

Conservation Gap Analysis of Native Mesoamerican Oaks



José Luciano Sabás-Rosales

Species profile: *Quercus dumosa*

Kate Good, José Luciano Sabás-Rosales, Oscar Javier Soto Arellano, Kieran Althaus, Victor Garcia Balderas, Silvia Alvarez-Clare

CRITICALLY ENDANGERED

Quercus graciliformis
Quercus mulleri

ENDANGERED

Quercus brandegeei
Quercus carmenensis
Quercus cualensis
Quercus cupreata
Quercus delgadoana
Quercus devia
Quercus diversifolia
Quercus dumosa
Quercus engelmannii
Quercus flocculenta

Quercus galeanensis
Quercus hintonii
Quercus hirtifolia
Quercus insignis
Quercus macdougallii
Quercus miquihuanensis
Quercus nixoniana
Quercus radiata
Quercus runcinatifolia
Quercus tomentella

VULNERABLE

Quercus acutifolia
Quercus ajoensis
Quercus cedrosensis
Quercus costaricensis
Quercus guilelmi-treleasei
Quercus hintoniorum
Quercus meavei
Quercus rubramenta
Quercus tuitensis
Quercus vicentensis



Quercus dumosa Nutt.

Common Names, English: Coastal Sage Scrub Oak, Nuttall's Scrub Oak

Common Names, Spanish: Joap (Kumiai)

IUCN Red List Category and Criteria: Endangered: B2ab(ii,iii,iv,v)

Species profile experts: José Luciano Sabás-Rosales, Instituto Nacional de Estadística y Geografía (INEGI); Oscar Javier Soto Arellano, Instituto Nacional de Estadística y Geografía (INEGI); Kieran Althaus, The University of Chicago, The Morton Arboretum

Contributors: Christy Powell, San Diego Zoo Wildlife Alliance; Fred Roberts, California Native Plant Society; Joseph Ree, San Diego Zoo Wildlife Alliance

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DISTRIBUTION AND BIOLOGY

Quercus dumosa occurs near the coast in Baja California from just south of Ensenada and north through the U.S. border (Figure 1). In the United States, this species occurs in coastal California in Orange, Santa Barbara, and San Diego counties. Until as recently as the beginning of the 21st century, *Q. dumosa* was a catch-all species whose name was applied to many different shrubby white oaks, including *Q. berberidifolia*, *Q. durata*, *Q. john-tuckeri*, *Q. cornelius-mulleri*, *Q. pacifica* (Beckman et al., 2019). Knowledge of the exact distribution of *Q. dumosa* remains a challenge due to herbarium specimens of this species being labeled as *Q. berberidifolia*, and vice versa (Stork et al., 2016). These two species hybridize readily (Ree, 2021).



Figure 1. Wild (i.e., *in situ*) occurrence points for *Quercus dumosa*.

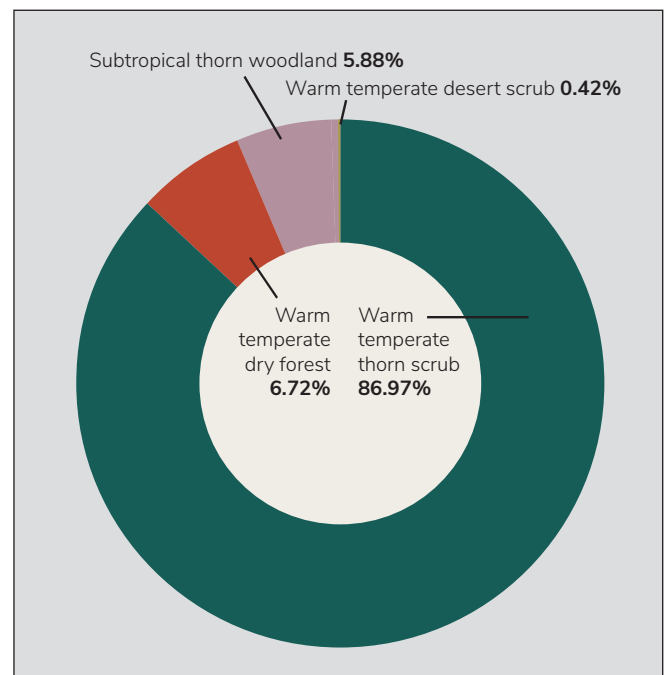


Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus dumosa* is distributed.

