DATA DEFICIENT SPECIES PROFILES

Quercus toxicodendrifolia (Béatrice Chassé)

INTRODUCTION

The International Union for the Conservation of Nature (IUCN) Red List is the world's most comprehensive source on extinction risk, and is a critical tool used to inform both conservation action and policy. The Red List assigns a species into one of nine categories based on extinction risk: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, Not Evaluated, or Data Deficient. The IUCN defines a Data Deficient species as one in which there is "inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status" (IUCN, 2023). According to the recently published State of the World's Trees, 7,700 (13.2%) of the world's 58,497 trees are assessed as Data Deficient (BGCI, 2021). A similar result can be found for the genus *Quercus*, where 16% of the world's oaks are assessed as Data Deficient. Recent studies suggest that Data Deficient species as a whole may be more threatened than data-sufficient species, and yet they are typically excluded from conservation priorities and funding opportunities (Borgelt et al., 2022).

Within Mesoamerica, 27 species of oaks are assessed as Data Deficient. For these species, very little is known regarding population size, trends, or threats. Some species are only known from a single occurrence and have not been observed in the wild since their original description. Here, we provide Species Profiles for all 27 Data Deficient species of oak that occur in Mesoamerica. The purpose of these profiles is to highlight the information that we do know regarding these rare species, and to serve as a guiding tool for conservation practitioners and land managers in identifying which gaps in knowledge remain.

METHODS

Once per year between 2017 and 2022 we distributed *ex situ* collections surveys to institutions that reported holding native United States and Mesoamerican oak species to the BGCI PlantSearch database (BGCI, 2022), Global Conservation Consortium for Oak (GCCO) members, as well as our professional networks. As part of the survey, we requested information on wild provenance details for our target taxa, including all Data Deficient species. Submitted accessions data was compiled and standardized following the methods outlined in Beckman Bruns (2023). In addition, we created a curated set of data points representing the known native distribution of each of our target Data Deficient species by gathering data from publicly available datasets (e.g., BIEN, GBIF, iDigBio), herbarium records, literature review, and conservations with experts.

Quercus acherdophylla (Béatrice Chassé)

For each species, the source locality of wild provenance individuals in *ex situ* collections as well as wild occurrence points were mapped in QGIS (Version 3.28.3-Firenze). We also mapped wild occurrence points overlaid with protected areas obtained from Protected Planet (UNEP-WCMC and IUCN, 2023). We placed a 20 km buffer around each occurrence point to represent the inferred native range of a species following established methods used in previous gap analyses (Beckman et al., 2019; Linskey et al., 2022).

For each species, we calculated a Conservation Action Score based on methods adapted from Khoury et al. (2020). Scores were divided into two categories: those related to *in situ* populations and those related to *ex situ* populations. *In situ* scores provide geographic and ecological measurements of the proportion of a species' range that is conserved in protected areas. *Ex situ* scores provide geographic and ecological measurements of the proportion of a species' range that is conserved in *ex situ* collections. All scores range from 0–100, with a score of 100 indicating complete conservation, and a score of 0 indicating extremely poor conservation. A combined final conservation score was then calculated by taking the average of the final conservation score *in situ* and final conservation score *ex situ* for each species.

Quercus coffeicolor (Francisco Garin)

Quercus deliquescens (Béatrice Chassé)

In Situ Scores

- **Representation:** The number of occurrence points that fall within protected areas divided by the total number of occurrence points.
- **Geographical coverage:** The area of a species' inferred native range that is covered by protected areas divided by the total area of a species' inferred native range.
- **Ecological coverage:** The number of Holdridge life zones within a species' inferred native range that are located inside protected areas divided by the number of Holdridge life zones within the species' inferred native range.
- **Final Conservation Score:** The mean of all *in situ* scores.

Ex Situ Scores

- **Representation:** The number of *ex situ* institutions that hold at least one accession of wild provenance of the target species, up to a maximum of 10. Final *ex situ* representation scores were multiplied by 10 to achieve a scale of 0–100.
- **Geographical coverage:** The area of the buffer surrounding all *ex situ* points divided by the area of the species' inferred native range.
- **Ecological coverage:** The number of Holdridge life zones in the buffer surrounding all *ex situ* points divided by the number of Holdridge life zones in the species' inferred native range.
- **Final Conservation Score:** The mean of all *ex situ* scores.

For each Data Deficient species we performed a literature review for information on distribution and biology. Finally, we reviewed each species' Red List assessment and noted the justification given for determining the species to be Data Deficient.

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Quercus toxicodendrifolia (Allen Coombes)

Quercus acherdophylla (Béatrice Chassé)

Quercus acherdophylla Trel.

DISTRIBUTION AND BIOLOGY

Quercus acherdophylla is endemic to Mexico. It is distributed primarily in the Sierra Madre Oriental in the states of Puebla, Veracruz, Hidalgo, and Oaxaca (Figure 1). It is restricted to cloud forest, riparian forests, and humid ravines (Jerome, 2018a). Trees are 10–20 m tall. Leaves are glabrescent, elliptic, elliptic-lanceolate or oblong (Valencia-A et al., 2017). Fruits mature annually. Acorns are ovoid to subspherical, 6–7(10) mm long x ca. 6 mm diameter (Valencia-A et al., 2017).

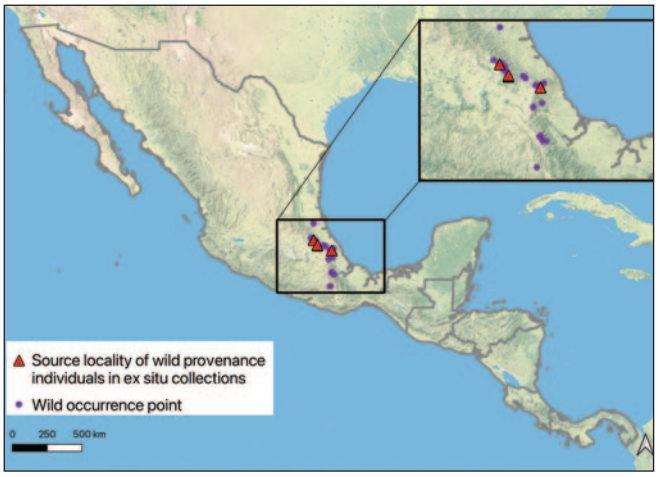


Figure 1. *In situ* (e.g., wild, within native habitat) and *ex situ* (e.g., within living collections) occurrence points for *Quercus acherdophylla*.

PROTECTED AREAS

Within the inferred native range of *Q. acherdophylla*, 9% is in protected areas (Figure 2). Protected areas include the Sistema de Represas y Corredores biológicos de la Cuenca Hidrográfica del Río Necaxa, a Ramsar site in Hidalgo and Puebla.

CONSERVATION ACTION SCORE

Quercus acherdophylla received a final combined Conservation Action Score of 49/100 (Table 1). According to the results of our *ex situ* surveys, it is currently held in 19 *ex situ* collections, 12 of which reported accessions of wild provenance. The Global Conservation Consortium for Oak (GCCO) Mexico and Central America is currently engaged in a multinational project called "Safeguarding Threatened Tropical Montane Cloud Forest (TMCF) Oaks in Mesoamerica". In Puebla, *Q. acherdophylla* has been identified as a target species for this project and will be the focus of future restoration work (Rodríguez-Acosta and Coombes, 2023).

Table 1. Conservation gap analysis summary results for *Quercus acherdophylla*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	26
Ecological coverage	44
Representation	100
Final *ex situ* score	56
***In situ* scores**	
Geographic coverage	9
Ecological coverage	88
Representation	28
Final *in situ* score	41
Final score combined	49

INFORMATION GAPS

Quercus acherdophylla is currently assessed as Data Deficient due to a lack of information on threats, population size, and trends (Jerome, 2018a).

