Conservation Gap Analysis of Native

Mesoamerican Oaks


Francisco Garin

Species profile: ***Quercus hintonii***

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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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Global Conservation Consortium Oak

CSS TREES Center for Species Survival

Franklinia Foundation

Quercus hintonii E.F.Warb.

Common Names, Spanish: Encino prieto, Encino tonto, Encino loco
IUCN Red List Category and Criteria: Endangered B1ab(i,ii,iii)+2ab(i,ii,iii)

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DISTRIBUTION AND BIOLOGY

Quercus hintonii is endemic to the state of México in the Sierra Madre del Sur (Figure 1). It is found in three primary localities: the Sierra de Goleta, the Sierra de Nanchititla, and between Temascaltepec and Tejupilco (Oldfield and Eastwood, 2007). The far southeastern occurrence point near the border with Michoacán is uncertain, and should be reviewed. *Quercus hintonii* inhabits mixed pine-oak forests in areas with a marked dry season in spring and abundant rainfall in the summer. It grows in association with *Q. magnoliifolia, Q. obtusata*, and *Q. peduncularis* at altitudes between 1,300 and 2,000 m asl (Reyes-Jaramillo, 2006). A majority of known occurrences of *Q. hintonii* occur in the subtropical moist forest life zone (Figure 2).

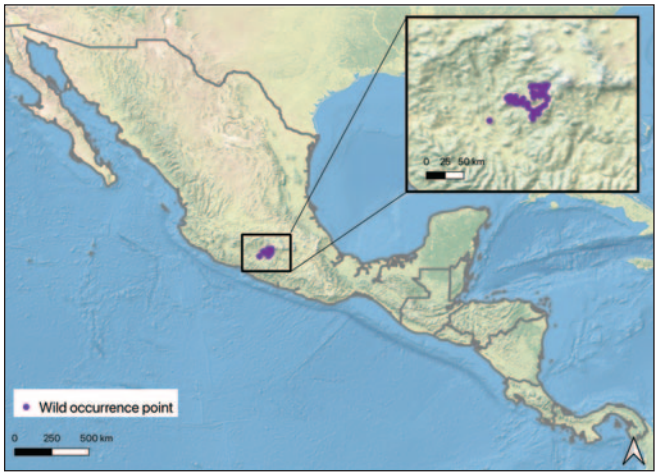

Figure 1. Wild (i.e., *in situ*) occurrence points for *Quercus hintonii*.


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Quercus hintonii is a deciduous tree that can grow up to 15 m tall, with nearly black bark cracked into small squares. Leaves are large (5–21 cm long x 3–10 cm wide), oboval, oval or elliptic and leathery in texture. The underside of the leaves is densely tomentose, resulting in a velvety appearance. (Reyes-Jaramillo, 2006)

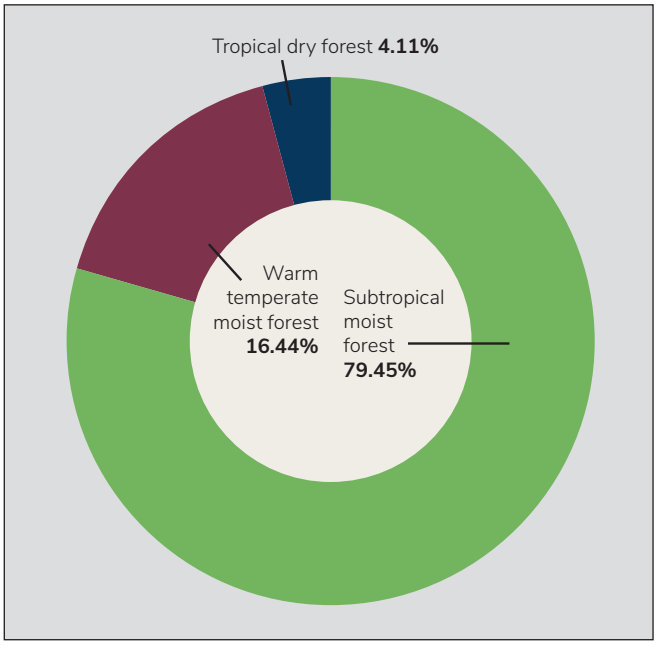

Figure 2. The percentage of wild occurrence points in each Holdridge life zone in which *Quercus hintonii* is distributed.

THREATS TO WILD POPULATIONS

Human use of species — wild harvesting: This species is used for firewood and construction materials. There are some reports of *Q. hintonii* being used for the production of tools such as hammers and axes, but since it is a soft wood, this needs to be verified.

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: Reduction in forest area due to agricultural expansion and logging is the primary threat facing *Q. hintonii*. Large scale deforestation occurred when a corridor between Goleta mountain and Tejupilco-Temascaltepec was opened to create agricultural areas and roads.