Quercus dumosa occurs in chaparral habitat on low hills near the coast (Nixon, 2002). The marine layer supplies humidity that helps sustain this species during dry summer months (Ree, 2021). A majority of occurrences are in the warm temperate thorn scrub life zone (Figure 2). It is an evergreen shrub that rarely exceeds three meters tall and grows in dense clusters.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: Similar to other species of oaks in Mexico, *Q. dumosa* is harvested for firewood.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: This is not currently considered a major threat.

Human use of landscape — residential/commercial development, mining, and/or roads: Human development along the coast of northern Baja California, Mexico is a major threat for this species that has left very little intact habitat. Northern Baja California is one of the fastest growing urban areas within Mexico, and the coastal region in which *Q. dumosa* is found is highly desirable real estate. There is currently little to no restriction on development and a lack of regulation related to construction. Permits are often issued without fully considering the environmental impacts.

Human use of landscape — tourism and/or recreation: This is not currently considered a threat. Ecotourism is present, but it is not prevalent in the region and is focused primarily near the beaches outside of *Q. dumosa* habitat.

Human modification of natural systems — altered fire regime, pollution, eradication: Untreated wastewater, both domestic and industrial, is discharged within *Q. dumosa* habitat. However, more research is needed to determine the impact on the species.

Altered fire regimes are thought to be of some threat. Long periods without fire are necessary for substantial reproduction and to grow the population at a level necessary to reverse population decline (Keely, 1992). However, controlled burns conducted throughout the San Gabriel Mountains suggests that *Q. dumosa* quickly recovers from fire, dominating burned landscapes with other stump-sprouting chaparral species (Kinucan, 1965).

Human modification of natural systems — invasive species competition/disturbance: This is not considered a major threat. Introduced nonnative annual grasses into chaparral habitats have generally increased fuel load, and thus fire intensity, along the California coast. However, current evidence suggests that *Q. dumosa* is relatively quick to recover and set seed after fires.



Roderick Cameron

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: *Quercus dumosa* is especially susceptible to drought. One study estimated that suitable habitat for *Q. dumosa* will decline by 59% under future climate change scenarios, relative to today's climate (Lawson, 2011).

Genetic material loss — inbreeding and/or introgression: In general, the low elevation and dry habitat of *Q. dumosa* limits hybridization between it and similar species of white oak (Beckman, 2017). Some hybrids have been observed with *Q. engelmannii* and *Q. lobata*, and there is some introgression where *Q. berberidifolia* borders populations of *Q. dumosa* (Burge et al., 2019).

Pests and/or pathogens: Unknown.

Extremely small and/or restricted population: Populations of this species are dispersed and restricted to a relatively narrow region near the coast in southern California and northern Baja California.

CONSERVATION ACTIVITIES

Once per year between 2017 and 2022, *Quercus* accessions data were requested from ex situ collections globally. A total of 197 institutions from 27 countries submitted data for Mesoamerican oak species, including *Q. dumosa* (Table 1, Figure 3). Past, present, and planned conservation activities for Mesoamerican oak species of concern were also examined through literature review and expert consultation.

A spatial analysis was conducted to estimate the geographic and ecological coverage of ex situ collections using methods adapted from Khoury et al. (2020; Figure 4). Twenty-kilometer buffers were placed around each wild occurrence point as well as the source locality of each plant living in ex situ collections. Collectively, the buffer area around the wild occurrence points represents the inferred native range of the species. The buffer area around ex situ points serves as the native range represented in ex situ collections. Geographic coverage of ex situ collections was estimated by dividing the ex situ buffer area by the area of the inferred native range. Ecological coverage of ex situ collections was estimated by dividing the number of Holdridge life zones present under the ex situ buffer by the number of Holdridge life zones under the inferred native range. The species representativeness ex situ was calculated by counting the number of ex situ institutions that currently have one or more living individuals of wild provenance in their collections, up to a maximum of ten. In order to maintain a consistent scale across all scores, this number was multiplied by ten. All three scores range from 0–100. A final ex situ conservation score was calculated by taking an average of the three scores above. Final scores range from 0–100, with scores near 100 indicating comprehensive ex situ conservation, and scores near 0 indicating poor ex situ conservation (Table 2). As a reference, the threatened Mesoamerican oaks with the highest ex situ conservation scores are *Q. engelmannii* with a score of 76/100, and *Q. brandegeei* with a score of 74/100. There are 10 threatened oaks with final ex situ scores of 10 or less.

