

Conservation Gap Analysis of Native Mesoamerican Oaks



Mora Olivo Arturo

Species profile: *Quercus flocculenta*

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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 gulielmi-treleasei
Quercus hintoniorum
Quercus meavei
Quercus rubramenta
Quercus tuitensis
Quercus vicentensis



THE
CHAMPION
of TREES



Quercus flocculenta C.H.Müll.

IUCN Red List Status: Endangered: B1ab(iii)+2ab(iii)

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DISTRIBUTION AND BIOLOGY

Quercus flocculenta is endemic to Nuevo Leon (Figure 1). It is found in montane chaparral and mixed pine forests, on the western slope of the Sierra Madre Oriental at elevations of 1,000–2,500 m asl. It typically occurs in association with *Juniperus mexicana*, *Pinus cembroides*, *Rhus virens*, *Cercocarpus mojadensis*, *Ceanothus ferox*, *Agave americana*, and *Garrya ovata* (Muller, 1939). A large percentage of its occurrences are within the warm temperate dry forest and cool temperate moist forest life zones (Figure 2). *Quercus flocculenta* was first described by C.H. Muller from Cerro El Potosí, which is the highest mountain in the Sierra Madre Oriental. This is the site of the largest currently recorded population (Jerome and Beckman, 2020). It can be a shrub or a small tree (~8 m.) with a low, spreading habitat that grows on openly wooded slopes (Muller, 1936).



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



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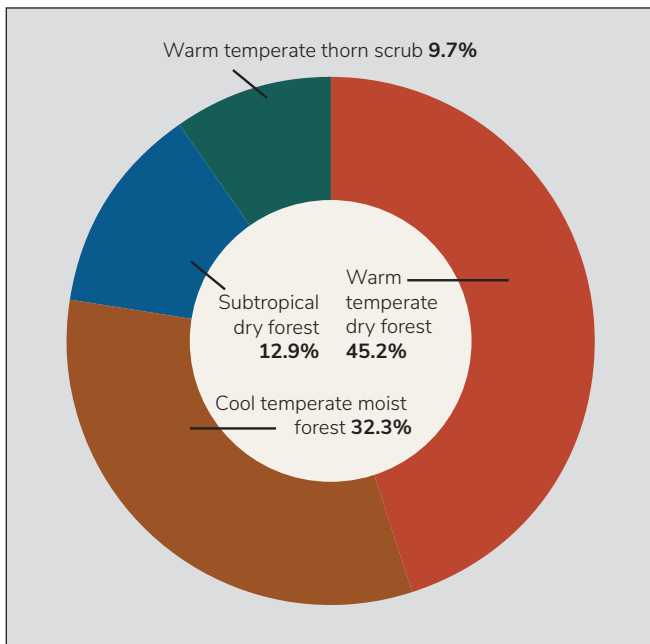


Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus flocculenta* is distributed.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: Unknown.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: *Quercus flocculenta* is threatened by the logging of timber species and grazing in its habitat. There are several ejidos (communal land) within its range (e.g., San José de las Joyas ejido) that may be impacting its habitat, but more work is needed to confirm this.

Human use of landscape — residential/commercial development, mining, and/or roads: *Quercus flocculenta* is found near the urban and rural areas of Monterrey. Urban expansion and land use change threatens the natural habitat of *Q. flocculenta*.

Human use of landscape — tourism and/or recreation: There is low-scale tourism in some locations within the species' native range, such as Cerro El Potosí. This is not considered a major threat at the time of publication.

Human modification of natural systems — altered fire regime, pollution, eradication: The logging that occurs within the habitat of *Q. flocculenta* has resulted in human induced fires.

Human modification of natural systems — invasive species competition/disturbance: Unknown.

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: In 2022 there was a severe drought in the northeastern part of Mexico where *Q. flocculenta* grows. This caused some populations of the oak woodlands to dry out. Within the inferred native range of *Q. flocculenta*, the warm temperate dry forest is expected to decrease in area by an average of 32% by the years 2061–2080 relative to current conditions (Good et al., 2024).

Genetic material loss — inbreeding and/or introgression: Unknown.

