ex situ* collections. A total of 162 institutions from 26 countries submitted data for native U.S. oaks (Figures 3 and 4). Past, present, and planned conservation activities for U.S. oak species of concern were also examined through literature review, expert consultation, and conduction of a questionnaire. Questionnaire respondents totaled 328 individuals from 252 organizations, including 78 institutions reporting on species of concern (Figure 6).

### Results of 2017 *ex situ* survey

|  |     |
|--|-----|
| Number of <i>ex situ</i> collections reporting this species: | 18  |
| Number of plants in <i>ex situ</i> collections:              | 217 |
| Average number of plants per institution:                    | 12  |
| Percent of <i>ex situ</i> plants of wild origin:             | 83% |
| Percent of wild origin plants with known locality:           | 99% |



**Figure 3.** Number and origin of *Quercus dumosa* plants in *ex situ* collections. Provenance types: W = wild; Z = indirect wild; H = horticultural; U = unknown.

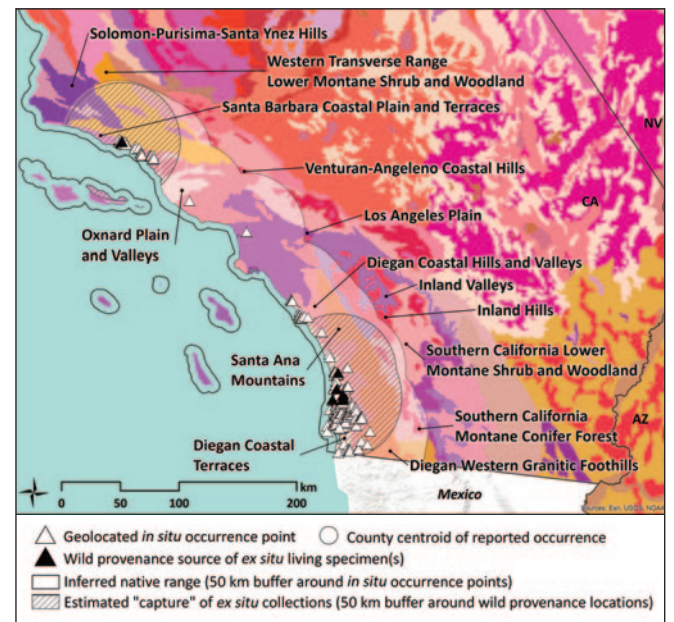


**Figure 4.** *Quercus dumosa* counties of *in situ* occurrence, reflecting the number of plants from each county in *ex situ* collections.

A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections (Figure 5). Only the native U.S. distribution of the species was considered in this analysis, due to availability of ecoregion maps. Fifty-kilometer buffers were placed around each *in situ* occurrence point and the source locality of each plant living in *ex situ* collections. Collectively, the *in situ* buffer area serves as the inferred native range of the species, or “combined area *in situ*” (CAI50). The *ex situ* buffer area represents the native range “captured” in *ex situ* collections, or “combined area *ex situ*” (CAE50). Geographic coverage of *ex situ* collections was estimated by dividing CAI50 by CAE50. Ecological coverage was estimated by dividing the number of EPA Level IV Ecoregions present in CAE50 by the number of ecoregions in CAI50.

### Estimated *ex situ* representation

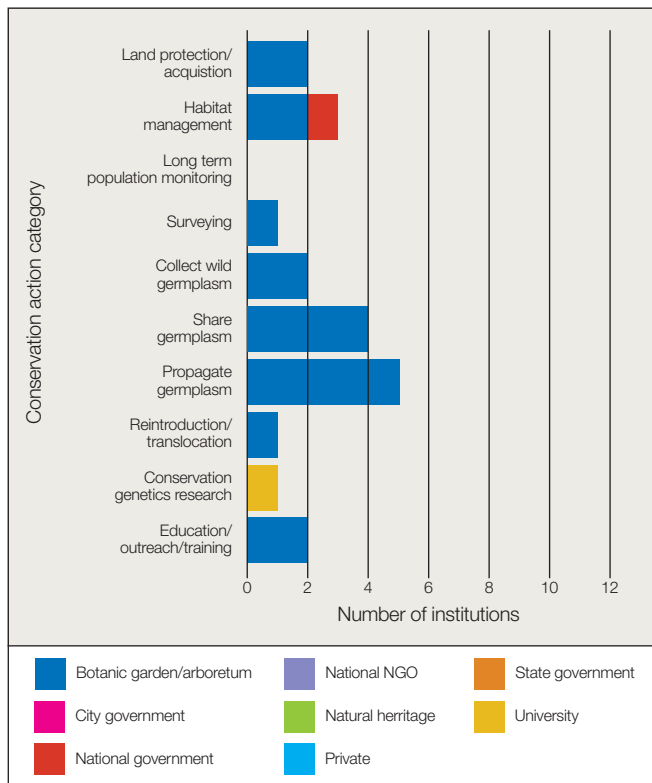
|                      |     |
|----------------------|-----|
| Geographic coverage: | 44% |
| Ecological coverage: | 75% |



**Figure 5.** *Quercus dumosa* *in situ* occurrence points and *ex situ* collection source localities within the United States. U.S. EPA Level IV Ecoregions are colored and labelled.<sup>9</sup> County centroid is shown if no precise locality data exist for that county of occurrence. Email [treeconservation@mortonarb.org](mailto:treeconservation@mortonarb.org) for more information regarding specific coordinates.



