

Conservation Gap Analysis of Native Mesoamerican Oaks



Species profile: *Quercus galeanensis*

Kate Good, Juan Encina Domínguez, José Luciano Sabás-Rosales,
Victor Garcia Balderas, Silvia Alvarez-Clare

CRITICALLY ENDANGERED

Quercus graciliformis
Quercus mulleri

ENDANGERED

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 galeanensis C.H.Müll.

Common name(s), Spanish: Charascillo, encino enano

IUCN Red List Category and Criteria: Endangered B2ab(iii)

Species profile experts: Juan Encina Domínguez, Universidad Autónoma Agraria Antonio Narro (UAAAN); José Luciano Sabás-Rosales, Instituto Nacional de Estadística y Geografía

Suggested citation: Good, K., Encina Domínguez, J., Sabás-Rosales, J. L., García Balderas, V., and Alvarez-Clare, S. (2024). *Quercus galeanensis* 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. 181-188). Lisle, IL: The Morton Arboretum.

DISTRIBUTION AND BIOLOGY

Quercus galeanensis is endemic to Mexico, where it can be found in the Sierra Madre Oriental primarily in the states of Nuevo León and Tamaulipas (Figure 1). It has also recently been observed in San Luis Potosí, where it has an extremely restricted distribution (Sabás-Rosales et al., 2015). This species was originally described by Muller in 1936 from the hills near Mun. de Galeana in Nuevo León, from which it was named. A majority of known occurrences are in the warm temperate thorn scrub life zone (Figure 2).



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

Quercus galeanensis is a large shrub that grows 1–2.5 m tall. It occurs in transitional areas between pinyon-pine forest and chaparral montane habitat at elevations from 1,900 to 2,500 m asl. It is associated with species such as *Comarostaphylis polifolia*, *Cercocarpus* sp., *Pinus cembroides*, *P. pseudostrobus*, *P. teocote*, *Q. pringlei*, *Brahea* sp., and *Rhus virens* (Pérez Mojica and Valencia-A, 2017).

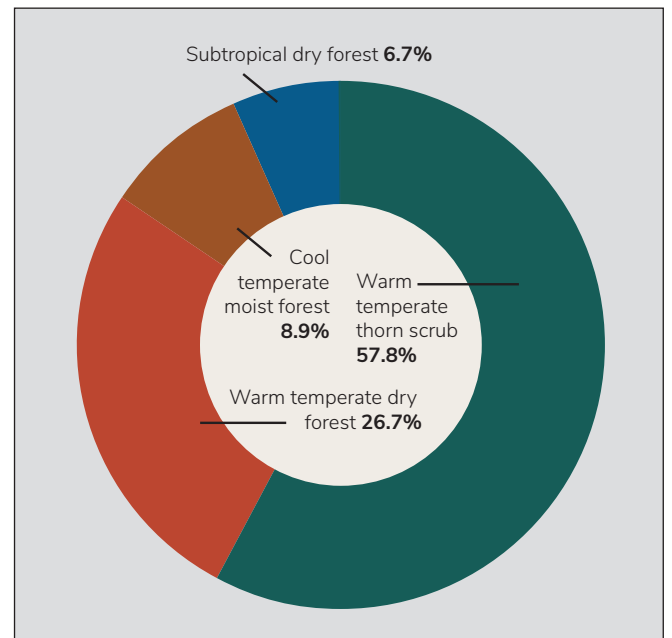


Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus galeanensis* is distributed.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: This is not currently considered a threat. *Quercus galeanensis* is shrub-like and does not provide firewood. Acorns are not reported to be consumed by people.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: This species grows in ejidos where extensive grazing from domestic animals can harm mature individuals as well as new growth.

Human use of landscape — residential/commercial development, mining, and/or roads: Soil/substrate is extracted from the mountains and the forests within *Q. galeanensis* habitat to use for gardens. There is some residential development within the region, where local people purchase properties within ejidos to construct homes/cabins in those regions.

Human use of landscape — tourism and/or recreation: This is not considered a major threat. There is little tourism in the area and the population density is low.

Human modification of natural systems — altered fire regime, pollution, eradication: Habitat fragmentation and cabins within the region may lead to forest fires.

Human modification of natural systems — invasive species competition/disturbance: When there are fires, other species such as *Mimosa aculeaticarpa* may replace the oaks. Although *M. aculeaticarpa* is a native species, it is quite aggressive and can out compete oaks.

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: The habitat of *Q. galeanensis* is typically dry and drought is not uncommon. Climate change, including more frequent or prolonged droughts, may affect regeneration of this species. There was an intense drought in the summer of 2023 which impacted the forests and many trees died. Within the inferred native range of *Q. galeanensis*, the warm temperate thorn scrub is expected to decrease in area by an average of 71% by the years 2061–2080 relative to current conditions (Good et al., 2024).