Human use of landscape — residential/commercial development, mining, and/or roads: Urban development is affecting the wild populations of *Q. hintonii*. There is a medium-large city (Tejupilco) near the diversity hotspot of this species. This city has grown extensively in the north and this has impacted the native flora and fauna within the region. Road widening, residential development, construction material banks and fires are common along the road to Temascaltepec.

Human use of landscape — tourism and/or recreation: *Quercus hintonii* is found within the Sierra de Nanchititla, a national park in the state of México, where it is codominant with *Pinus oocarpa*. Although this area is protected, it's possible that camping and tourism takes place here, especially in the higher elevation range of the species. However, it is unknown if this currently poses a major threat.

Human modification of natural systems — altered fire regime, pollution, eradication: Some fires to control weeds are promoted along the roadsides. However, this is not currently thought to be a major threat.

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

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: Within the inferred native range of *Q. hintonii*, the subtropical moist forest is expected to decrease in area by an average of 15% 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: This species is frequently attacked by insects and fungi in leaves and acorns.

Extremely small and/or restricted population: This is not currently thought to be a threat. In 2010, an area of occupation of 18,633 was calculated for *Q. hintonii*. However, the total amount of deforested area within this range is currently unknown.

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. hintonii* (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.

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	4
Average number of plants per institution	1
Percent of ex *situ* plants of wild origin	25%
Percent of wild origin plants with known locality	100%

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..

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

Table 2. Ex *situ* conservation scores for *Quercus hintonii* 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*	19
Ecological coverage ex *situ*	67
Representation in ex *situ* collections	10
Final ex *situ* conservation score	32