Keir Morse



**Figure 6.** Number of institutions reporting conservation activities for *Quercus dumosa* grouped by organization type. Nine of 252 institutions reported activities focused on *Q. dumosa* (see Appendix D for a list of all responding institutions).

**Land protection:** Within the inferred native range of *Q. dumosa*, 44% of the land is covered by protected areas (Figure 7). However, most of the remaining significant populations are protected to some extent.

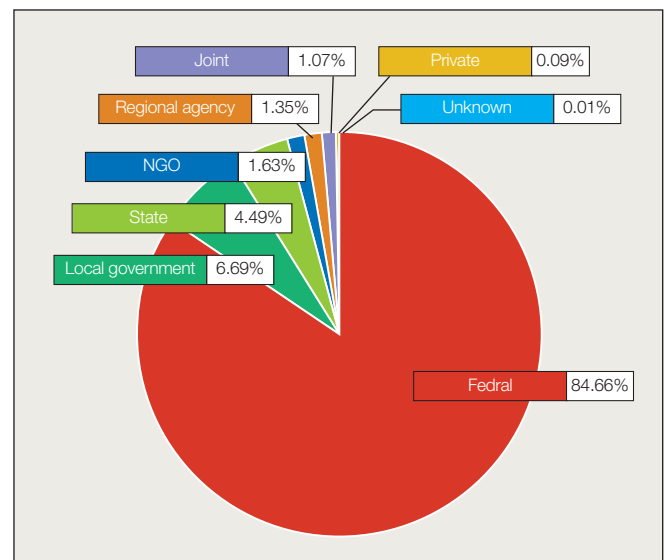
The Del Mar region contains several large protected populations of *Q. dumosa*.<sup>10</sup> Other protected areas with relatively intact coastal sage scrub habitat include Camp Pendleton Marine Corps base, Santa Monica Mountains parklands, San Joaquin Hills near Laguna Beach, and Irvine Ranch in Orange County.<sup>11</sup> *Quercus dumosa* has also been found near the Los Padres National Forest boundary, but has not been formally documented within the park.<sup>12</sup> Most remaining reserves are small, and almost all are isolated.

**Sustainable management of land:** Three institutions reported this activity in the conservation action questionnaire, but no other details are currently known.

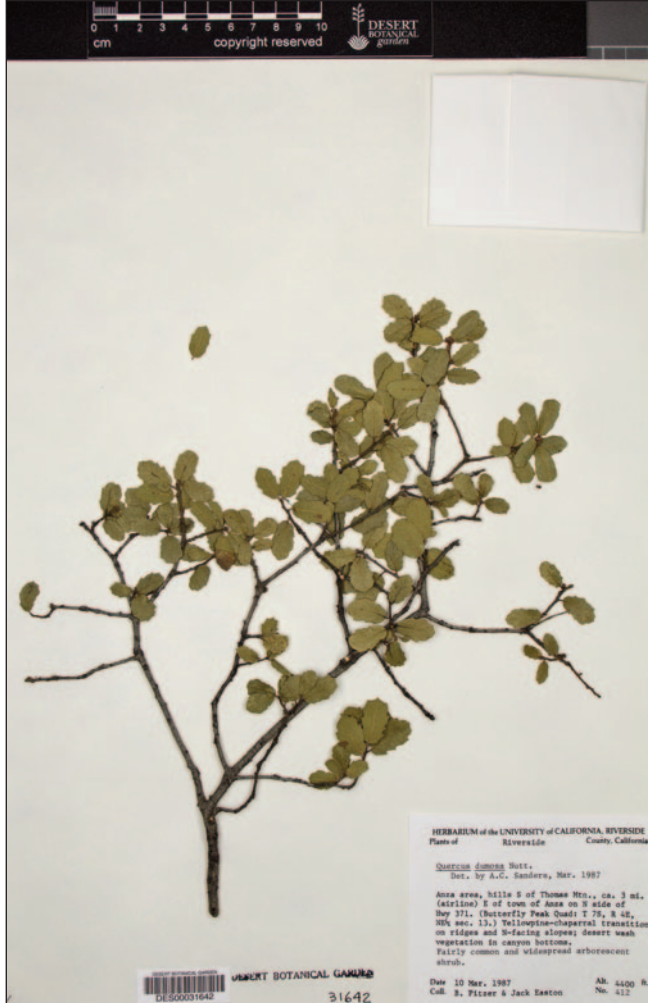
**Population monitoring and/or occurrence surveys:** The San Diego Chapter of the California Native Plant Society (CNPS) has coordinated with the San Diego Natural History Museum to work on a flora of the Del Mar Mesa. During the CNPS 2013 Rare Plant Treasure Hunt, the San Diego Chapter confirmed a grove previously thought to be *Q. berberidifolia* as *Q. dumosa*.<sup>10</sup>

