



Conservation Gap Analysis of Native U.S. Oaks

Species profile: *Quercus cedrosensis*

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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 toumeyi

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 cedrosensis C.H.Müll.

Synonyms: *Quercus sedrosensis* C.H.Müll. **Common Names:** Cedros Island oak

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DISTRIBUTION AND ECOLOGY

Quercus cedrosensis, or Cedros Island oak, is distributed across Baja California, Mexico, and extends slightly into southern California, U.S. One unverified occurrence is located further south, across the border into Baja California Sur, Mexico. Most populations are concentrated in the northern half of the Baja Peninsula and on Cedros Island, located off the western coast of the peninsula. Recent discoveries have also documented a small but significant population near the Otay Mountains in southwestern San Diego County. Soil preferences likely restrict the distribution of *Q. cedrosensis*, though more research is necessary to determine its specific range of tolerance (J. Rebman pers comm., 2018). Other shrubs and trees coexisting in this chaparral habitat are evergreens with leaves that are thick, leathery, and small. Cedros Island oak is shrubby and very occasionally reaches a maximum of five meters in height. The species tolerates a wide range of elevation, from 75 to 1,400 meters above sea level.^{1,2}

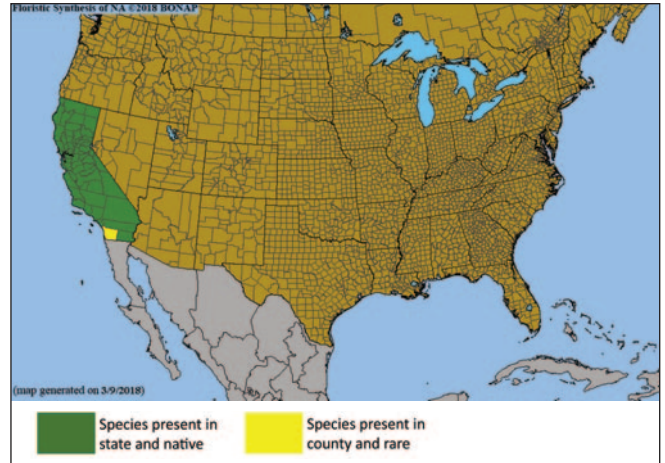


Figure 1. County-level distribution map for the U.S. distribution of *Quercus cedrosensis*. Source: Biota of North America Program (BONAP).³

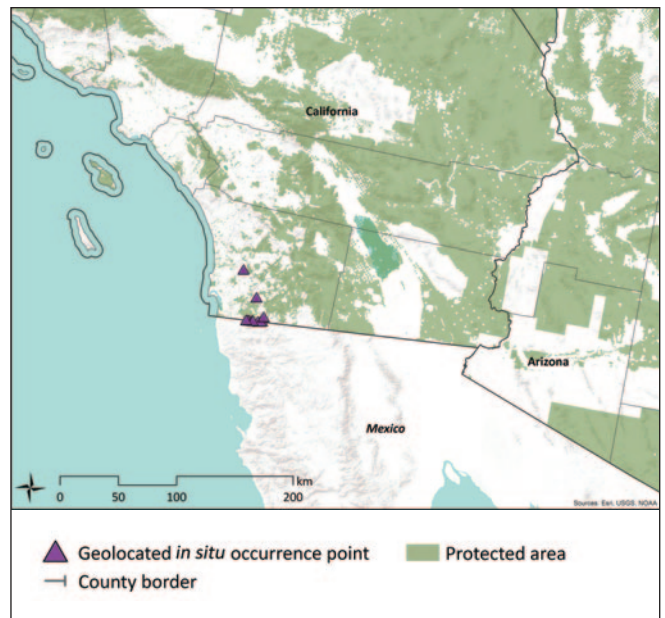


Figure 2. Documented *in situ* occurrence points for the U.S. distribution of *Quercus cedrosensis*. Protected areas layer from U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).⁴

VULNERABILITY OF WILD POPULATIONS

Table 1. Scoring matrix identifying the most severe demographic issues affecting *Quercus cedrosensis*. 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 Score = 40 | High Score = 20 | Moderate Score = 10 | Low Score = 5 | None Score = 0 | Unknown No score | |
| Population size | < 50 | < 250 | < 2,500 | < 10,000 | > 10,000 | Unknown | 5 |
| Range/endemism | Extremely small range or 1 location | E00 < 100 km ² or A00 < 10 km ² or 2-4 locations | E00 < 5,000 km ² or A00 < 500 km ² or 5-9 locations | E00 < 20,000 km ² or A00 < 2,000 km ² or 10+ locations | E00 > 20,000 km ² or A00 > 2,000 km ² | Unknown | 5 |
| 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 | 10 |
| 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 | - |
| Genetic variation/integrity | Extremely low | Low | Medium | High | Very high | Unknown | 10 |
| Average vulnerability score | | | | | | | 8.0 |
| Rank relative to all U.S. oak species of concern (out of 19) | | | | | | | 12 |