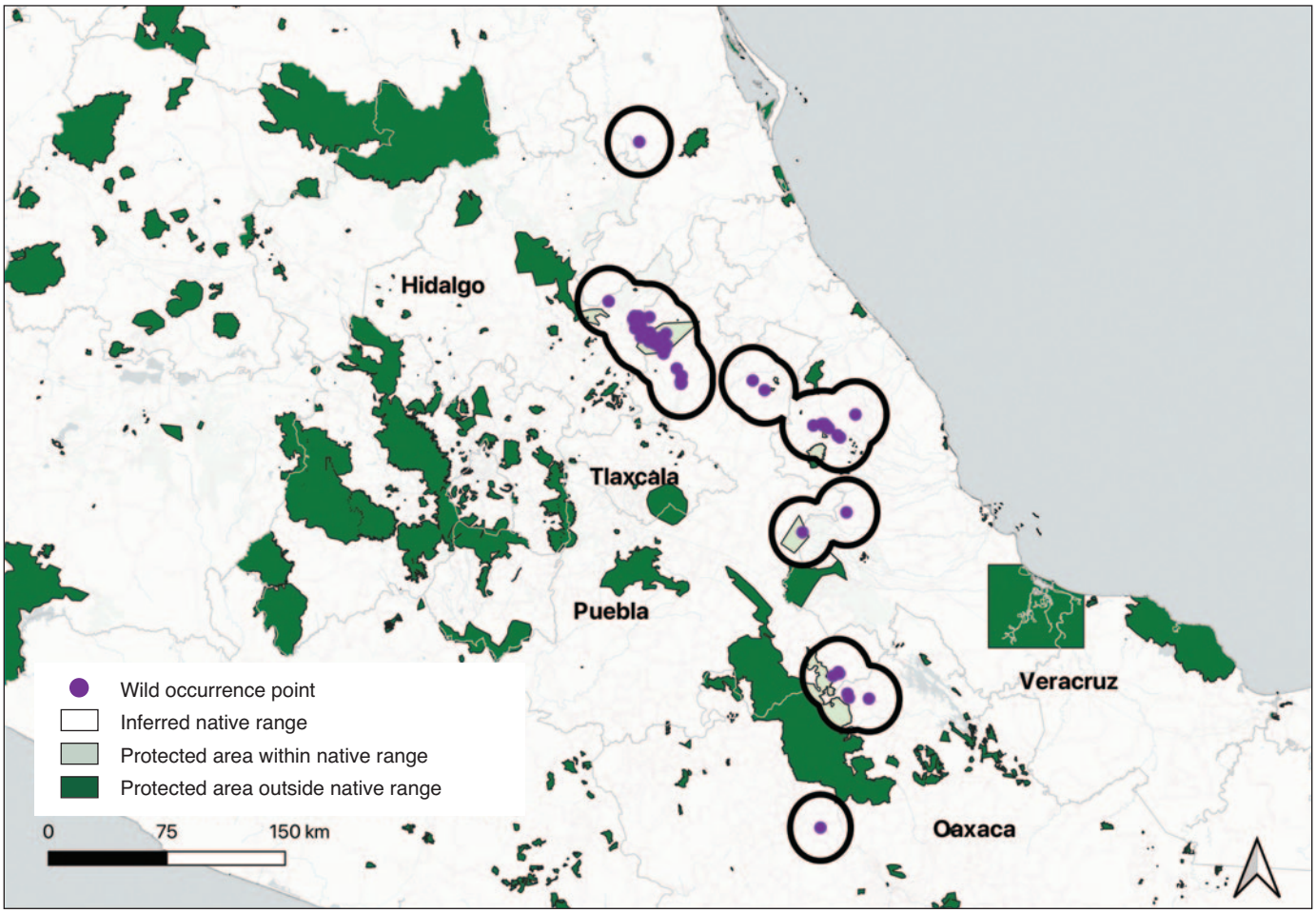


Figure 2. Wild occurrence points and inferred native range in relation to protected areas for *Quercus acherdophylla*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus aerea Trel.

DISTRIBUTION AND BIOLOGY

Quercus aerea is endemic to Mexico, within the states of Chihuahua and Durango (Figure 3). The southernmost point in Durango was collected in the early 1990s and was found as part of a hybrid storm intermixed with *Q. jonesii* and *Q. emoryi*. This location should be verified. In general there is very little information known regarding habitat, ecology, or distribution of this species. *Quercus aerea* is a shrub or small tree up to 8 m tall. Leaves are evergreen, and elliptic to ovate in shape. Acorns are ovoid, 10–12 mm long and 6–8 mm in diameter. (García Morales, 2016)

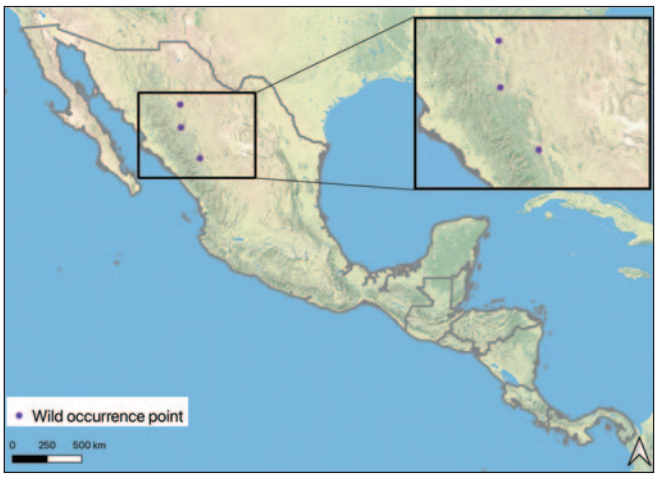


Figure 3. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus aerea*.

PROTECTED AREAS

There are no protected areas within the inferred native range of *Q. aerea* (Figure 4).

CONSERVATION ACTION SCORE

Quercus aerea received a final combined Conservation Action Score of 0.01/100 (Table 2). According to the results of our *ex situ* surveys, it is not currently held in any *ex situ* collections.

Table 2. Conservation gap analysis summary results for *Quercus aerea*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	0.03
Ecological coverage	0
Representation	0
Final *in situ* score	0.01
Final score combined	0.01

INFORMATION GAPS

Quercus aerea is currently assessed as Data Deficient due to a lack of information on distribution, population size/trends, habitat, use, and threats (Carrero, 2020a). The taxonomy of this species is also questioned, with Oaks of the World considering it a synonym of *Q. jonesii* (Hélardot, 2018a).

