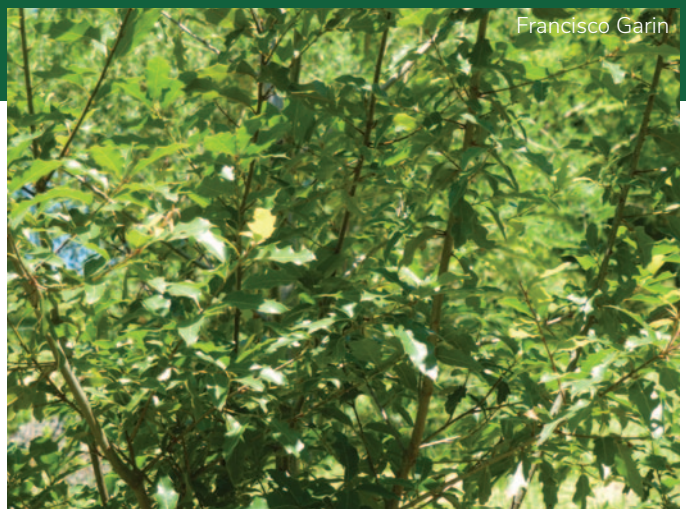
Conservation Gap Analysis of Native

Mesoamerican Oaks


Francisco Garin

Species profile: ***Quercus cupreata***

Kate Good, Juan Encina Domínguez, Aida Leal Robles,
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 gulielmi-treleasei
Quercus hintoniorum
Quercus meavei
Quercus rubramenta
Quercus tuitensis
Quercus vicentensis

The Morton Arboretum | THE CHAMPION of TREES
Global Conservation Consortium Oak
CSS TREES Center for Species Survival
Franklinia Foundation

Quercus cupreata Trel. & C.H.Mull.

IUCN Red List Category and Criteria: Endangered B1ab(iii)+2ab(iii)

Species profile experts: **Juan Encina Domínguez,** Universidad Autónoma Agraria Antonio Narro (UAAAN); **Aida Isabel Leal Robles,** Universidad Autónoma Agraria Antonio Narro (UAAAN)

Suggested citation: Good, K., Encina Domínguez, J., Leal Robles, A., Garcia Balderas, V., and Alvarez-Clare, S. (2024). *Quercus cupreata* Née. 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. 125-132). Lisle, IL: The Morton Arboretum.

DISTRIBUTION AND BIOLOGY

Quercus cupreata is a geographically restricted species that occurs in northern Sierra Madre Oriental, primarily in the Mexican state of Nuevo León (Figure 1). There is also a herbarium specimen identified as *Q. cupreata* that was collected from Tamaulipas near Cañón de La Peregrina in 2015. However, in a review of herbarium specimens from Tamaulipas by Pérez Mojica and Valencia-A (2017), they found no evidence of *Q. cupreata* in Tamaulipas. More work is needed here. *Quercus cupreata* inhabits sclerophyll oak and pine forest in association with *Q. fusiformis, Q. laceyi, Q. canbyi, Q. glaucoides, Q. rysophylla, Q. polymorpha, Q. mexicana, Juglans* spp., *Carya illinoinensis, Ungnadia speciosa, Arbutus arizonica, Pinus pseudostrobus*, and *P. montezumae* (Rahim and Maginot, 2017). It can be found at an elevation of 800–1,400 m asl (Jerome, 2018). All known occurrences are within the life zones subtropical dry forest, warm temperate thorn scrub, and warm temperate dry forest (Figure 2).

Quercus cupreata is a mid-sized tree that grows from 5–10 m. Leaves are narrowly lanceolate and lobed with long-setaceous points, 3–4 x 10–12 cm. Bark is dark gray or black and deeply fissured. Fruit is biennial. (Mueller, 1936)

Leon Béatrice Chassé

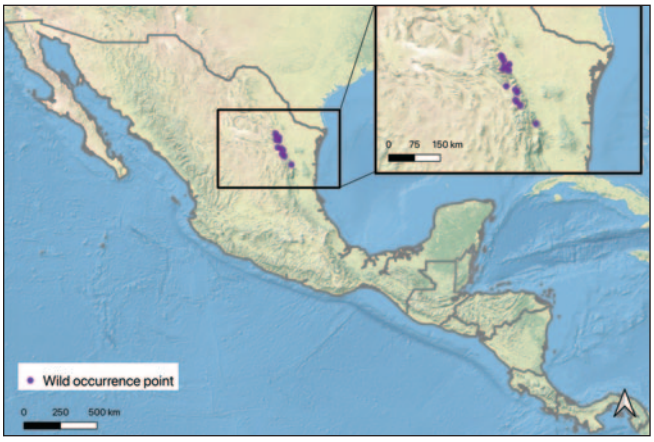


Figure 1. Wild (i.e., *in situ*) occurrence points for *Quercus cupreata*.