THREATS TO WILD POPULATIONS

High Impact Threats

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: Grazing is a significant issue on the mainland, especially within Southern California Dry Mesic Chaparral, which is dominated by *Q. cedrosensis*, *Malosma laurina*, and *Lotus scoparius*.⁵ Goats were introduced on Cedros Island in the nineteenth century, but introduced wild dogs kept their numbers low, reducing their impact.⁶

Human use of landscape — residential/commercial development, mining, and/or roads: *Quercus cedrosensis* is affected by land use changes including road construction, border patrol activities, and both urban and rural development. In 2007, the Customs and Border Patrol Agency proposed to “construct, operate, and maintain tactical infrastructure consisting of primary pedestrian fence and associated patrol roads, and access roads along two discrete areas of the U.S./Mexico international border” in San Diego County.⁷ Similar border safety projects continue today. In Baja California, more than 120,000 acres have been lost to urbanization, agriculture, and rural residential development in the past ten years.⁸

Moderate Impact Threats

Human modification of natural systems — disturbance regime modification, pollution, and/or eradication: There is evidence of a burn around 2003 within the U.S. population of *Q. cedrosensis*, and the native vegetation seems to be struggling to recover.⁵

Human modification of natural systems — invasive species competition: Cedros Island oak habitat in the U.S. is “of moderate to poor quality,” with some invasive plant species. Footpaths and grazing activities have facilitated the spread of invasive plants, which further hinder fire recovery.⁵

Genetic material loss — inbreeding and/or introgression: There is concern that mainland populations are facing threats of introgression, as leaf morphology begins to shift.²

Low Impact Threats

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: Drought has led to a slow recovery from the 2003 fire.⁵

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 (Figure 3). 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 5).

Results of 2017 *ex situ* survey

| | |
|--|------|
| Number of <i>ex situ</i> collections reporting this species: | 1 |
| Number of plants in <i>ex situ</i> collections: | 1 |
| Average number of plants per institution: | 1 |
| Percent of <i>ex situ</i> plants of wild origin: | 100% |
| Percent of wild origin plants with known locality: | 100% |

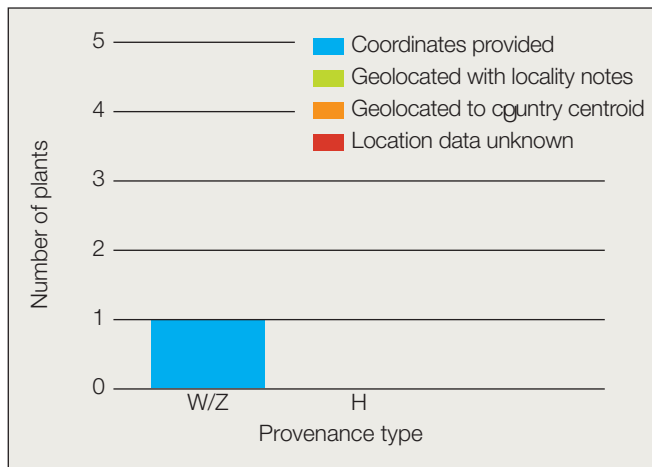


Figure 3. Number and origin of *Quercus cedrosensis* plants in *ex situ* collections. Provenance types: W = wild; Z = indirect wild; H = horticultural; U = unknown.