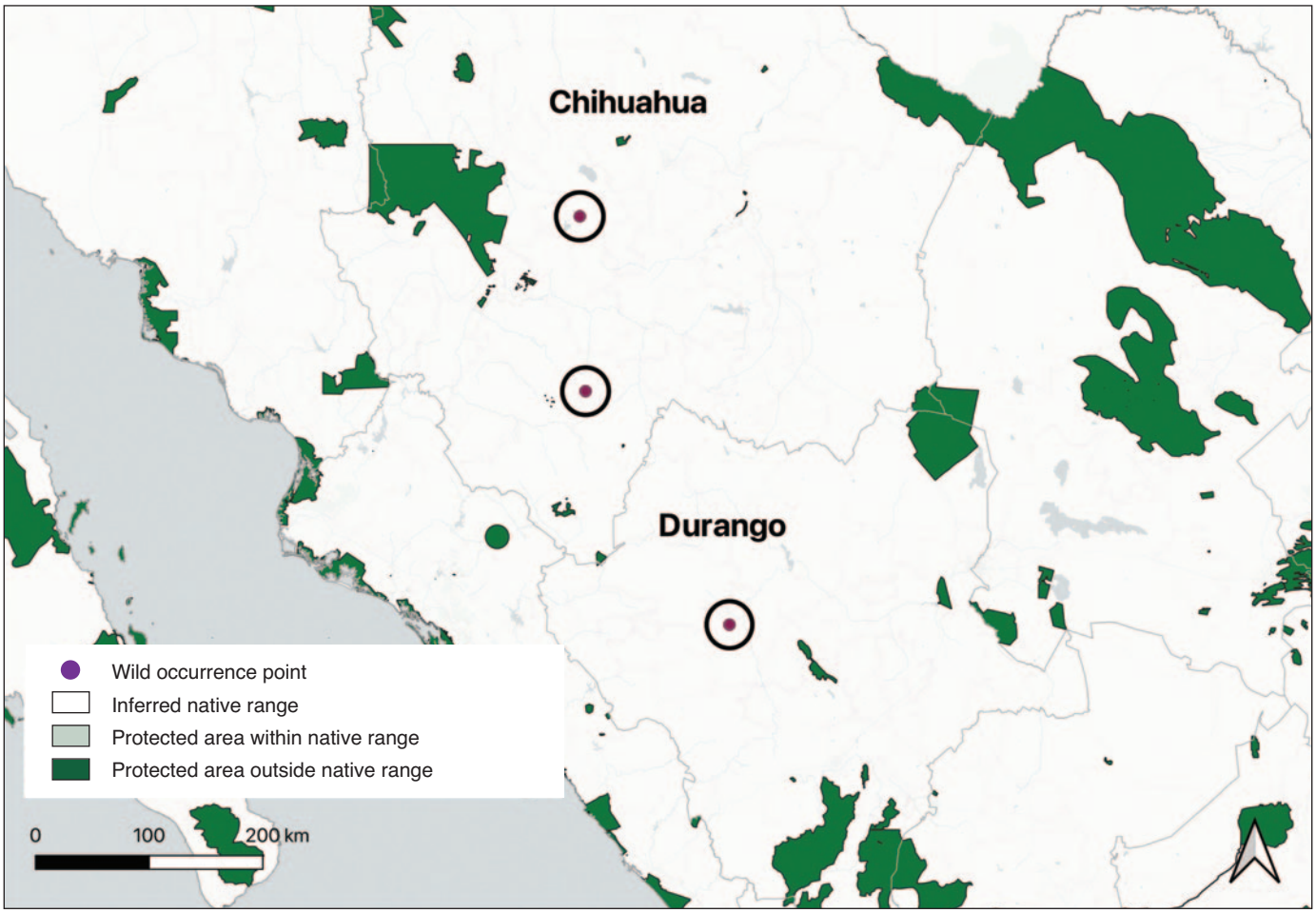


Figure 4. Wild occurrence points and inferred native range in relation to protected areas for *Quercus aerea*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus barrancana Spellenb.

DISTRIBUTION AND BIOLOGY

Quercus barrancana is endemic to Mexico in the states of Sonora and Chihuahua, predominantly within the western slope of the Sierra Madre Occidental (Figure 5). This species was historically identified as *Q. toumeyi*. In 2014, Spellenberg recognized the individuals in the southern portion of *Q. toumeyi*'s range to be a new species: *Q. barrancana*. *Quercus barrancana* is a small, evergreen species (1–5 m tall) with small, toothed leaves and acorns 12–19 mm long and 8–10 mm wide. It inhabits rocky slopes at an elevation of 1,300–2,115 m. It is named for the rocky canyons ("barrancas") in which it is typically found. (Spellenberg, 2014)

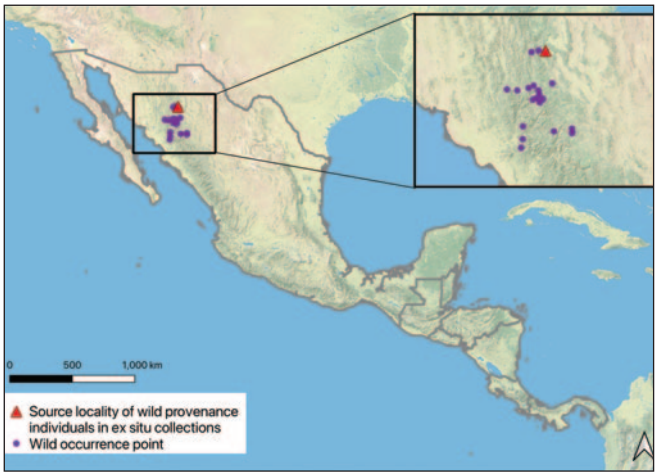


Figure 5. *In situ* (e.g., wild, within native habitat) and *ex situ* (e.g., within living collections) occurrence points for *Quercus barrancana*.

PROTECTED AREAS

Within the inferred native range of *Q. barrancana*, 22% is in protected areas (Figure 6). Important protected areas include three Flora and Fauna Protection Areas: two in Chihuahua (Tutuaca and Papigochic) and one in Sonora (Sierra de Álamos-Río Cuchujaqui).

CONSERVATION ACTION SCORE

Quercus barrancana received a final combined Conservation Action Score of 32/100 (Table 3). According to the results of our *ex situ surveys*, wild provenance individuals are currently held in one *ex situ* collection.

Table 3. Conservation gap analysis summary results for *Quercus barrancana*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	8
Ecological coverage	29
Representation	10
Final *ex situ* score	15
***In situ* scores**	
Geographic coverage	22
Ecological coverage	86
Representation	36
Final *in situ* score	48
Final score combined	32

INFORMATION GAPS

Quercus barrancana is assessed as Data Deficient due to lack of information on the threats facing this species (Kenny et al., 2020). *Quercus barrancana* is used for firewood, and the acorns are used in esquiate (a drink or soup) or eaten raw (Spellenberg, 2014).

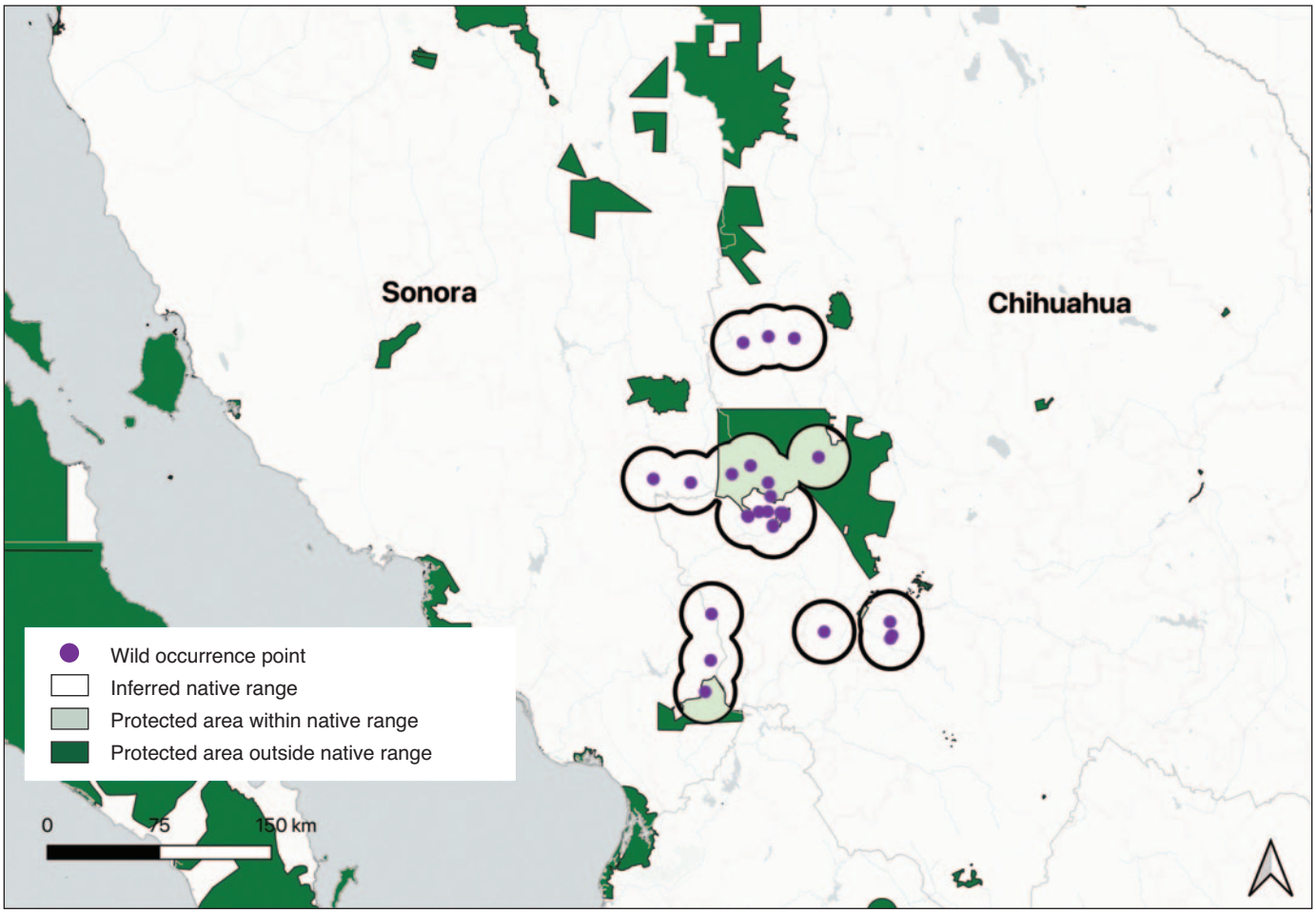


Figure 6. Wild occurrence points and inferred native range in relation to protected areas for *Quercus barrancana*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus breedloveana Nixon & Barrie