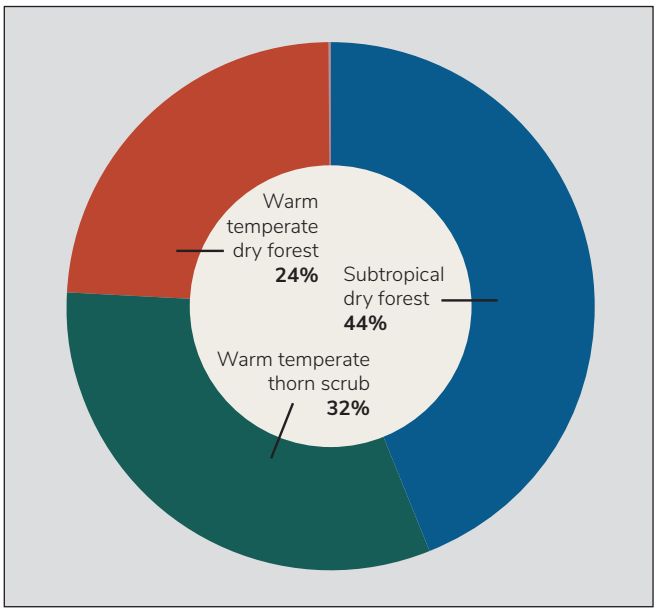


Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus cupreata* is distributed.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: This is not currently considered a threat. It is possible that the wood of *Q. cupreata* provides sources of firewood or building material in ejidos, but this has not been confirmed and is unlikely to be a major threat.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: Grazing and logging threaten *Q. cupreata* in the southern portion of its range. Grazing from horses, cows, and sheep can affect the new growth and seedlings. This species occurs in ejidos, where grazing is common.

Human use of landscape — residential/commercial development, mining, and/or roads: This species is vulnerable to land conversion for the development of "fraccionamientos" (camping cabins) near Monterrey in the suburbs. Population growth in Monterrey, and with it residential and commercial development, is increasing.

Human use of landscape — tourism and/or recreation: There is tourism and recreation within the area. Although people are not there to specifically see the oaks, there is still an environmental impact.

Human modification of natural systems — altered fire regime, pollution, eradication: The people in the ejidos occasionally start fires, which have the potential to grow out of control and lead to wildfires. In regards to pollution, proximity to the city results in locals dumping their trash (e.g., construction materials) in clandestine ways.

Human modification of natural systems — invasive species competition/disturbance: *Ligustrum lucidum* is an invasive exotic shrub that competes with oaks and can be found in small groves within *Q. cupreata* habitat. There are 24 additional invasive species that have been identified within the Cumbres de Monterrey, a national park in the region (CONAP, 2020). More work is needed to determine if they impact oaks.

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: In 2022 there was a severe drought in the northeastern part of Mexico. This caused some populations of the oak woodlands to dry out. In the past, the wet season and dry season were more predictable. As droughts become more intense, it is likely that *Q. cupreata* will suffer. Within the inferred native range of *Q. cupreata*, the subtropical dry forest is expected to decrease in area by an average of 13% by the years 2061–2080 relative to current conditions (Good et al., 2024).

Genetic material loss — inbreeding and/or introgression: Within *Q. cupreata* habitat there are various red oak species, and it is likely that there is introgression and hybridization among those oaks. This species potentially hybridizes with *Q. canbyi*. Because this species is restricted, it is prone to genetic loss if individuals die. More research is needed, however, to determine if this poses a threat.

Pests and/or pathogens: Unknown.

Extremely small and/or restricted population: According to the herbarium collections, this species is a microendemic to the region.