**Wild collecting and/or ex situ curation:** In 2015, funded by the APGA-USFS Tree Germplasm Conservation Partnership, Rancho Santa Ana Botanic Gardens and Botanic Gardens Conservation International U.S. collaboratively set out to collect *Q. dumosa* acorns for establishment in ex situ collections. However, drought and difficulty in receiving collection permits caused additional challenges. Four populations were visited, all within San Diego County, and acorn production was sporadic and unpredictable. Over 500 acorns were collected from four populations and distributed to five gardens in California.<sup>13</sup>

**Propagation and/or breeding programs:** The California Native Plant Link Exchange provides a platform to search nurseries and seed sources for native California plants; *Quercus dumosa* is listed as propagated by at least nine different seed sources.<sup>14</sup> Two-hundred *Q. dumosa* acorns had germinated at Rancho Santa Ana Botanic Garden by December, 2015, which were collected through funding from the above-mentioned APGA-USFS grant. Germinations are ongoing. Seeds were also distributed to UC Davis Arboretum, Huntington Botanical Gardens, UC Berkeley Botanic Garden, and UC Fullerton Arboretum for propagation, with each garden receiving about 100 acorns.<sup>13</sup> The Tree of Life Nursery has been producing native California plants for more than two decades and is one of the largest suppliers of native plants in the state. The nursery includes 30 acres of growing area as well as laboratories for propagation and testing. They grow a wide variety of native oak species, including *Q. dumosa*.<sup>15</sup>



**Figure 7.** Management type of protected areas within the inferred native range of *Quercus dumosa*. Protected areas data from the U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).<sup>6</sup>



**Reintroduction, reinforcement, and/or translocation:** One institution reported this activity in the conservation action questionnaire, but no other details are currently known.

**Research:** The potential distribution of *Q. dumosa* has been estimated using species distribution modeling. The process revealed that maximum temperature in January, available water holding capacity, and maximum temperature in July are the top three predictor variables for the presence or absence of *Q. dumosa*. Under the PCM climate change scenario, a 59% decline in suitable habitat area is predicted, compared to *Q. dumosa*'s modeled species distribution within the current climate.<sup>9</sup>

**Education, outreach, and/or training:** The USDA Forest Service has classified *Q. dumosa* as a "Sensitive Species" due to the amount of habitat that has been destroyed by coastal development.<sup>12</sup> The World Wildlife Foundation has created an ecoregion profile for California Coastal Sage and Chaparral, of which *Q. dumosa* is an important component. This ecoregion has extremely high levels of species diversity and endemism, which includes the California gnatcatcher. This rare bird is "currently being used as an umbrella species to protect the endemic flora and fauna of this region from urban development." The region has also been listed as an Endemic Bird Area, as identified by BirdLife International, which brings additional awareness to its rare and valuable natural components.<sup>11</sup>

**Species protection policies:** No known initiatives at the time of publication.

## PRIORITY CONSERVATION ACTIONS

Coastal sage scrub oak is geographically limited to coastal areas, however can be easily confused with similar species that are more widespread. Habitat destruction has been the biggest factor in reducing populations to what they are today. Many remaining populations of *Q. dumosa* are on protected land, though inappropriate fire management may negatively impact seedling recruitment. It is unlikely that more populations can be brought under protection, but opportunities to work with landowners to preserve the species habitat should be pursued when possible. Remaining populations are also being monitored by local organizations, providing an invaluable service, which many threatened species do not have. Those organizations, including the California Native Plant Society, should be commended and supported as they continue this important work.

In light of projected habitat decline, genetic diversity of *in situ* and *ex situ* populations needs to be assessed. The species should be highlighted in outreach efforts in order to build local public awareness of its threat status and ecological value. Additional acorn collections should be made to complement existing *ex situ* collections and augment wild populations. Research regarding appropriate land management for the successful regeneration of *Q. dumosa*, as well as best practices for population reinforcement may be necessary for successful *in situ* conservation. Further climate change modeling could also be helpful in determining priority locations for conservation work. Finally, population genetics could greatly inform both *in situ* and *ex situ* conservation efforts if such data were compiled.

### Conservation recommendations for *Quercus dumosa*

#### Highest Priority

- Education, outreach, and/or training
- Wild collecting and/or *ex situ* curation

#### Recommended

- Land protection
- Population monitoring and/or occurrence surveys
- Reintroduction, reinforcement, and/or translocation
- Research (climate change modeling; land management/disturbance regime needs; population genetics; restoration protocols/guidelines)
- Sustainable management of land

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