DISTRIBUTION AND BIOLOGY

Quercus breedloveana is endemic to Mexico, and occurs within the states of Guerrero and Chiapas (Figure 7). It is likely that this species is also found in Oaxaca, and more survey work is needed to confirm its full distribution within Mexico. It is a cloud forest species, and is typically found at elevations 1,100–1,800 m. Trees are 20 m or taller. Leaves are highly symmetric, and narrowly elliptic or lance-elliptic in shape, with all but the lowest vein terminating in a bristle. Acorns are broadly ovoid or depressed-globose, 14–17 x 13–15 mm. (Nixon and Barrie, 2017)

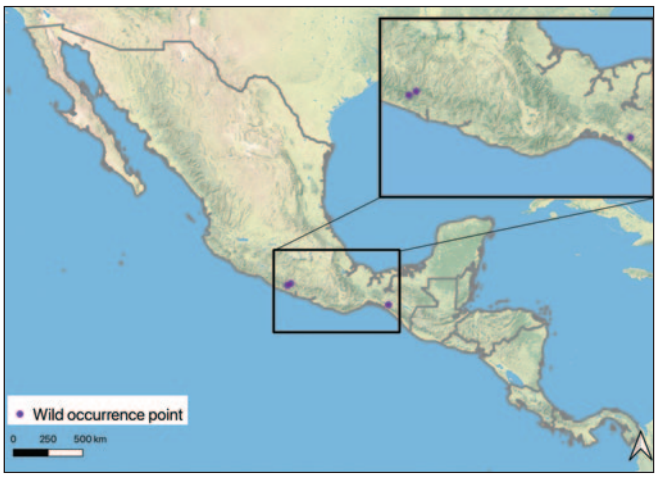


Figure 7. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus breedloveana*.

PROTECTED AREAS

Within the inferred native range of Q. *breedloveana*, 32% is in protected areas (Figure 8). Major protected areas include La Sepultura, a Biosphere Reserve in Chiapas.

CONSERVATION ACTION SCORE

Quercus breedloveana received a final combined Conservation Action Score of 28/100 (Table 4). According to the results of our ex *situ* surveys, it is not currently held in any ex *situ* collections.

Table 4. Conservation gap analysis summary results for *Quercus breedloveana*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	32
Ecological coverage	100
Representation	33
Final *in situ* score	55
Final score combined	28

INFORMATION GAPS

Quercus breedloveana is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses (Carrero, 2021a). This species is only known from three occurrences: two in Guerrero and one in Chiapas. More survey work is needed.

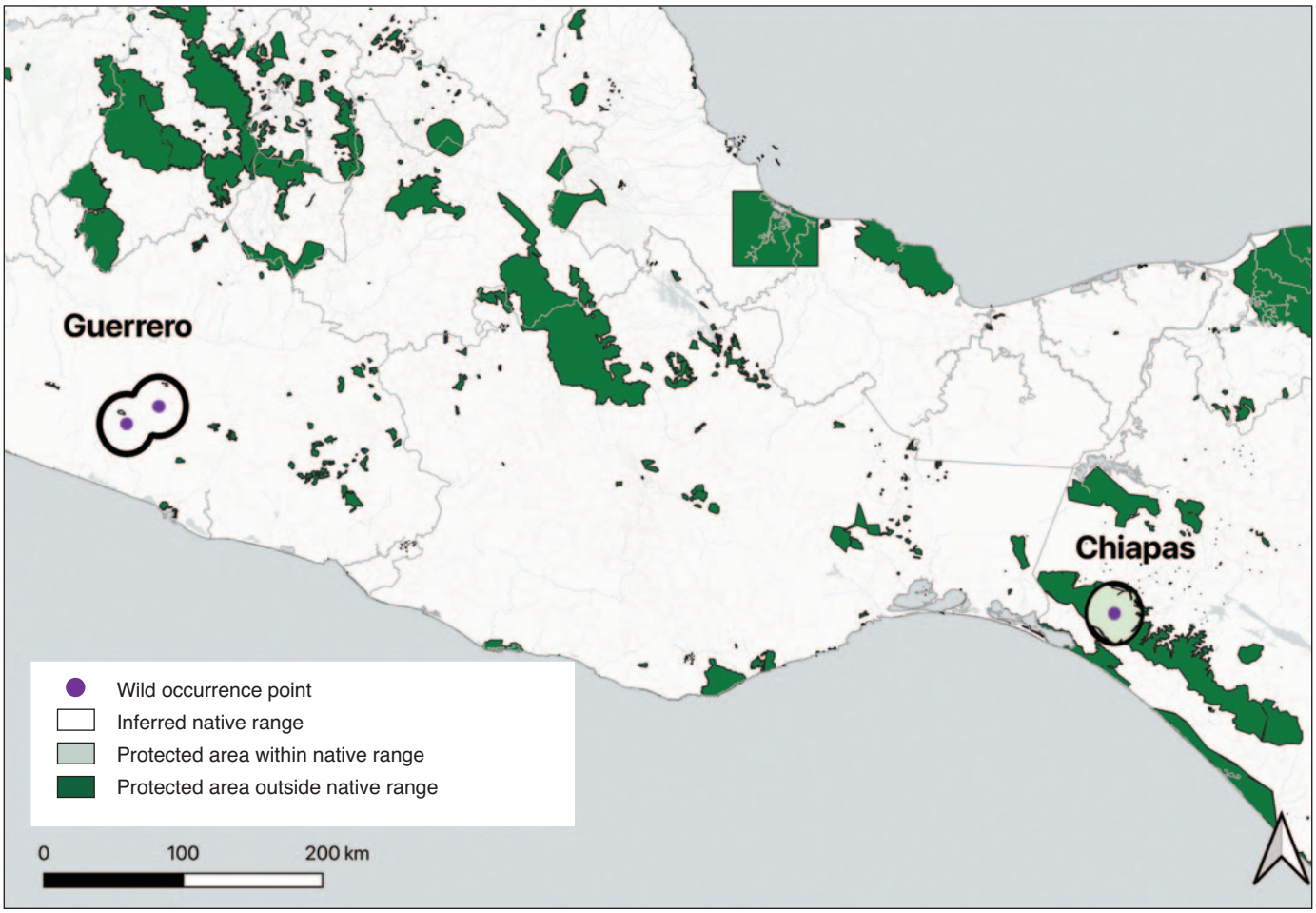
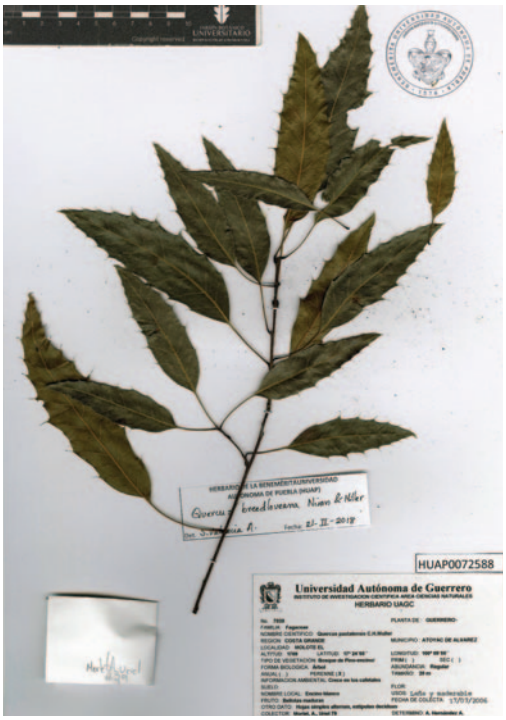


Figure 8. Wild occurrence points and inferred native range in relation to protected areas for *Quercus breedloveana*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).