Table 1. Results of 2017–2022 ex situ surveys.

Number of ex situ collections reporting this species	23
Number of plants in ex situ collections	359
Average number of plants per institution	16
Percent of ex situ plants of wild origin	83%
Percent of wild origin plants with known locality	99%

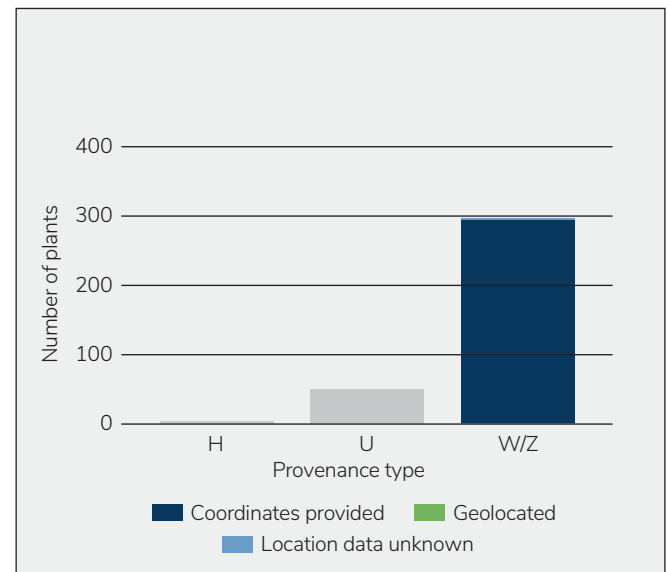


Figure 3. Number and origin of *Quercus dumosa* plants in ex situ collections. Provenance types: H = horticultural; U = unknown; W = wild; Z = propagated from wild.



