Conservation Gap Analysis of Native

Mesoamerican Oaks


Francisco Garin

Species profile: ***Quercus gulielmi-treleasei***

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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

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Quercus gulielmi-treleasei C.H.Müll.

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

Species profile expert: Olvin Oyuela Andino, National Autonomous University of Honduras

Suggested citation: Good, K., Oyuela Andino, O., Garcia Balderas-V., and Alvarez-Clare. S. (2024). *Quercus gulielmi-treleasei* C.H.Müll. In Good, K., Coombes, A. J., Valencia-A, S., Rodríguez-Acosta, M., Beckman Bruns, E., and Alvarez-Clare, S. *Conservation Gap Analysis of Native Mesoamerican Oaks*. (pp. 197-204). Lisle, IL: The Morton Arboretum.

DISTRIBUTION AND BIOLOGY

The taxonomic status of *Quercus gulielmi-treleasei* is debated, which has resulted in conflicting accounts of its distribution. According to the IUCN Red List, *Q. gulielmi-treleasei* only occurs in Panama and Costa Rica (Gallagher, 2020). However, this species is in the flora of Guatemala (Rodas Duarte et al., 2018) and has recently been identified in Honduras (Figure 1). In Honduras there are four locations where the species has been recorded, all of which are part of protected areas: La Tigra National Park, Trifinio National Park, Reserva Biológica Guajiquiro, and Uyuca Biological Reserve. *Quercus gulielmi-treleasei* is also known to occur in Mexico in the states of Chiapas and Oaxaca, although we do not have any occurrence points for this region (Susana Valencia-A, personal communication, 2024).

Quercus gulielmi-treleasei is a large oak that can reach heights greater than 30 m. It inhabits wet montane forests at elevations between 1,300 and 3,000 m asl (Gallagher, 2020). *Quercus gulielmi-treleasei* has been recorded from seven life zones, the most common being warm temperate moist forest (Figure 2). Leaves are large (8–18 cm long and 2–5 cm wide), narrowly or broadly lanceolate, with entire margins. Acorns are 7–15 mm long and 11–15 mm wide and hemispheric to broadly ovate in shape (Muller, 1942).

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


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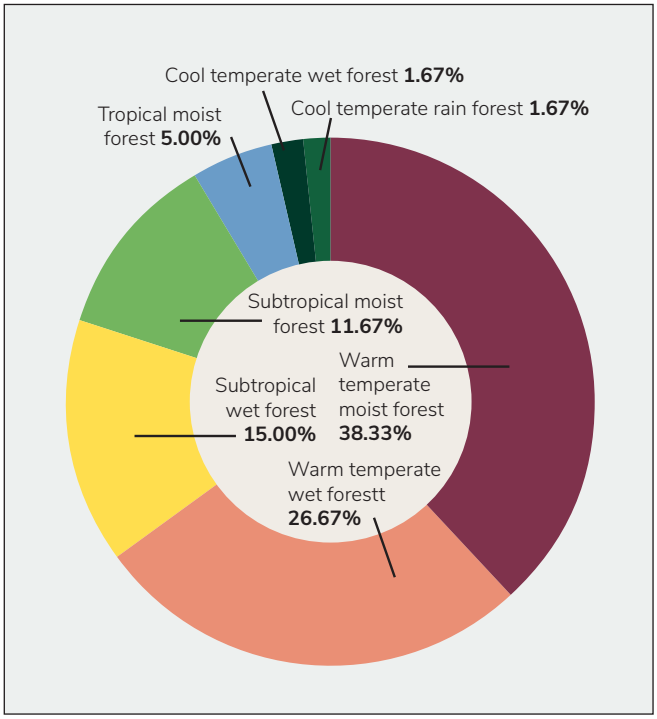

Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus gulielmi-treleasei* is distributed.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: In Honduras, the main use of *Q. gulielmi-treleasei* is for firewood. The regions with highest fragmentation are outside of the protected areas, and illegal harvesting of the trees within these areas is likely.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: Agriculture and livestock farming is common on the land outside of protected areas.

Human use of landscape — residential/commercial development, mining, and/or roads: This is not currently considered a threat.

Human use of landscape — tourism and/or recreation: Hiking and biking are two activities that are allowed within the buffer zones of protected areas. Both of these activities are a threat to the species.

Human modification of natural systems — altered fire regime, pollution, eradication: Unknown.