Quercus centenaria L.M. González.

DISTRIBUTION AND BIOLOGY

Quercus centenaria is endemic to Mexico, within the states of Nayarit, Jalisco, and Colima (Figure 9). In the northernmost portion of its range in Nayarit, *Q. centenaria* is scarce and found within the protected area Sierra de San Juan. The species has a greater distribution in Jalisco, where it occurs in the Sierra Madre del Sur, typically in ravines. It also grows in the Sierra de Manantlán in Colima near streams in mesophyll mountain forest. It is an evergreen species, 20–30 m tall. *Quercus centenaria* is similar to *Q. lancifolia*, and is distinguished by its larger petiole, dull ochraceous leaves, and a shorter acorn with a flat base. Leaves are elliptical to lanceolate and variable in size with a wavy to crimped-wavy edge. (González-Villarreal, 2018)

Figure 9. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus centenaria*.

PROTECTED AREAS

Within the inferred native range of *Q. centenaria*, 23% is in protected areas (Figure 10). Major protected areas include the Sierra de San Juan (a Biosphere Reserve in Nayarit), the C.A.D.N.R.043 Estado de Nayarit (a Natural Resources Protection Area in Nayarit and Jalisco), and the Sierra de Manantlán (a Biosphere Reserve in Jalisco and Colima).

CONSERVATION ACTION SCORE

Quercus centenaria received a final combined Conservation Action Score of 29/100 (Table 5). According to the results of our ex *situ* surveys, it is not currently held in any ex *situ* collections.

Table 5. Conservation gap analysis summary results for *Quercus centenaria*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	23
Ecological coverage	100
Representation	53
Final *in situ* score	59
Final score combined	29

INFORMATION GAPS

Quercus centenaria is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses of this species (Carrero, 2021b). This is a recently described species, and the only research comes from the original paper by González-Villarreal in 2018.

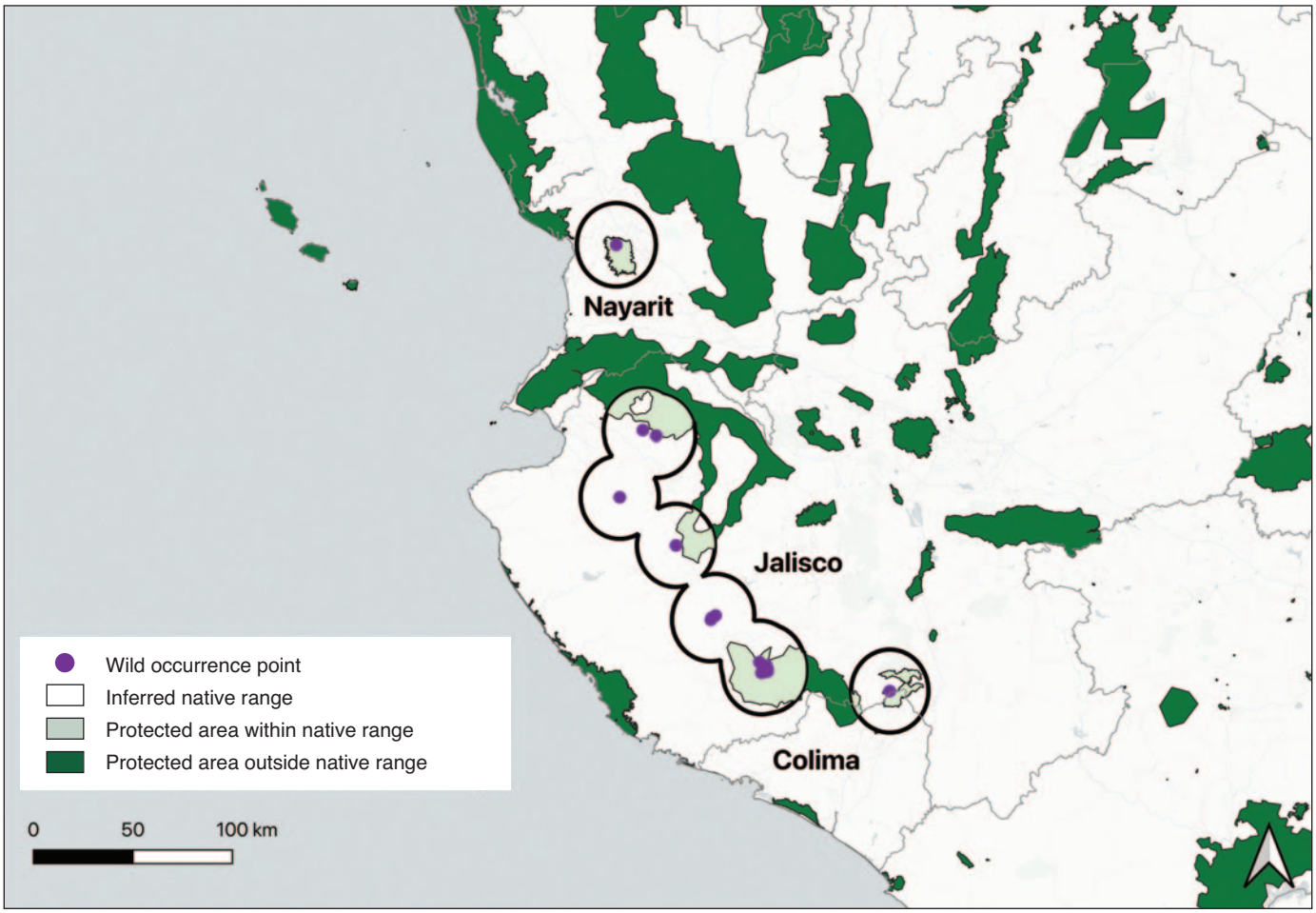


Figure 10. Wild occurrence points and inferred native range in relation to protected areas for *Quercus centenaria*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus coahuilensis Nixon & C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus coahuilensis is endemic to Mexico in the state of Coahuila, for which it was named. Its reported range also includes Chihuahua, although we do not have coordinates for this state (Figure 11). It is found at an elevation of 2,000–3,550 m (Valencia-A, 2004). *Quercus coahuilensis* is an evergreen species and it can grow up to 8 m tall. Leaves are narrowly elliptic to oblong with spinescent teeth. It is a common species of the chaparral and oak woodland habitat in southeastern Chihuahua and central to east Coahuila (Nixon and Muller, 1993).

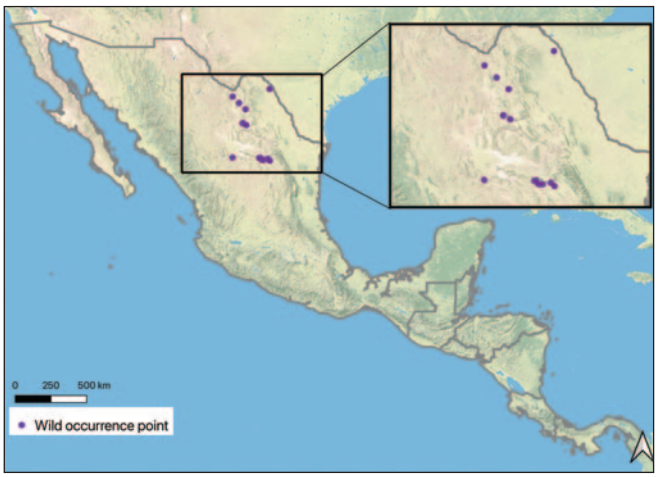


Figure 11. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus coahuilensis*.

PROTECTED AREAS

Within the inferred native range of *Q. coahuilensis*, 17% is in protected areas (Figure 12). Protected areas include Ocampo (Flora and Fauna Protection Area) and C.A.D.N.R.004 Don Martín (Natural Resources Protection Area) in Coahuila.

CONSERVATION ACTION SCORE

Quercus coahuilensis received a final combined Conservation Action Score of 16/100 (Table 6). According to the results of our *ex situ* surveys, this species is not currently held in any *ex situ* collections.