Genetic material loss — inbreeding and/or introgression: This is not currently considered a threat.

Pests and/or pathogens: Unknown.

Extremely small and/or restricted population: Although the population is not extremely small, it is restricted. This species is endemic to the Galeana region, and the distribution is restricted to scrubland.



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. galeanensis* (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

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

Number of ex situ collections reporting this species	9
Number of plants in ex situ collections	20
Average number of plants per institution	2
Percent of ex situ plants of wild origin	20%
Percent of wild origin plants with known locality	75%

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.

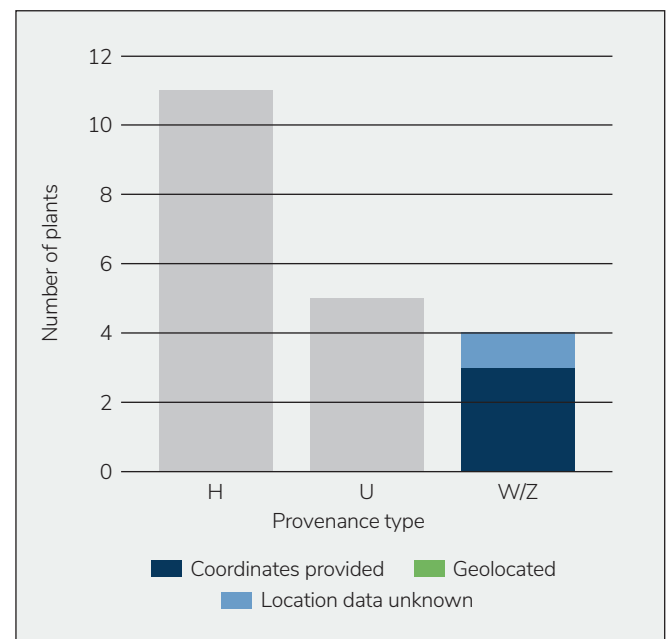


Figure 3. Number and origin of *Quercus galeanensis* plants in ex situ collections. Provenance types: H = horticultural; U = unknown; W = wild; Z = propagated from wild.