Human modification of natural systems — invasive species competition/disturbance: This is not currently considered a threat.

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: Climate projections show a warming of 3–7°C, a reduction in annual precipitation, and an increase in dry spells by the end of the century for Guatemala, Honduras, Costa Rica, and Panama (Lyra et al., 2017). A recent study focusing on Costa Rica found that climate change will result in a shift in Holdridge life zones, with the most prominent impacts occurring at higher elevations where species such as *Q. gulielmi-treleasei* are found (Birkel et al., 2022). Within the inferred native range of *Q. gulielmi-treleasei*, the warm temperate moist forest is expected to decrease in area by an average of 31% 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: Unknown.

Extremely small and/or restricted population: Unknown.


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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. gulielmi-treleasei* (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	4
Number of plants in *ex situ* collections	4
Average number of plants per institution	1
Percent of *ex situ* plants of wild origin	75%
Percent of wild origin plants with known locality	100%

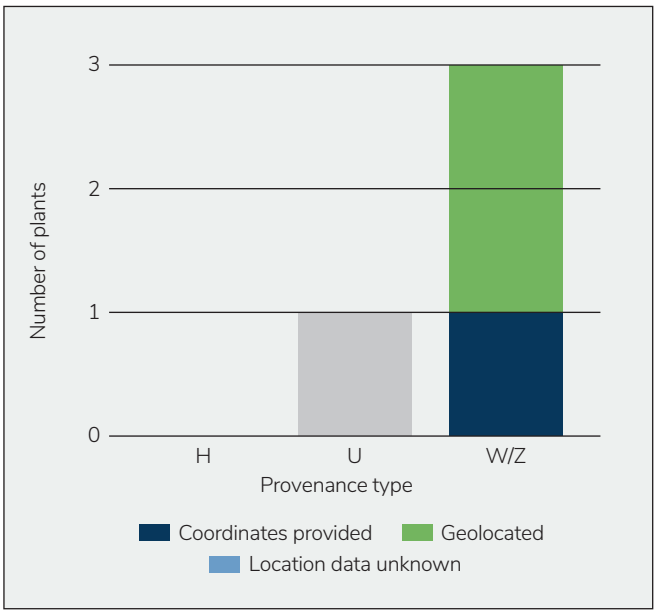

Figure 3. Number and origin of *Quercus gulielmi-treleasei* plants in *ex situ* collections. Provenance types: H = horticultural; U = unknown; W = wild; Z = propagated from wild.