Table 6. Conservation gap analysis summary results for *Quercus coahuilensis*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	17
Ecological coverage	67
Representation	13
Final *in situ* score	32
Final score combined	16

INFORMATION GAPS

Quercus coahuilensis is currently assessed as Data Deficient due to a lack of information on population trends, dynamics, and threats (Carrero and IUCN SSC Global Tree Specialist Group, 2020).

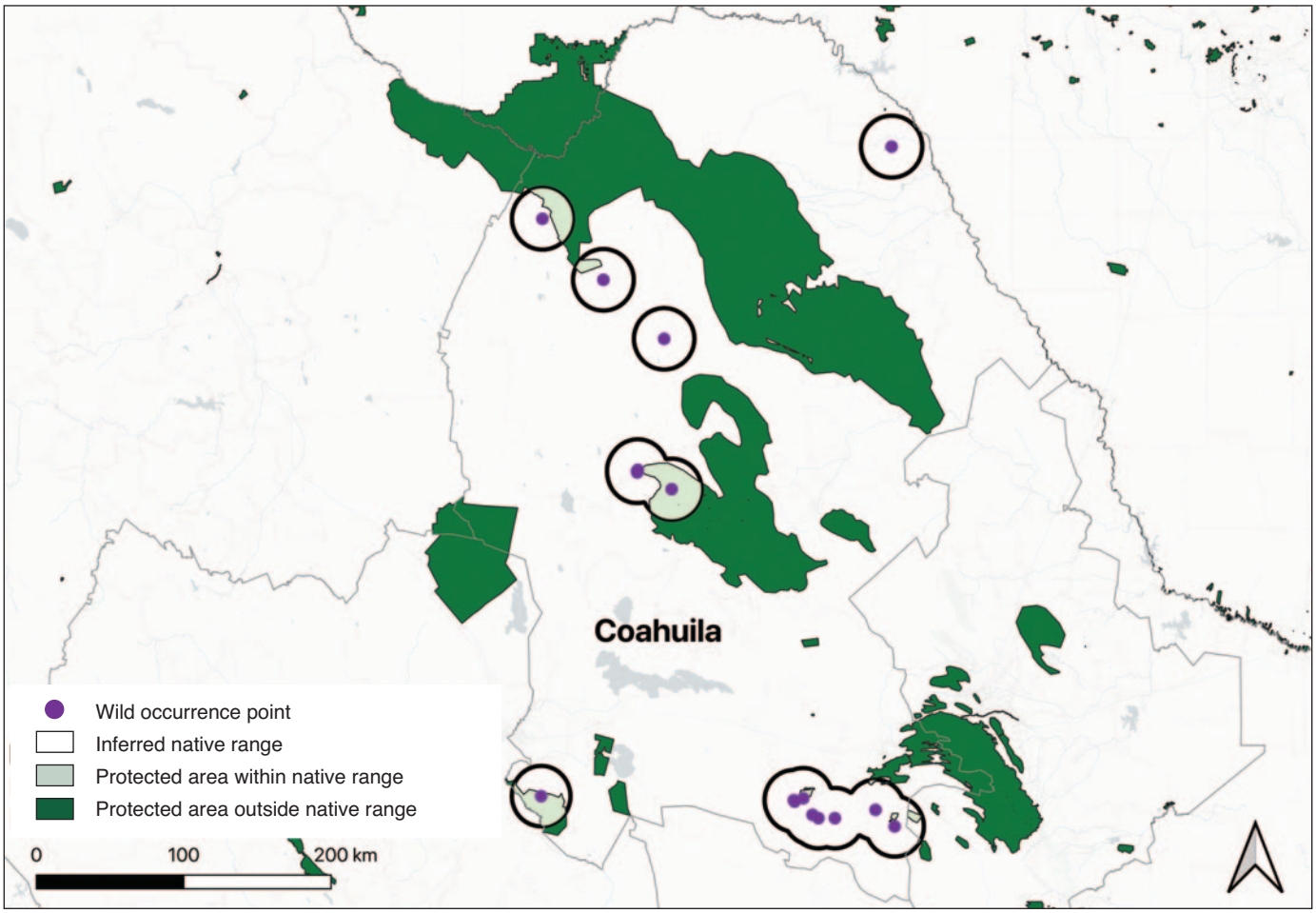


Figure 12. Wild occurrence points and inferred native range in relation to protected areas for *Quercus coahuilensis*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus coffeicolor Trel.

DISTRIBUTION AND BIOLOGY

Quercus coffeicolor is endemic to Mexico and occurs in the states of Sinaloa, Nayarit, and Jalisco (Figure 13). It inhabits the Sierra Madre Occidental, and is at elevations of 900–1,900 m (Carrero, 2020b). According to Oaks of the World, *Q. coffeicolor* can reach heights up to 10 m, with leaves that are elliptic, oblong, to oval with a bristle tip (Hélardot, 2018b). It inhabits rocky, dry soils.

Figure 13. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus coffeicolor*.

PROTECTED AREAS

Within the inferred native range of *Q. coffeicolor*, 18% is in protected areas (Figure 14). Protected areas include Sierra del Águila (a National Protected Area) in Jalisco and C.A.D.N.R.043 Estado de Nayarit (a Natural Resources Protection Area) in Nayarit.

CONSERVATION ACTION SCORE

Quercus coffeicolor received a final combined Conservation Action Score of 21/100 (Table 7). According to the results of our *ex situ* surveys, this species is not currently held in any *ex situ* collections.

Table 7. Conservation gap analysis summary results for *Quercus coffeicolor*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	18
Ecological coverage	83
Representation	25
Final *in situ* score	42
Final score combined	21

INFORMATION GAPS

Quercus coffeicolor is currently assessed as Data Deficient due to a lack of information on distribution, population size/trends, habitat, uses, and threats (Carrero, 2020b). More research and surveying are needed.