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. cupreata* (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	6
Number of plants in ex *situ* collections	19
Average number of plants per institution	3
Percent of ex *situ* plants of wild origin	95%
Percent of wild origin plants with known locality	100%

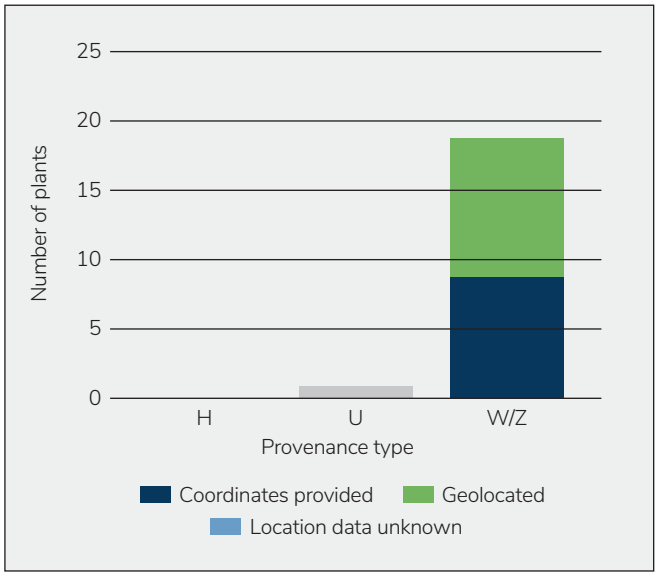


Figure 3. Number and origin of *Quercus cupreata* plants in ex *situ* collections. Provenance types: H = horticultural; U = unknown; W = wild; Z = propagated from wild.