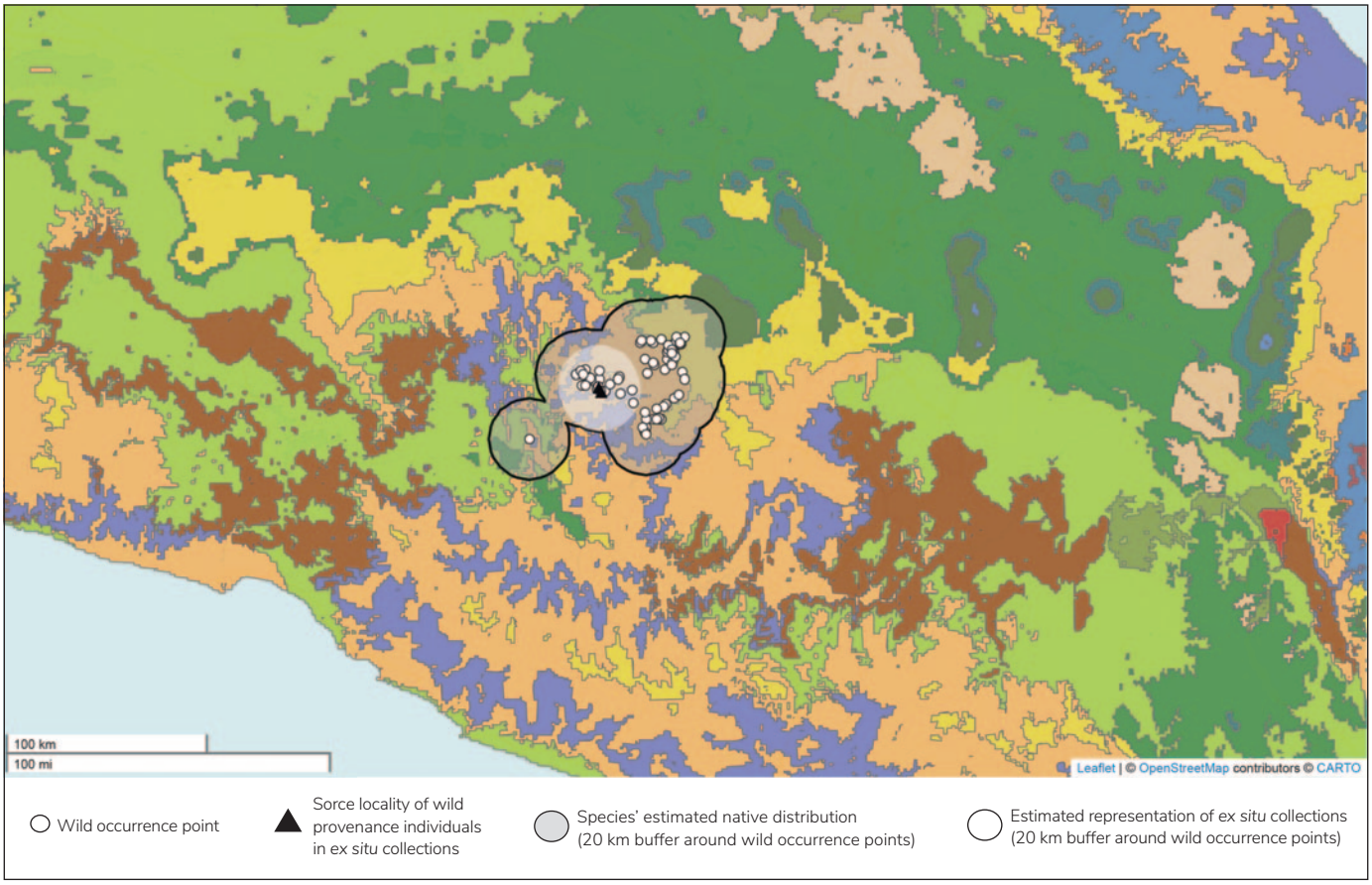

Figure 4. *Quercus hintonii* wild occurrence points and ex *situ* collection source localities. Colored regions are Holdridge life zones. All ex *situ* collection source localities are also wild occurrence points.

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

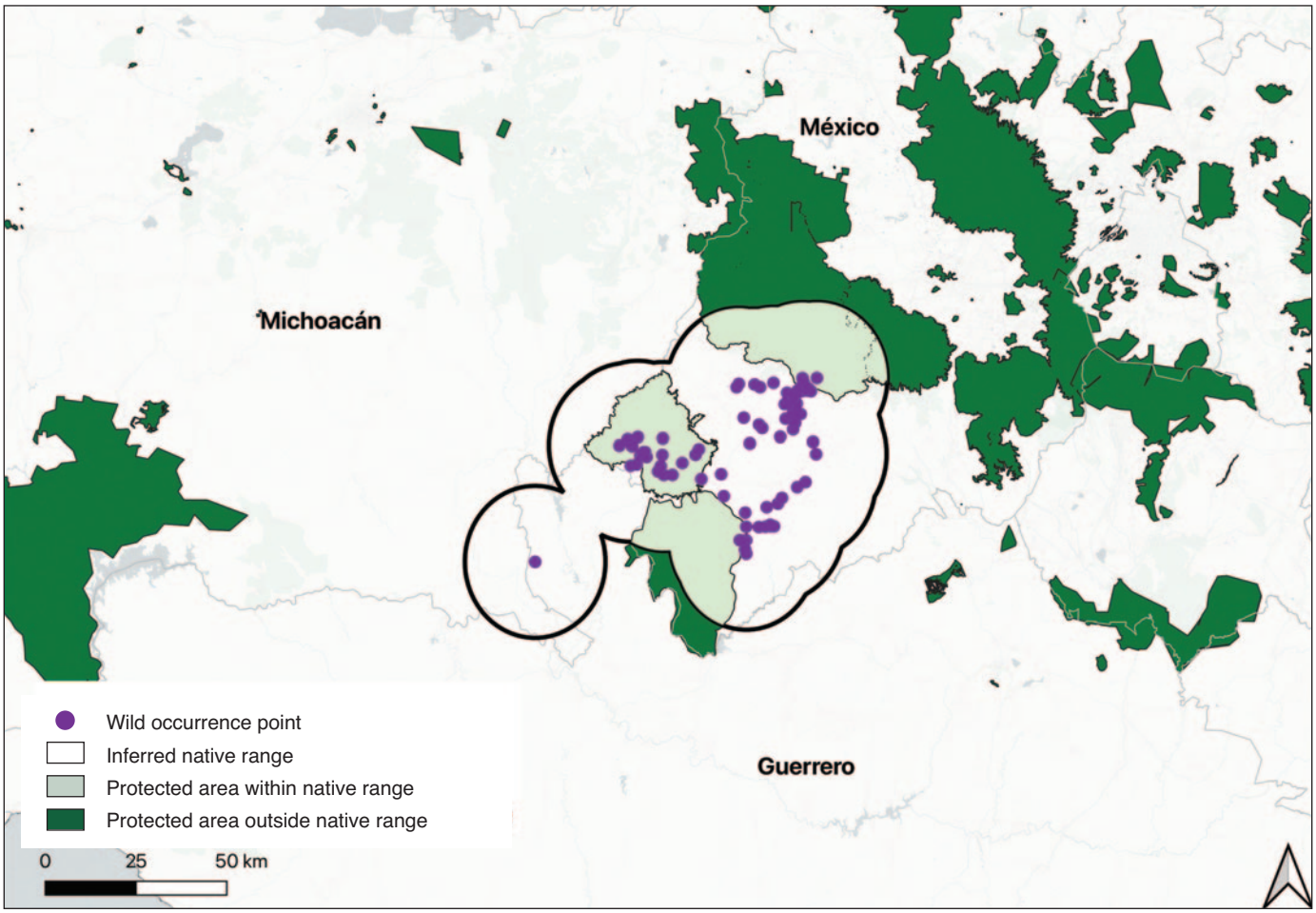

Figure 5. Wild occurrence points and inferred native range of *Quercus hintonii* in relation to protected areas. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Table 3. *In situ* conservation scores for *Quercus hintonii*, 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*	30
Ecological coverage *in situ*	100
Species representation in *in situ* collections	32
Final *in situ* conservation score	54