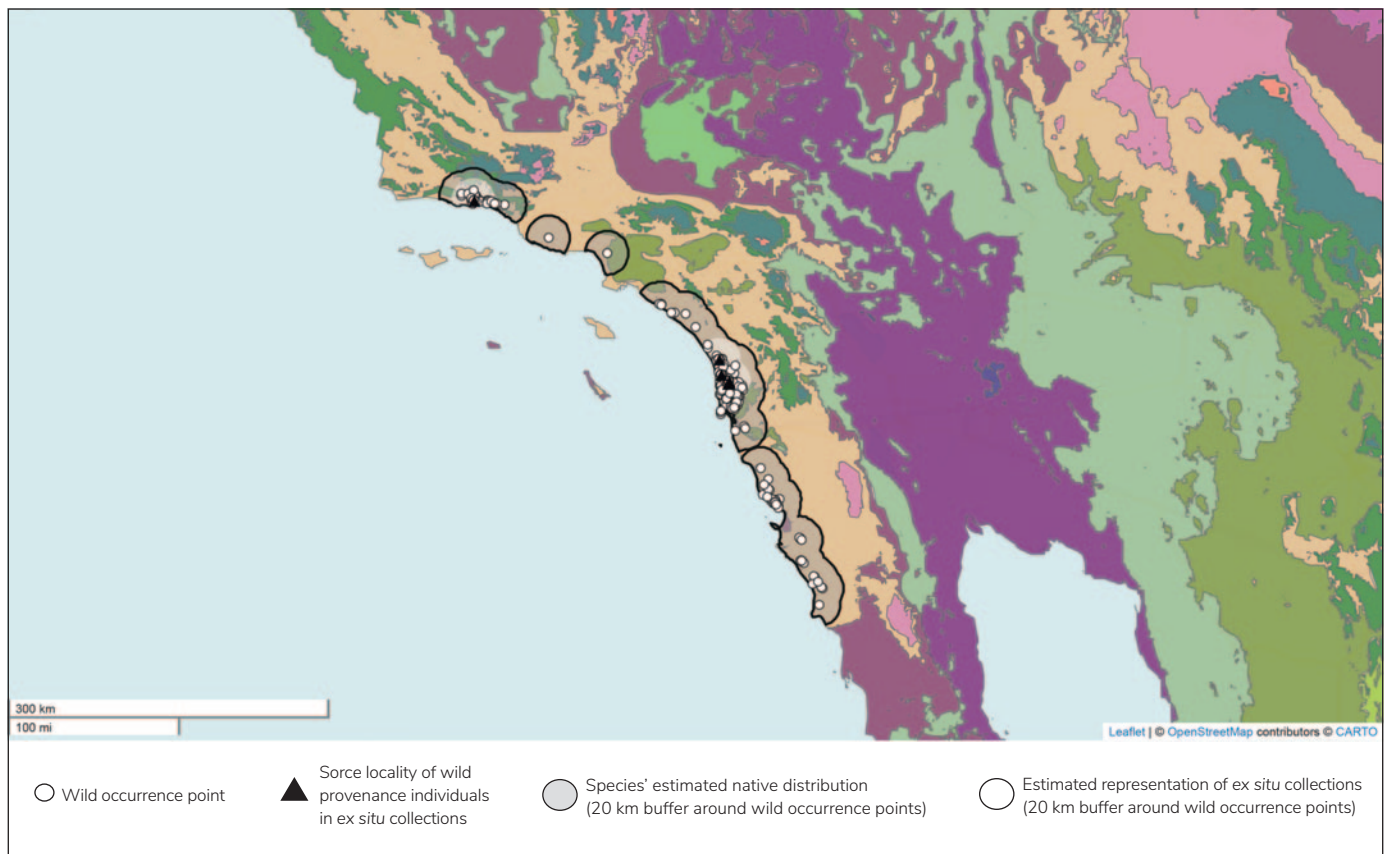


Figure 4. *Quercus dumosa* wild occurrence points and ex situ collection source localities. Colored regions are Holdridge life zones. All ex situ collection source localities are also wild occurrence points.

Table 2. Ex situ conservation scores for *Quercus dumosa* with all scores ranging from 0–100. A final score of 100 indicates comprehensive ex situ conservation, and a score of 0 represents poor ex situ conservation.

Geographic coverage ex situ	17
Ecological coverage ex situ	50
Representation in ex situ collections	80
Final ex situ conservation score	49

Using methods adapted from Khoury et al. (2020), we estimated the degree of representation of *Q. dumosa* in protected areas in order to identify *in situ* conservation gaps. Wild occurrence points were mapped and overlaid with protected areas from the World Database on Protected Areas (Figure 5; UNEP-WCMC and IUCN, 2023). A twenty-kilometer buffer was placed around each occurrence point to represent the species inferred native range. Geographic coverage *in situ* was estimated by calculating the proportion

of a species inferred native range that is covered by protected areas. Ecological coverage *in situ* was estimated by identifying the Holdridge life zones in the inferred native range as well as the Holdridge life zones in protected areas within the inferred native range and calculating the percentage of life zones that are conserved in protected areas. Species representativeness *in situ* was estimated by calculating the percentage of known occurrence points within the species inferred native range that fall inside protected areas. All three scores range from 0–100. A final conservation score *in situ* was calculated by taking an average of the three scores above. Final scores range from 0–100, with scores near 100 indicating comprehensive *in situ* conservation, and scores near 0 indicating poor *in situ* conservation (Table 3). As a reference, the threatened Mesoamerican oaks with the highest *in situ* conservation scores are *Q. carmenensis* with a score of 99/100, and *Q. costaricensis* with a score of 94/100. There are two threatened oaks with final *in situ* scores of 10 or less.