Pests and/or pathogens: In 2023, an expedition to the area surrounding Cerro Potosi found some individuals of *Q. flocculenta* covered with mistletoe. This could be a potential threat, however, more research is needed.

Extremely small and/or restricted population: Populations of *Q. flocculenta* are not abundant.



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. flocculenta* (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

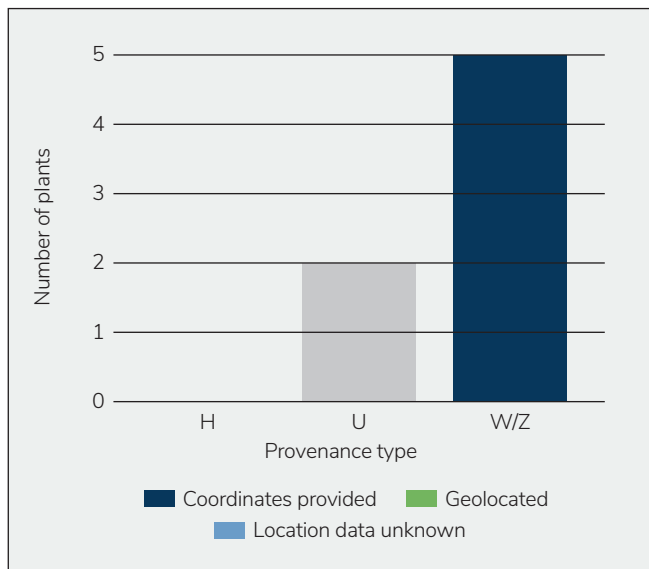


Figure 3. Number and origin of *Quercus flocculenta* plants in ex situ collections. Provenance types: H = horticultural; U = unknown; W = wild; Z = propagated from wild.

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

Number of ex situ collections reporting this species	3
Number of plants in ex situ collections	7
Average number of plants per institution	2
Percent of ex situ plants of wild origin	71%
Percent of wild origin plants with known locality	100%

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.