A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections (Figure 4). 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: | 0% |
| Ecological coverage: | 0% |

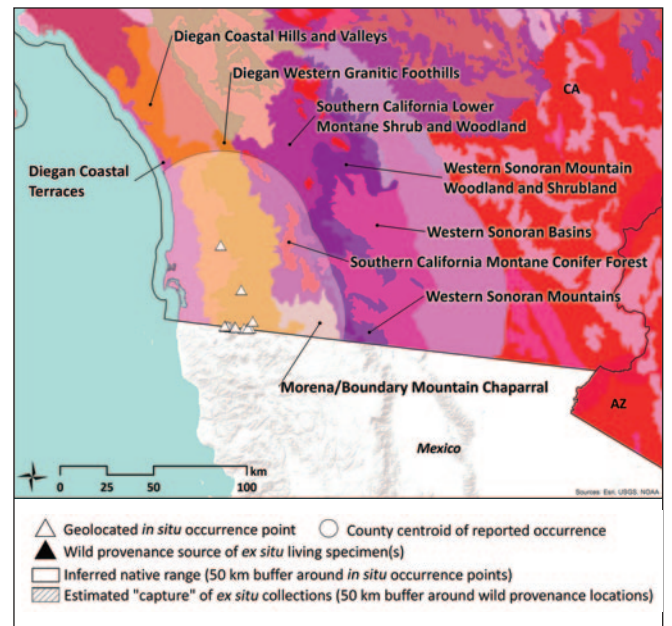


Figure 4. *Quercus cedrosensis* *in situ* occurrence points and *ex situ* collection source localities within the United States. U.S. EPA Level IV Ecoregions are colored and labelled.⁹ County centroid is shown if no precise locality data exist for that county of occurrence. Email treeconservation@mortonarb.org for more information regarding specific coordinates.

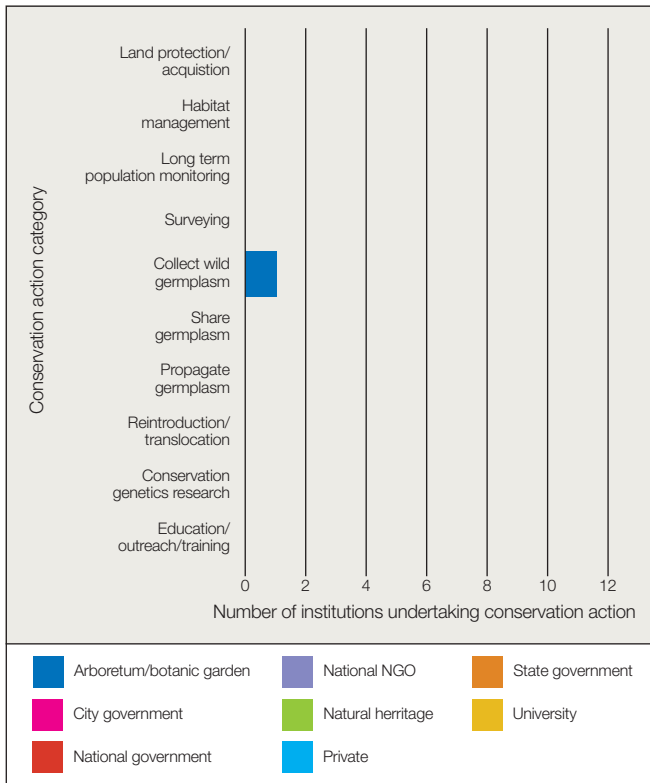


Figure 5. Number of institutions reporting conservation activities for *Quercus cedrosensis* grouped by organization type. One of 252 institutions reported activities focused on *Q. cedrosensis* (see Appendix D for a list of all responding institutions).

Land protection: Within the inferred native range of *Q. cedrosensis* in the U.S., 48% of the land is covered by protected areas (Figure 7). However, while portions of a few occurrences of *Q. cedrosensis* lie within protected areas, this provides little protection.

President Nieto of Mexico and Governor Brown of California met in 2014 and committed to “more effective cross-border coordination in development, transportation, and the environment.” As part of California’s Natural Community Conservation Planning program, more than 13,000 acres of private land were acquired in southern San Diego County between 2004 and 2014. This created a “conservation core” of almost 82,000 acres. The Las Californias Binational Conservation Initiative found the Otay Mountains Wilderness Area to be a critically important protected site for *Q. cedrosensis*.⁸

Sustainable management of land: The Las Californias Binational Conservation Initiative, located in the Baja California Border Region, began as a partnership in 2004 among Terra Peninsular, Pro Natura, and The Nature Conservancy. A review document was published in 2015 to outline the conservation gains and habitat losses over the last ten years, underscoring the urgency of conservation investments in the region. Conservation gains include “additional habitat conservation, launch of new management and monitoring programs.”⁸