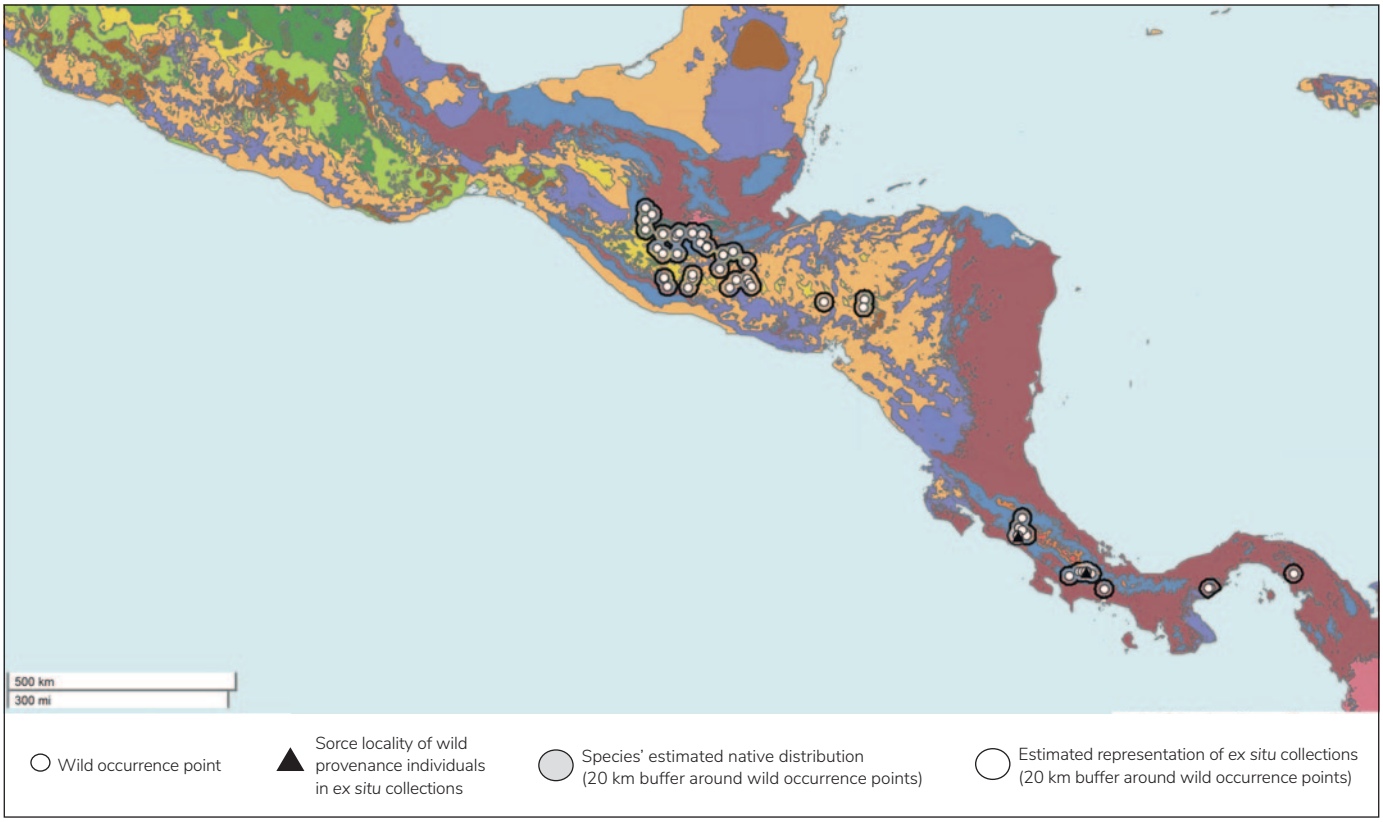

Figure 4. *Quercus gulielmi-treleasei* wild occurrence points and *ex situ* collection source localities. Colored regions are Holdridge life zones. All *ex situ* collection source localities are also wild occurrence points.

Table 2. *Ex situ* conservation scores for *Quercus gulielmi-treleasei* 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*	7
Ecological coverage *ex situ*	50
Representation in *ex situ* collections	30
Final *ex situ* conservation score	29


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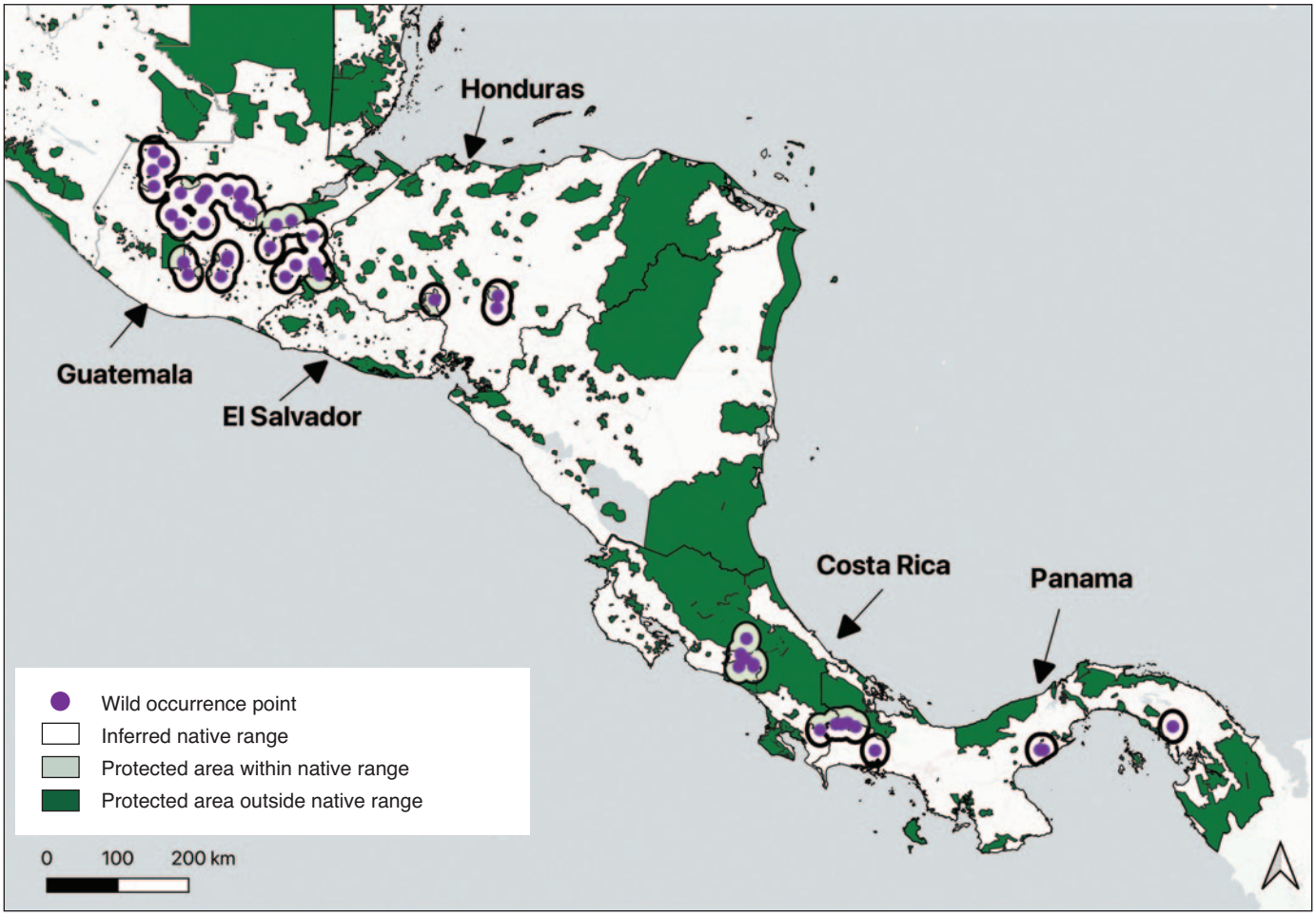