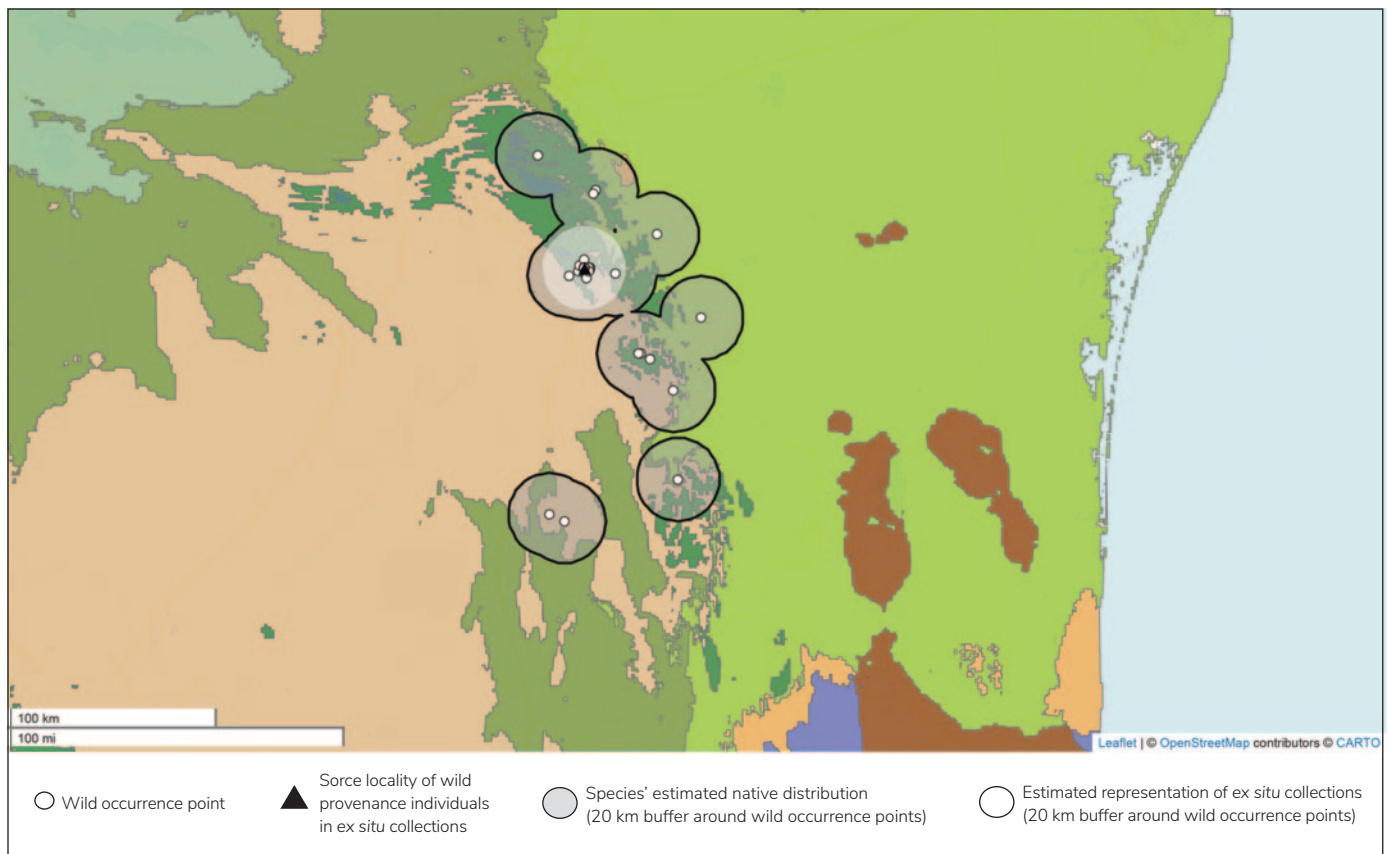


Figure 4. *Quercus flocculenta* wild occurrence points and ex situ collection source localities. Colored regions are Holdridge life zones. All ex situ collection source localities are also wild occurrence points.

Table 2. Ex situ conservation scores for *Quercus flocculenta* 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	11
Ecological coverage ex situ	67
Representation in ex situ collections	10
Final ex situ conservation score	29

Using methods adapted from Khoury et al. (2020), we estimated the degree of representation of *Q. flocculenta* 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.