Land protection: Within the inferred native range of *Q. hintonii*, 30% is within protected areas (Figure 5). An important protected area for this species is the Sierra de Nanchititla, a national park in the state of México. Temascaltepec, a Natural Resources Protection Area, also has known occurrences of *Q. hintonii*. This species has very specific altitude requirements, and the nearby national park of Río Grande San Pedro may not be at a suitable elevation.

Sustainable management of land: Land owners in the Temascaltepec-Tejupilco area and la Goleta have developed sustainable farming practices and contain landslides in order to protect their water. They also plant oaks and other species to avoid erosion. These activities all make the land more sustainable.

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 our *ex situ* surveys, there are three *ex situ* institutions that have living collections of this species. However, the small number of individuals (including those with unknown provenance) are challenges to having a good living collection. Additional *ex situ* collections in Mexico are needed.

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 have been studies investigating the effect of storage conditions on acorn survival time (Díaz-Pontones and Reyes-Jaramillo, 2012), as well as the role of arbuscular mycorrhizal fungi (AMF) and septate endophytic fungi (SEF) on the development of *Q. hintonii* (Reyes-Jaramillo et al., 2007). Tree survival is especially challenging for this species and necessitates more research, as very low survival rates were achieved in Xochitla and Puebla University botanic gardens.

Education, outreach, and/or training: A Global Trees Campaign project worked with local authorities and community members to provide propagation training as well as develop an education campaign. In 2010 talks were held with the office responsible for parks in the state of México, and with each of the municipal presidents in the distribution area of *Q. hintonii*. Printed and electronic versions of project results and maps were distributed.

The Puebla University Botanic Garden (JBU-BUAP), the botanic garden "Louise Wardle de Camacho" Africam Safari, and the Fundación Xochitla botanic garden in collaboration with Sir Harold Hillier Gardens and the Arboretum of England with the support of Flora and Fauna International developed a "Estrategia de Conservación de *Quercus hintonii*" (Rodríguez-Acosta et al., 2000). This plan included workshops with the Coordinación Regional Sur IX, de la Secretaría de Educación Pública, which includes all the schools in the area of the five municipalities where *Q. hintonii* occurs. Seventy-five inspectors (coordinators) attended this meeting, where they promised to distribute in the 900 schools under their control the materials and the information gained during the workshop. The Xochitla Foundation also used the material produced for this project in their education programs.

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

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PRIORITY CONSERVATION ACTIONS

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

Population monitoring and/or occurrence surveys

It is necessary to survey the current population and compare this to the survey that took place in 2010 in order to better understand changes in population size and the extent of habitat loss.

Research

As the *Q. hintonii* populations are very well defined, studies on genetic diversity would help to prioritize areas for conservation.

Propagation and/or breeding programs

Collecting material for propagation (acorns, cuttings, seedlings, etc.) is necessary to protect this species.

Education, outreach, and/or training

There is a need to establish communication with the Coordinaciones Regionales in the area in order to increase awareness about the species.


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REFERENCES

Díaz-Pontones, D. M, and Reyes-Jaramillo, I. 2012. Controllable storage conditions increase survival and germination rates of Quercus hintonii acorns. Current Topics in Plant Biology 13: 45–55.

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

Oldfield, S. and Eastwood, A. 2007. *The Red List of Oaks*. Flora and Fauna International. Cambridge, UK.

Reyes-Jaramillo, I. 2006. *Quercus hintonii* Warb: endemic species of the holm oak forest in the SW of the State of Mexico. Rev. Contacts 60: 64–72

Reyes-Jaramillo, I., Monano, N. M., and Silva-Gonzalez, E. 2007. Septate endophytic fungi, but not arbuscular mycorrhizal fungi affect the early growth of *Quercus hintonii*, an endemic oak from Mexico State. *Botanical Sciences* 98(3): 453–463. https://doi.org/10.17129/botsci.2505

Rodríguez-Acosta, M., Coombes, A. and Morales, H. 2000. Estrategia de conservación de *Quercus hintonii* Warburg. Reporte Final. Ref. 99429. FFI.

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