Jon Rebman

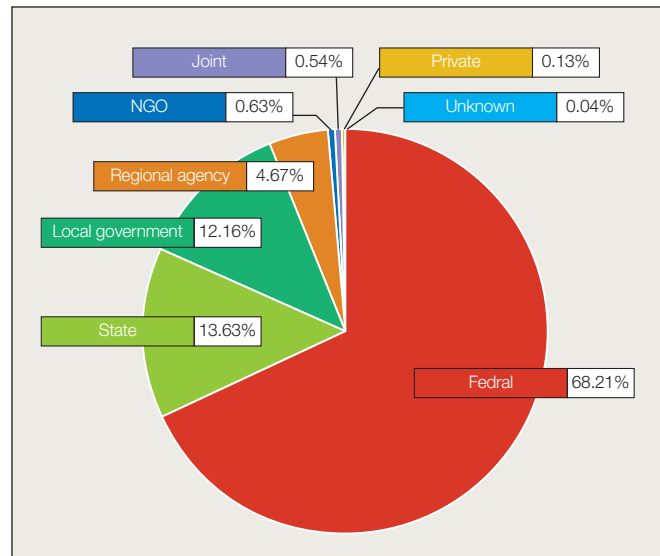


Figure 6. Management type of protected areas within the inferred native range of *Quercus cedrosensis*. Protected areas data from the U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).⁴

Population monitoring and/or occurrence surveys: *Quercus cedrosensis* populations were surveyed as part of the Vegetation Classification Manual for Western San Diego County, lead by the California Department of Fish and Game's Vegetation Classification and Mapping Program, in partnership with the Conservation Biology Institute. The recently discovered population at Otay Mountain was surveyed, in addition to smaller populations near the mountain. They found that these very localized populations are not well documented currently, and are therefore "special stands." At least four of these stands were newly discovered, expanding the species known range.¹⁰ The Las Californias Binational Conservation Initiative also plans to launch additional management and monitoring programs.⁸

Wild collecting and/or ex situ curation: In 2018, Rancho Santa Ana Botanic Garden (RSABG) was awarded funds through the APGA-USFS Tree Gene Conservation Partnership to make maternal line acorn collections of multiple *Q. cedrosensis* occurrences, establish a conservation grove at RSABG, and distribute propagules to other botanic institutions. After 2018 scouting efforts found that no acorns had been produced that year, acorn collecting was postponed until 2019 (C. Birker & D. Bell pers. comm., 2018).

Propagation and/or breeding programs: No known initiatives at the time of publication.

Reintroduction, reinforcement, and/or translocation: No known initiatives at the time of publication.

Research: The Las Californias Binational Conservation Initiative's 2015 review compiles the conservation gains and habitat losses over the last ten years, using these data to determine areas of success and need.⁸

Education, outreach, and/or training: Growth of private land trusts and community outreach non-profits in both southern California and Baja California, Mexico, have increased the public visibility of the region's conservation importance and the value of open space protection.⁸

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

PRIORITY CONSERVATION ACTIONS

In California, Cedros Island oak is primarily found immediately along the border between the U.S. and Mexico, which sees a great deal of activity from both border patrol security as well as from groups of people crossing the border. While portions of a few occurrences of *Q. cedrosensis* lie within a wilderness area, this provides little protection. It is the roadside occurrences, however, that are the most vulnerable. For conservation purposes it is recommended that all known *Q. cedrosensis* occurrences be fully mapped and that annual or even bi-annual field surveys be conducted. These monitoring activities will help determine whether or not these populations are being damaged by the heavy vehicle and OHV traffic through this area, in addition to road and fence maintenance and expansion, brush clearing, and other border activities. Being of chaparral habitat, this area is also strongly prone to human-caused fires. Demographic studies could also be carried out during monitoring activities to determine population trends.

In terms of *ex situ* conservation, it is recommended that maternal line conservation "groves" be established at a number of botanical institutions, with source material from as many wild populations as possible. These groves could serve as source material for restoration purposes in case any *Q. cedrosensis* occurrences are destroyed or heavily damaged by border management, fire, etc. Population genetics research could inform these collecting activities by aiding in the prioritization of subpopulations for inclusion in conservation groves. Development of restoration protocols would also be important if populations must be reinforced and/or translocated.

Conservation recommendations for *Quercus cedrosensis*

Highest Priority

- Population monitoring and/or occurrence surveys
- Wild collecting and/or *ex situ* curation

Recommended

- Land protection
- Propagation and/or breeding programs
- Reintroduction, reinforcement, and/or translocation
- Research (climate change modeling; demographic studies/ecological niche modeling; population genetics; restoration protocols/guidelines)
- Sustainable management of land

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