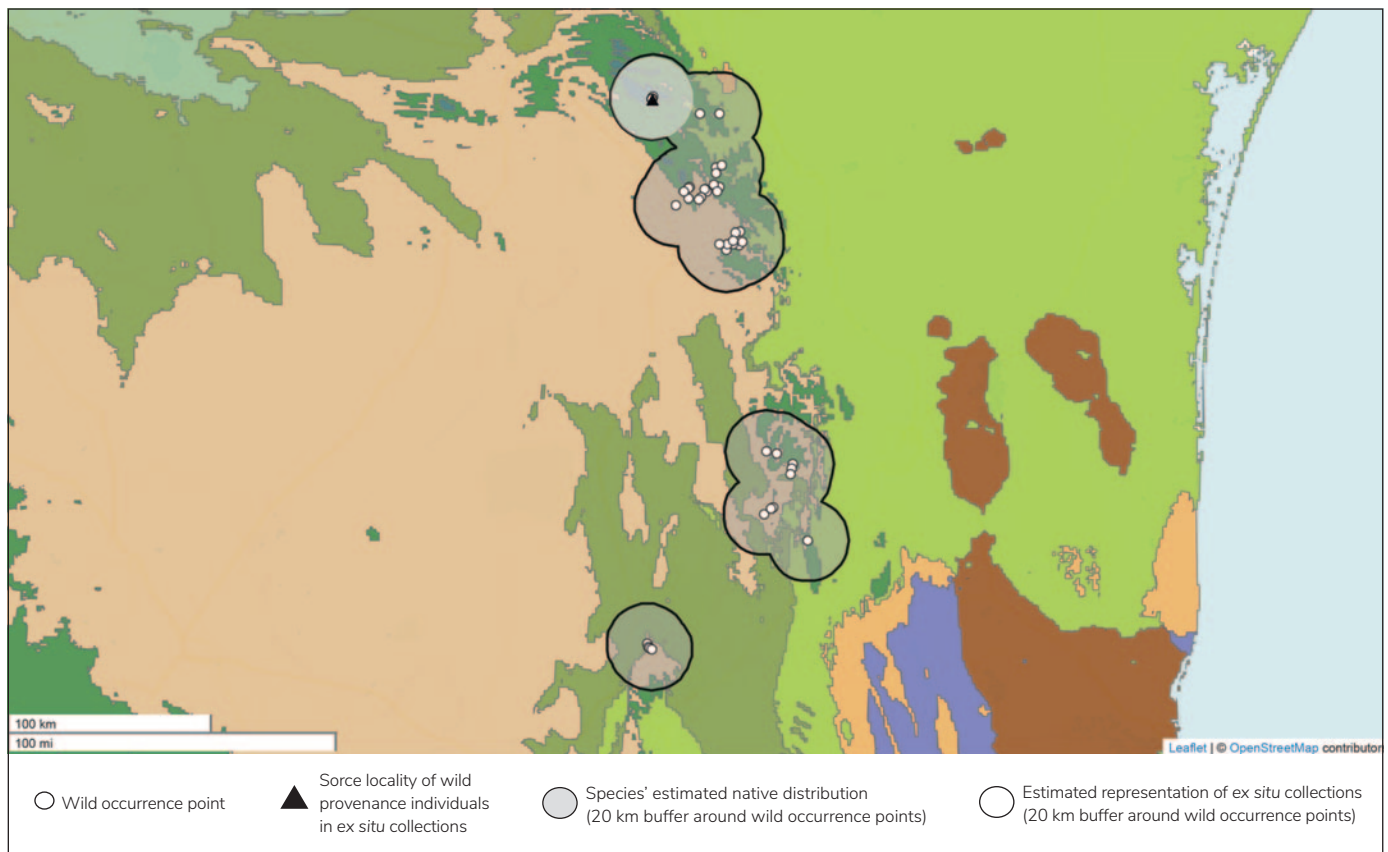


Figure 4. *Quercus galeanensis* wild occurrence points and ex situ collection source localities. Colored regions are Holdridge life zones. All ex situ collection source localities are also wild occurrence points.

Table 2. Ex situ conservation scores for *Quercus galeanensis* 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	20
Final ex situ conservation score	33