Béatrice Chassé

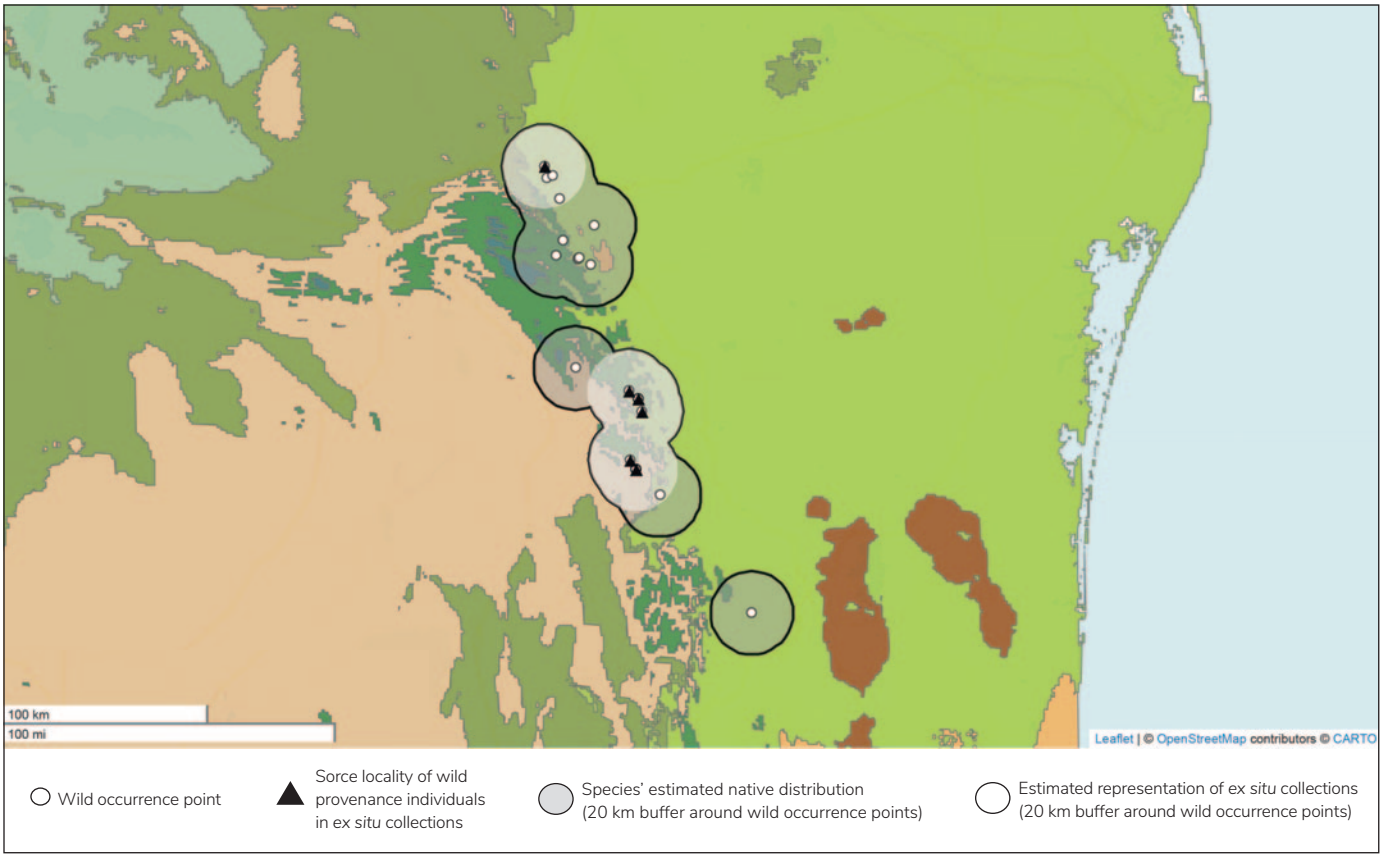


Figure 4. *Quercus cupreata* wild occurrence points and *ex situ* collection source localities. Colored regions are Holdridge life zones. All *ex situ* collection source localities are also wild occurrence points.

Table 2. *Ex situ* conservation scores for *Quercus cupreata* 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*	44
Ecological coverage *ex situ*	67
Representation in *ex situ* collections	50
Final *ex situ* conservation score	53