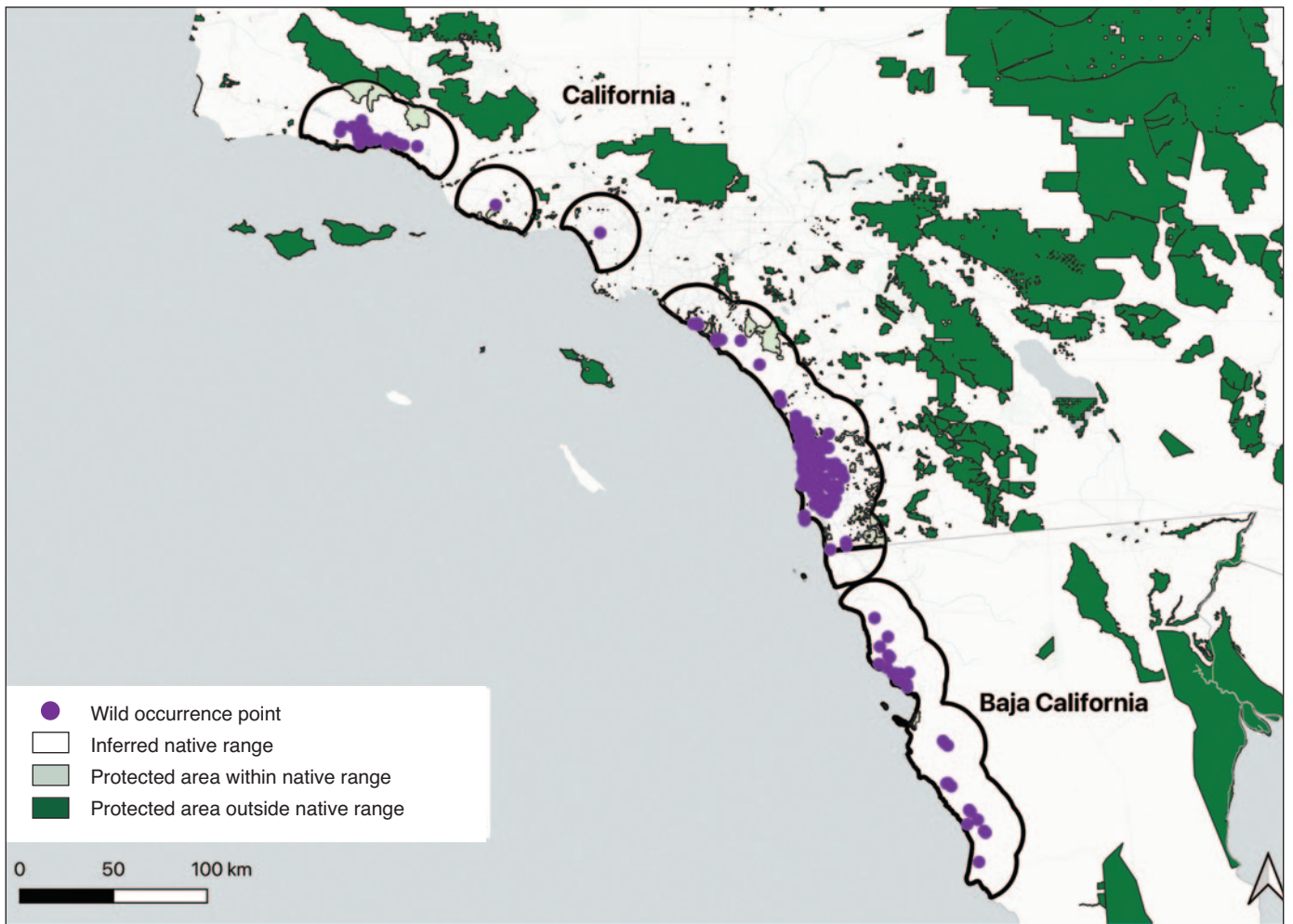


Figure 5. Wild occurrence points and inferred native range of *Quercus dumosa* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Table 3. *In situ* conservation scores for *Quercus dumosa* with all scores ranging from 0–100. A final score of 100 indicates comprehensive *in situ* conservation, and a score of 0 represents poor *in situ* conservation.

Geographic coverage <i>in situ</i>	6
Ecological coverage <i>in situ</i>	83
Species representation in <i>in situ</i> collections	12
Final <i>in situ</i> conservation score	34



Maricela Rodríguez-Acosta

Land protection: Within the inferred native range of *Q. dumosa*, 6% is within protected areas (Figure 5). The only protected area in Mexico is Estero de Punta Banda, a Ramsar site 13 km south of Ensenada in Baja California.