Figure 5. Wild occurrence points and inferred native range of *Quercus gulielmi-treleasei* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023.

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

Table 3. *In situ* conservation scores for *Quercus gulielmi-treleasei* 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 *in situ*	24
Ecological coverage *in situ*	93
Species representation in *in situ* collections	46
Final *in situ* conservation score	54

Land protection: Within the inferred native range of *Q. gulielmi-treleasei*, 24% is within protected areas (Figure 5). A majority of the protected area is within Costa Rica, and includes the Biosphere Reserves Cordillera Volcánica Central and Los Santos. In Honduras, *Q. gulielmi-treleasei* was recently observed in Reserva Biológica Guajiquiro, La Tigra National Park, Trifinio National Park, and Uyuca Biological Reserve.

Sustainable management of land: Within the native range of *Q. gulielmi-treleasei* there are management plans for the land and ecosystem as a whole, but they are not species specific.

Population monitoring and/or occurrence surveys: This is not a conservation activity at the time of publication.

Wild collecting and/or ex *situ* curation: According to the results of the ex *situ* surveys, this species is in four collections. All wild provenance individuals were collected from two locations in Costa Rica. There are no living individuals in ex *situ* collections from Guatemala, Honduras, Mexico, or Panama.

Propagation and/or breeding programs: This is not a conservation activity at the time of publication.

Reintroduction, reinforcement, and/or translocation: This is not a conservation activity at the time of publication.

Research: There is little to no research focused on *Q. gulielmi-treleasei*.

Education, outreach, and/or training: This is not a conservation activity at the time of publication.

Species protection policies: There are no species protection policies for *Q. gulielmi-treleasei*.

PRIORITY CONSERVATION ACTIONS

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

Research

There is an urgent need to conduct scientific studies to better understand the ecology and biology of *Q. gulielmi-treleasei*, including habitat requirements, population size and trends, and reproduction.

Land protection

It should be considered a priority to identify and further protect key areas that support significant populations of *Q. gulielmi-treleasei*, including forests and natural habitats. There is a need to implement measures to control and prevent illegal logging of *Q. gulielmi-treleasei* trees, as well as strengthen the enforcement of forest laws and regulations.

Sustainable management of land

Reforestation and restoration programs should be established for degraded areas that contain *Q. gulielmi-treleasei*, using appropriate planting and sustainable management methods.

Education, outreach, and/or training

Encouraging the participation of local communities in conservation efforts and promoting environmental education and awareness about the importance of protecting *Q. gulielmi-treleasei* forests is necessary for long-term conservation of this species.

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