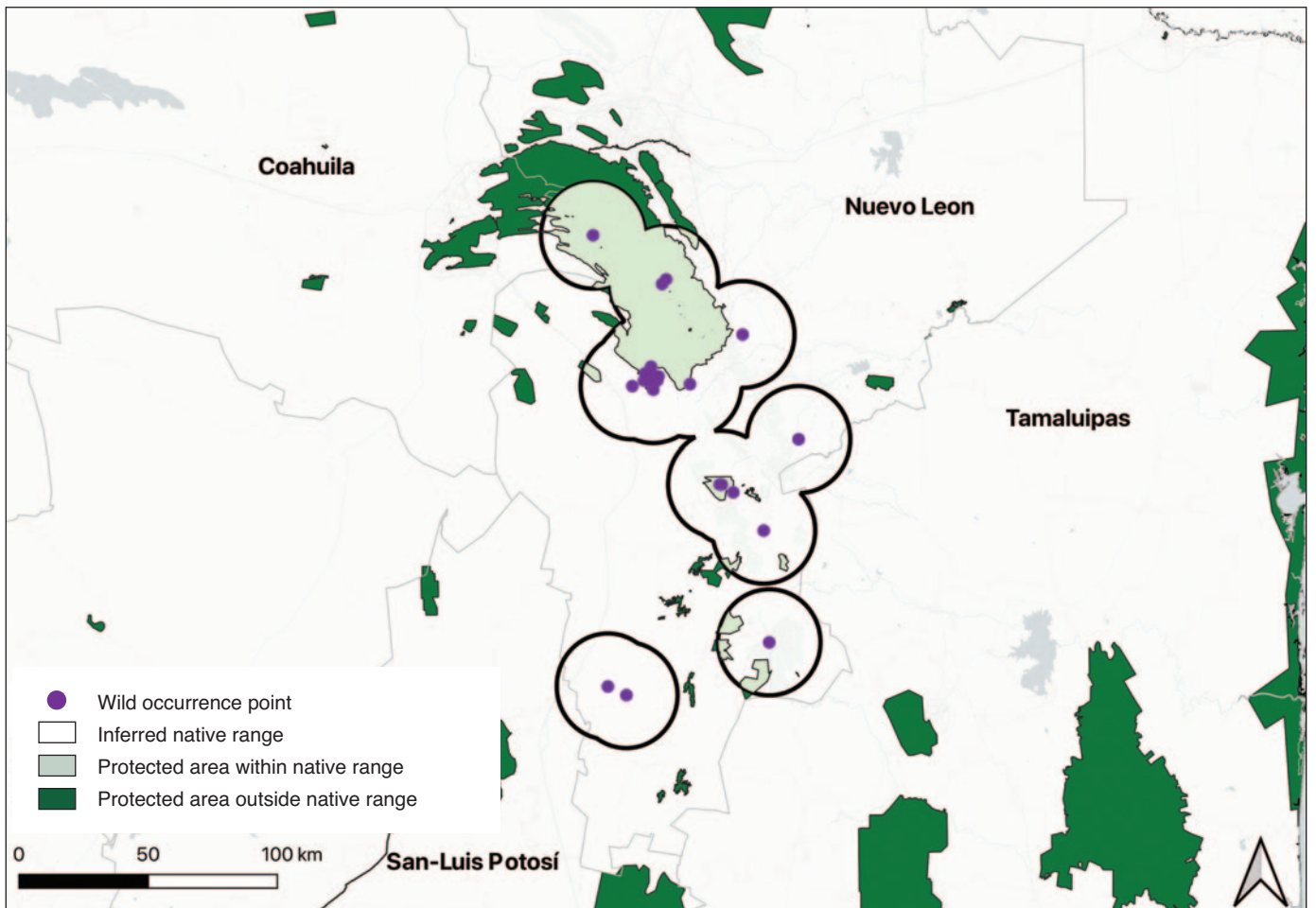


Figure 5. Wild occurrence points and inferred native range of *Quercus flocculenta* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Table 3. *In situ* conservation scores for *Quercus flocculenta* 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>	25
Ecological coverage <i>in situ</i>	100
Species representation in <i>in situ</i> collections	32
Final <i>in situ</i> conservation score	52

Land protection: Within the inferred native range of *Q. flocculenta*, 25% is within protected areas (Figure 5). There are recorded populations of *Q. flocculenta* in the Cerro El Potosí protected natural area. The Cumbres de Monterrey Biosphere Reserve and the C.A.D.N.R.026 Bajo Río San Juan (Natural Resources Protected Area) are the two major protected areas within the northern portion of the species' range.

Sustainable management of land: All biosphere reserves in Mexico are required to have a management plan, which regulates activities in the area and ensures that objectives of the reserve are achieved. However, a relatively small portion of this species' range is in a biosphere reserve and it is not clear how the management plan impacts oaks. Therefore, this is not considered to be a conservation activity at the time of publication.

Population monitoring and/or occurrence surveys: In 2023, a botanical survey was conducted to locate individuals of *Q. flocculenta*. Several individuals were found and georeferenced for future population monitoring. Additional survey work is needed in order to monitor the populations.

Wild collecting and/or ex situ curation: According to the results of our ex situ surveys, there are three ex situ collections that report holding this species. However, at least one of these collections is believed to be mis-identified as *Q. flocculenta*. More work is needed to confirm the identity of this species in each of the three ex situ collections.

Propagation and/or breeding programs: Unknown.

Reintroduction, reinforcement, and/or translocation: Unknown.

Research: There is currently little to no research focusing on *Q. flocculenta*.

Education, outreach, and/or training: Unknown.

Species protection policies: There are no known species protection policies for *Q. flocculenta*.

PRIORITY CONSERVATION ACTIONS

In order to conserve *Q. flocculenta*, the conservation activities that should be given the highest priority are:

Education, outreach, and/or training

There are currently no education or outreach programs focusing on this species. *Quercus flocculenta* is threatened by logging, grazing, urban expansion, and land use change. Increasing the awareness of this species with the general public could be one way to address these threats, and should be a priority.

Species protection policies

As with most species of oak in Mesoamerica, there is no species protection policy for *Q. flocculenta*.

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