Sustainable management of land: Unknown. There is a report of fire exclusion zones and wildfire exclusion strips within the native range of *Q. dumosa*, however we cannot confirm if this is true or how extensive it is.

Population monitoring and/or occurrence surveys: There have been surveys for *Q. dumosa* in California as part of the California Native Plant Society (CNPS) 2013 Rare Plant Treasure Hunt (Beckman et al., 2019). This is not a current conservation activity within Mexico.

Wild collecting and/or ex situ curation: This species is held in 23 ex situ collections. However, according to the results of our ex situ surveys there are currently no individuals living in ex situ collections with wild provenance from Mexico.

Propagation and/or breeding programs: This is not a current conservation activity within Mexico. In the United States, the San Diego Zoo Wildlife Alliance and San Diego Botanic Garden have successfully trialed air layering and cutting propagation methods.

Reintroduction, reinforcement, and/or translocation: The San Diego Botanic Garden planted *Q. dumosa* at a restoration project in 2021, which are now fully established. California Botanic Garden has two conservation groves of *Q. dumosa*. This is not a current conservation activity within Mexico.

Research: There is very little research on the Mexican population of *Q. dumosa*. A recent study was performed in California on the impact of an environmental gradient on genetic exchange between *Q. dumosa* and *Q. berberidifolia* (Burge et al., 2019).

Education, outreach, and/or training: There is work being done with the indigenous community in Northern Baja California on education and community involvement in species protection.

Species protection policies: There are currently no species protection policies for *Q. dumosa*.

PRIORITY CONSERVATION ACTIONS

In order to conserve *Q. dumosa*, the conservation activity that should be given the highest priority is:

Education, outreach, and/or training

There is a need to work with the indigenous communities to exchange knowledge (including improved field guides/keys and an effective communication campaign) and assist with employment opportunities. One potential is to increase the availability of *Q. dumosa* in the nursery trade for wide distribution.

Wild collecting and/or ex situ curation

Acorn collection, especially from the Mexican population, is a priority. This species presents a unique opportunity for cross-border collaboration between researchers in the United States and Mexico.



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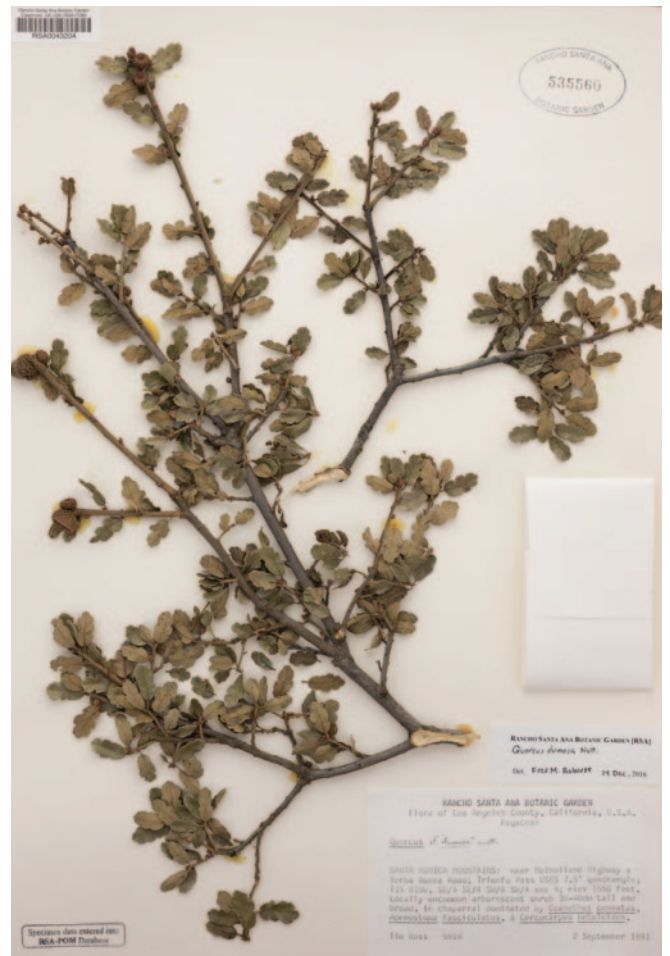
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