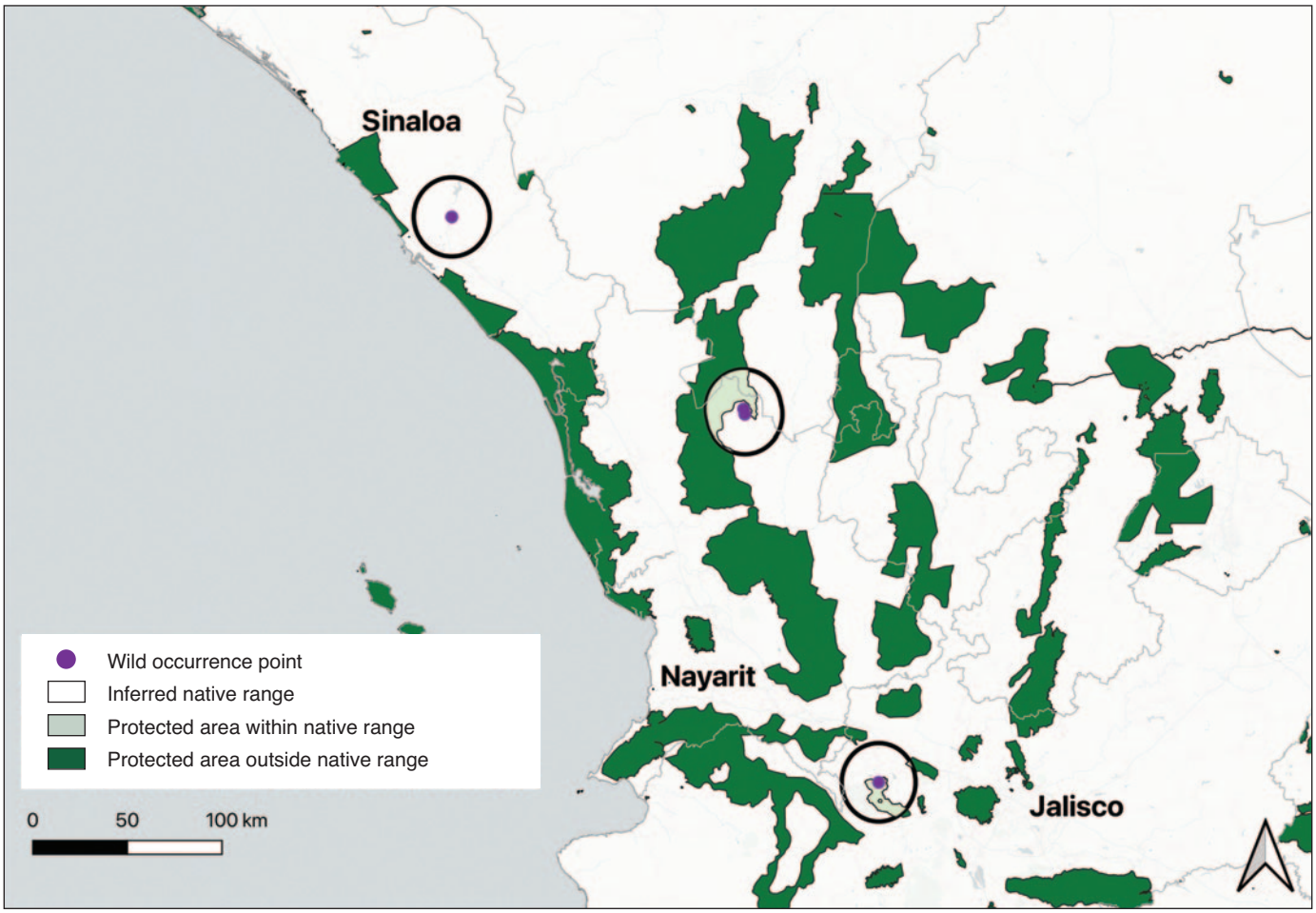
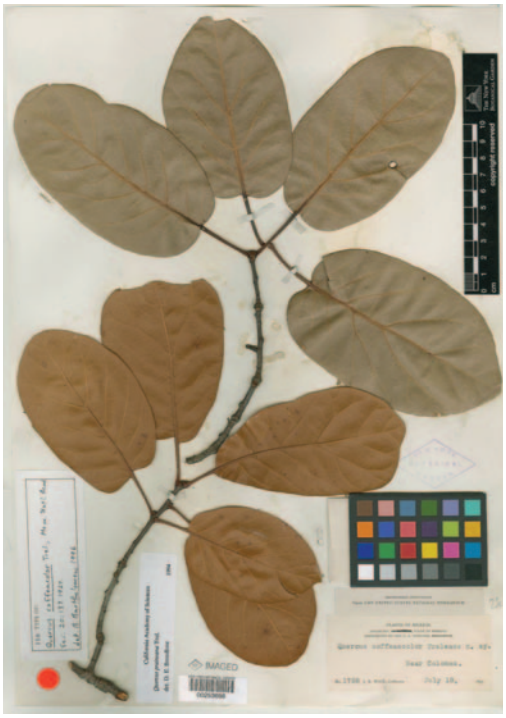


Figure 14. Wild occurrence points and inferred native range in relation to protected areas for *Quercus coffeicolor*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).



Quercus deliquescens C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus deliquescens is endemic to Mexico, where it is found in the Mexican state of Chihuahua (Figure 15). This species may have a much wider range, and it has potentially been identified in Durango, north of Zacatecas and south of Coahuila (Sabás-Rosales et al., 2017). Hybridization between *Q. deliquescens* and the closely related *Q. intricata* is very likely, and more research is needed to verify this. *Quercus deliquescens* is found in chaparral habitat on limestone slopes and on desert mountains (Muller, 1979). It occurs in small subpopulations that are widely dispersed (Jerome, 2018b).

A shrubby species, *Q. deliquescens* grows up to 1.5 m tall and is named for its dense, intricate branching. Leaves are ovate, 12–25 (35) mm long and 10–15 (25) mm wide, with revolute and toothed margins.

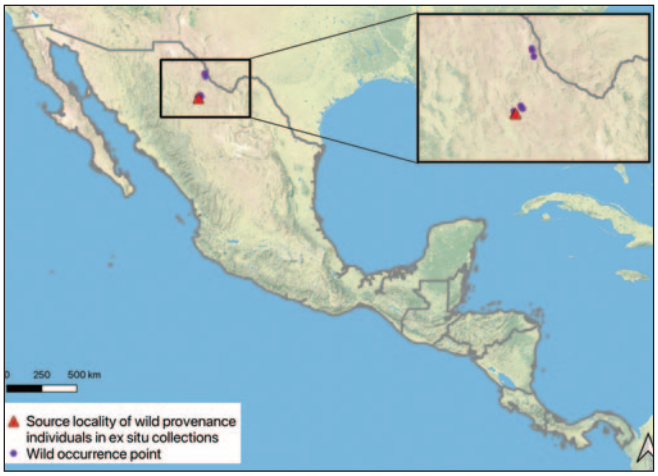


Figure 15. *In situ* (e.g., wild, within native habitat) and *ex situ* (e.g., within living collections) occurrence points for *Quercus deliquescens*.

PROTECTED AREAS

There are no protected areas within the inferred native range of *Q. deliquescens* (Figure 16).

CONSERVATION ACTION SCORE

Quercus deliquescens received a final combined Conservation Action Score of 31/100 (Table 8). According to the results of our *ex situ* surveys, it is currently held in six *ex situ* collections, five of which reported having individuals of wild provenance.

Table 8. Conservation gap analysis summary results for *Quercus deliquescens*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	33
Ecological coverage	100
Representation	50
Final *ex situ* score	61
***In situ* scores**	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *in situ* score	0
Final score combined	31

INFORMATION GAPS

Quercus deliquescens is currently assessed as Data Deficient due to a lack of information on population size and trends (Jerome, 2018b). More research on species distribution and threats are necessary.