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

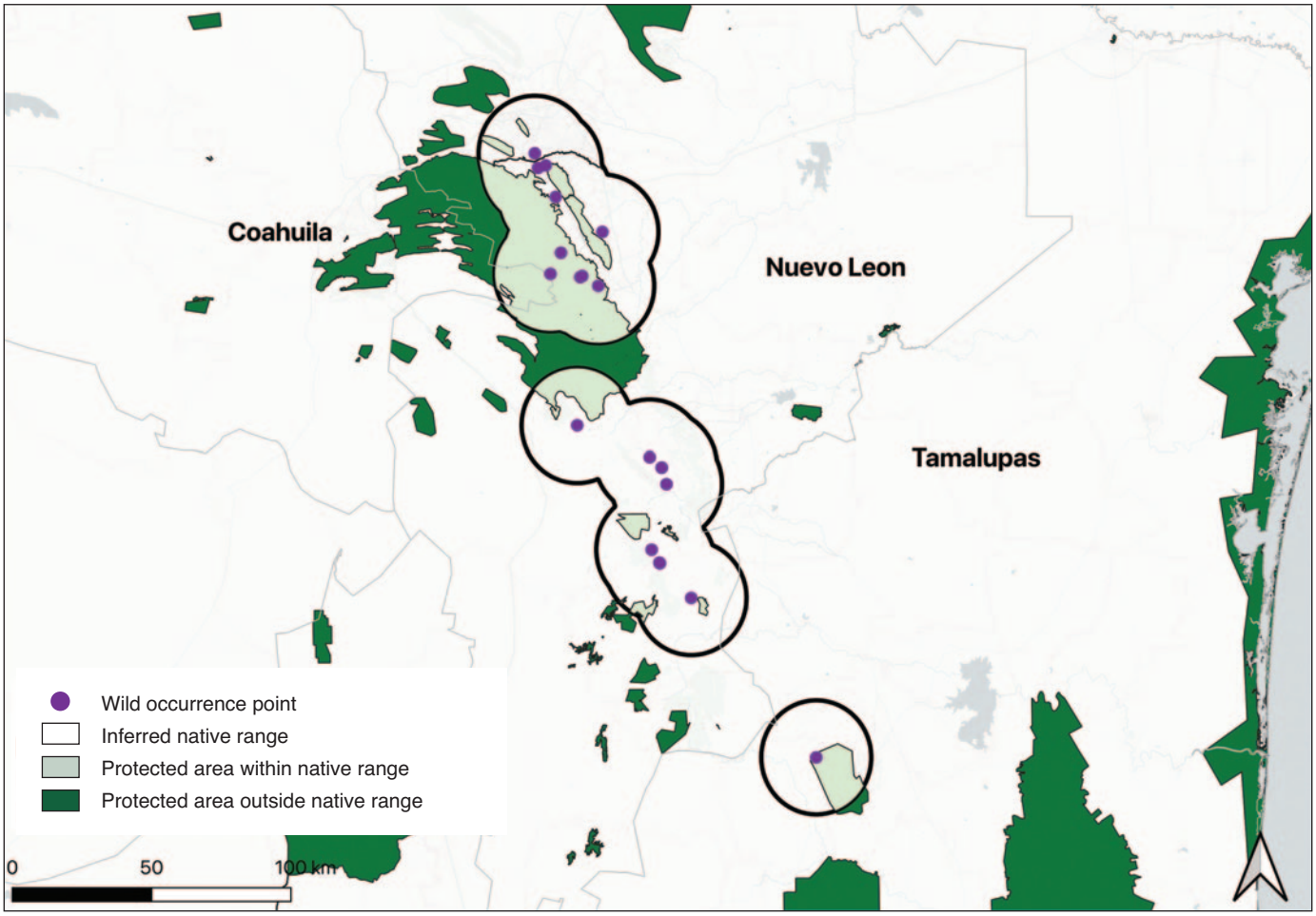


Figure 5. Wild occurrence points and inferred native range of *Quercus cupreata* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023.


Béatrice Chassé

Table 3. *In situ* conservation scores for *Quercus cupreata* 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*	27
Ecological coverage *in situ*	100
Species representation in *in situ* collections	29
Final *in situ* conservation score	52

Land protection: Within the inferred native range of *Q. cupreata*, 27% is within protected areas (Figure 5). This species is located within Cumbres de Monterrey national park.

Sustainable management of land: Cumbres de Monterrey national park is managed by the Comisión Nacional de Áreas Naturales Protegidas (CONAP) to address insect plagues, invasive species, and reduce fire risk.

Population monitoring and/or occurrence surveys: This is not a conservation activity at the time of publication. Occurrence points have been documented from a few herbarium specimens and iNaturalist. More research is needed on the current population status.

Wild collecting and/or *ex situ* curation: According to the results of our *ex situ* survey, this species is currently held in six *ex situ* collections.

Propagation and/or breeding programs: This is not currently a conservation activity, however it is planned for the 2024 field season by the Universidad Autónoma Agraria Antonio Narro (UAAAN) nursery.

Reintroduction, reinforcement, and/or translocation: This is not currently a conservation activity, however it is planned for the 2024 field season by the UAAAN nursery.

Research: There is little to no research focused on *Q. cupreata* at the time of publication. More research is needed to study the ecology of the species, as well as the diversity of its forest habitat.

Education, outreach, and/or training: There are no known education or outreach programs for this species. There are environmental education programs in Chipinque ecological park, but they do not include *Q. cupreata*.

Species protection policies: There are no species protection policies in place for *Q. cupreata*.

PRIORITY CONSERVATION ACTIONS

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

Population monitoring and/or occurrence surveys

Very little survey work has been done for *Q. cupreata* and occurrence points need to be verified. Field work is also needed to provide information on population structure, forest structure, and ecology. More herbarium specimens should be collected.

Propagation and/or breeding programs

Acorns should be collected and a propagation program established for this species.

Research

There is very little research on *Q. cupreata*. More is needed, especially qualitative information on regeneration of this species.

Education, outreach, and/or training

Quercus cupreata grows near the urban area of Monterrey. Education and outreach to the local community on the conservation value of this species is vital, especially in the face of urban expansion and development within the region.

REFERENCES

Comisión Nacional de Áreas Naturales Protegidas (CONAP). 2020. Parque Nacional Cumbres de Monterrey: Borrador Programa de Manejo. Available at https://www.conanp.gob.mx/anp/consulta/Borrador%20PM%20PN%20Cumbres%20Mty%20para%20Consulta%20P%C3%BAblica%202020.pdf. Accessed February 2024.

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.

Jerome, D. 2018. *Quercus cupreata*. The IUCN Red List of Threatened Species 2018: e.T89183788A89183819. Available at https://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T89183788A89183819.en. Accessed January 2024.

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

Mueller, C. H. 1936. New and noteworthy trees in Texas and Mexico. *Bulletin of the Torrey Botanical Club* 63(3): 147–155. https://doi.org/10.2307/2481214

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

Rahim, H., and Maginot, N. H. 2017. Structure and Floristic Compositions of Ecosystems of Northeast of Mexico. *Chronicle of Bioresource Management* 1(2): 060–064.

UNEP-WCMC and IUCN. 2023. Protected Planet: The World Database on Protected Areas (WDPA) [Online] Cambridge, UK. Available at www.protectedplanet.net. Accessed 2023.