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

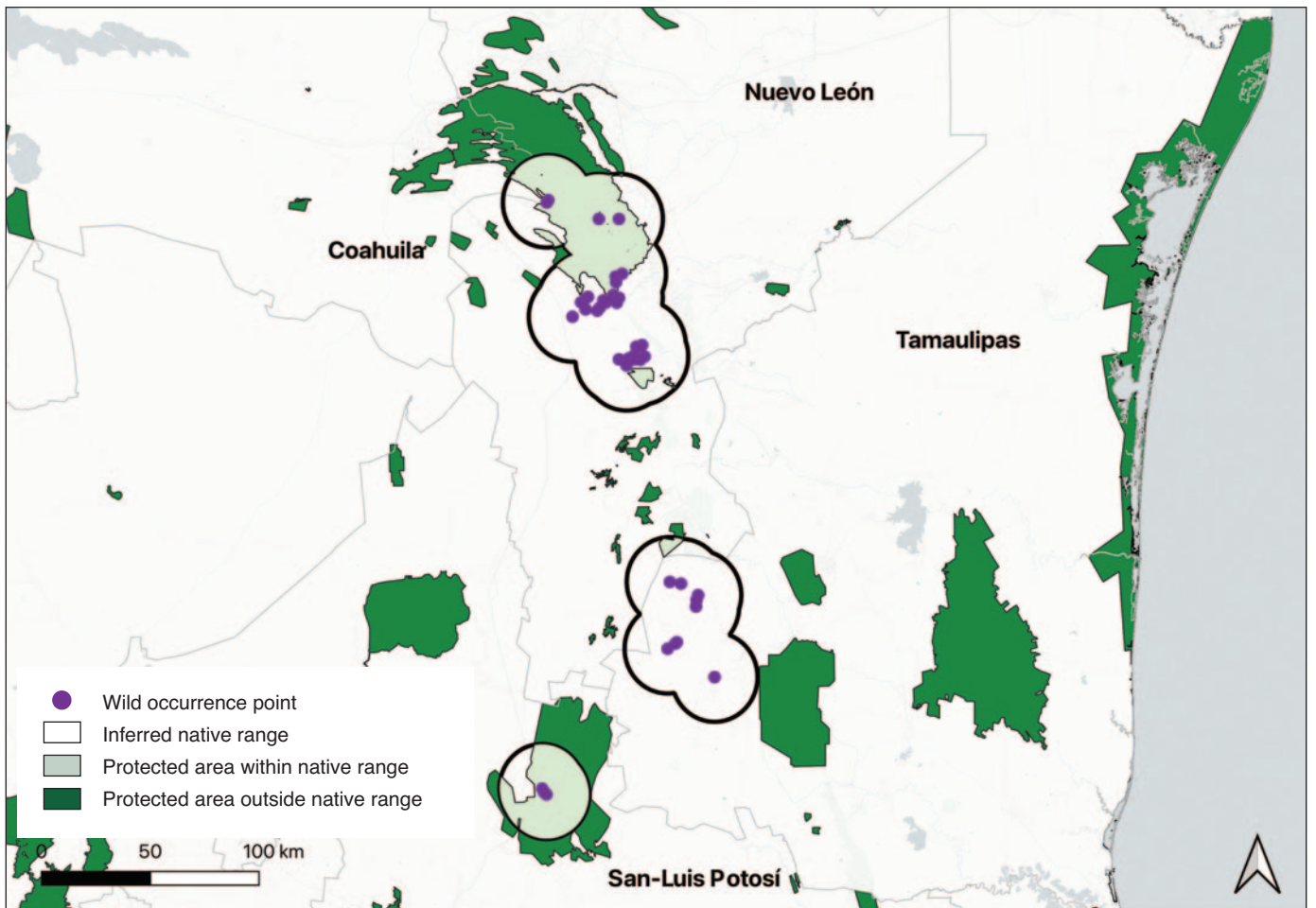


Figure 5. Wild occurrence points and inferred native range of *Quercus galeanensis* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Table 3. *In situ* conservation scores for *Quercus galeanensis* 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>	26
Ecological coverage <i>in situ</i>	100
Species representation in <i>in situ</i> collections	26
Final <i>in situ</i> conservation score	51

Land protection: Within the inferred native range of *Q. galeanensis*, 26% is within protected areas (Figure 5). The species is found within the Cumbres de Monterrey Biosphere Reserve.

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.

Population monitoring and/or occurrence surveys: Field work and explorations have been completed for this species. Further research is needed to determine population size.

Wild collecting and/or ex situ curation: According to the results of our *ex situ* survey, *Q. galeanensis* is currently in nine collections. All wild provenance individuals were collected from the far northern portion of this species range (Figure 4). Herbarium specimens have also been collected. However, it should be noted that plants under this name in Europe are not *Q. galeanensis* but are a new species to be described in 2025. These all came from Coahuila, Sierra de Arteaga, La Moneda in 2003.

Propagation and/or breeding programs: This is not currently a conservation activity at the time of publication. However, there are plans to collect acorns for propagation in 2024 with the intention of sharing them with botanic gardens in the region.

Reintroduction, reinforcement, and/or translocation: This is not currently a conservation activity at the time of publication. However, there are plans to collect acorns for propagation in 2024 and these could be used for *in situ* conservation. There is a nursery at the Universidad Autónoma Agraria Antonio Narro that has the appropriate equipment to support the propagation/breeding program that would be necessary to establish *in situ* conservation efforts for this species.

Research: There is very little research focused on *Q. galeanensis*. There are recent herbarium vouchers with distinctions of the species, but there is a need for ecological studies.

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

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

PRIORITY CONSERVATION ACTIONS

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

Population monitoring and/or occurrence surveys

Field work is needed to verify historical occurrences of this species, quantify distribution and calculate the species' extent of occurrence (EOO) and area of occupancy (AOO). More information is needed on the property type in which this species is found (ejidos, private land, protected areas, etc.) to further direct conservation efforts.

Research

There is currently little to no research on *Q. galeanensis*. There is especially a need for ecological studies.

REFERENCES

- Good, K., Coombes, A. J., Valencia-A, S., Rodríguez-Acosta, M., Beckman Bruns, E., and Alvarez-Clare, S. 2024. Conservation Gap Analysis of Native Mesoamerican Oaks. Lisle, IL: The Morton Arboretum.
- Khoury, C. K, Carver, D., Greene, S. L., and Frances, A. 2020. Crop wild relatives of the United States require urgent conservation action. *PNAS* 117(52): 33351–33357. <https://doi.org/10.1073/pnas.2007029117>
- Muller, C. H. 1936. Studies in the oaks of the mountains of Northeastern Mexico. *Journal of the Arnold Arboretum* 17(3): 160–179. <https://www.jstor.org/stable/43782382>
- Pérez Mojica, E. and Valencia-A., S. 2017. Estudio preliminar del género *Quercus* (Fagaceae) en Tamaulipas, México. *Acta Botanica Mexicana* 120: 59–111. <https://doi.org/10.21829/abm120.2017.1264>
- Sabás-Rosales J. L., Sosa-Ramírez, J. and Luna-Ruiz, J. d. J. 2015. Diversidad, distribución y caracterización básica del hábitat de los encinos (*Quercus*: Fagaceae) del Estado de San Luis Potosí, México. *Botanical Sciences* 93(4): 881–897. <https://doi.org/10.17129/botsci.205>
- UNEP-WCMC and IUCN. 2023. Protected Planet: The World Database on Protected Areas (WDPA) [Online] Cambridge, UK. Available at www.protectedplanet.net. Accessed 2023.