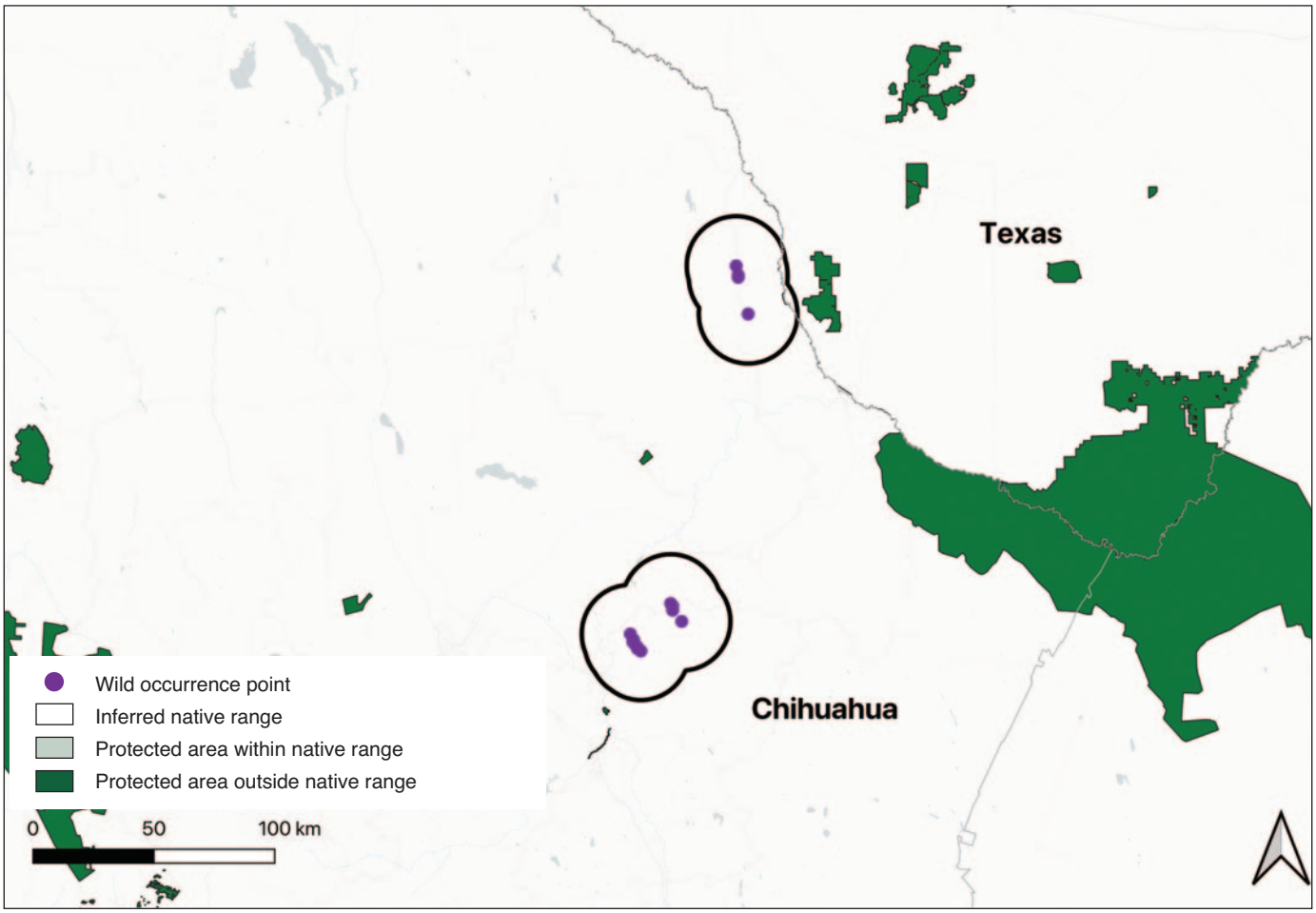


Figure 16. Wild occurrence points and inferred native range in relation to protected areas for *Quercus deliquescens*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus ghiesbreghtii M. Martens & Galeotti

DISTRIBUTION AND BIOLOGY

Quercus ghiesbreghtii is endemic to Mexico and is known primarily within the state of Veracruz (Figure 17). The occurrence in Chiapas is from a 1979 herbarium specimen, and should be verified. Very little is known regarding the full distribution and ecology of this species. According to Oaks of the World Online, *Q. ghiesbreghtii* can grow up to 20 m tall, and has leaves that are lanceolate (Hélardot, 2018c). Acorns are 1.2 cm long by 1.2 cm wide, with a cup that covers less than half of the acorn.

Figure 17. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus ghiesbreghtii*.

PROTECTED AREAS

Within the inferred native range of *Q. ghiesbreghtii*, 9% is in protected areas (Figure 18). The occurrence point on the border of Veracruz and Puebla is in the national park Pico de Orizaba.

CONSERVATION ACTION SCORE

Quercus ghiesbreghtii received a final combined Conservation Action Score of 24/100 (Table 9). According to the results of our ex *situ* surveys, it is currently not held in any ex *situ* collections.

Table 9. Conservation gap analysis summary results for *Quercus ghiesbreghtii*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	9
Ecological coverage	88
Representation	50
Final *in situ* score	49
Final score combined	24

INFORMATION GAPS

Quercus ghiesbreghtii is currently assessed as Data Deficient due to a lack of information on distribution, population size/trends, habitat, use, and threats (Carrero, 2020c). The taxonomy of this species is also in question. Oaks of the World considers *Q. ghiesbreghtii* to be a hybrid, whereas as of 2012, Valencia-A considers it to be a valid species (Hélardot, 2018c).

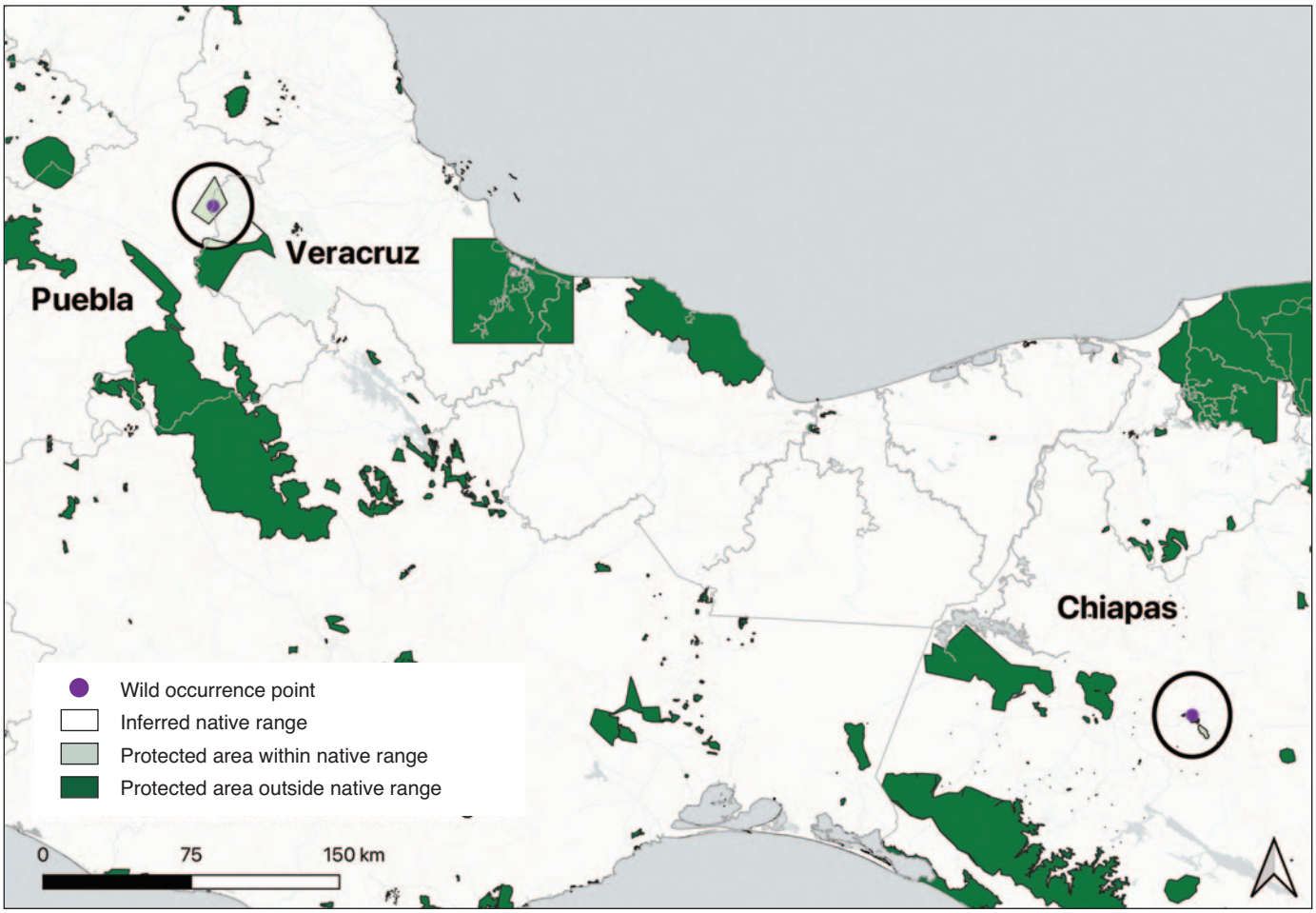


Figure 18. Wild occurrence points and inferred native range in relation to protected areas for *Quercus ghiesbreghtii*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus gracilior C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus gracilior is native to Honduras and Nicaragua (Figure 19). In Honduras it is found at an elevation of 1,200–1,800 m (Moscoso, 1998). There is very little information known about this species except from its original description. *Quercus gracilior* is a large tree with deciduous leaves. Leaves are linear-lanceolate or oblanceolate, and 10–12 cm long x 2–3 cm wide. Leaf margins are entire except for small teeth near the apex. This species fruits annually (Muller, 1942a).

Figure 19. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus gracilior*.

PROTECTED AREAS

Within the inferred native range of *Q. gracilior*, 46% is in protected areas (Figure 20). In Honduras, this species is found within the national park La Tigre. In Nicaragua, this species is found within Reserva de Biosfera Bosawas, a UNESCO-MAB Biosphere Reserve.

CONSERVATION ACTION SCORE

Quercus gracilior received a final combined Conservation Action Score of 34/100 (Table 10). According to the results of our ex *situ* surveys, this species is not currently not held in any ex *situ* collections.

Table 10. Conservation gap analysis summary results for *Quercus gracilior*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	46
Ecological coverage	86
Representation	75
Final *in situ* score	69
Final score combined	34

INFORMATION GAPS

Quercus gracilior is currently assessed as Data Deficient due to a lack of information on population dynamics, uses, and threats (Carrero, 2021c).

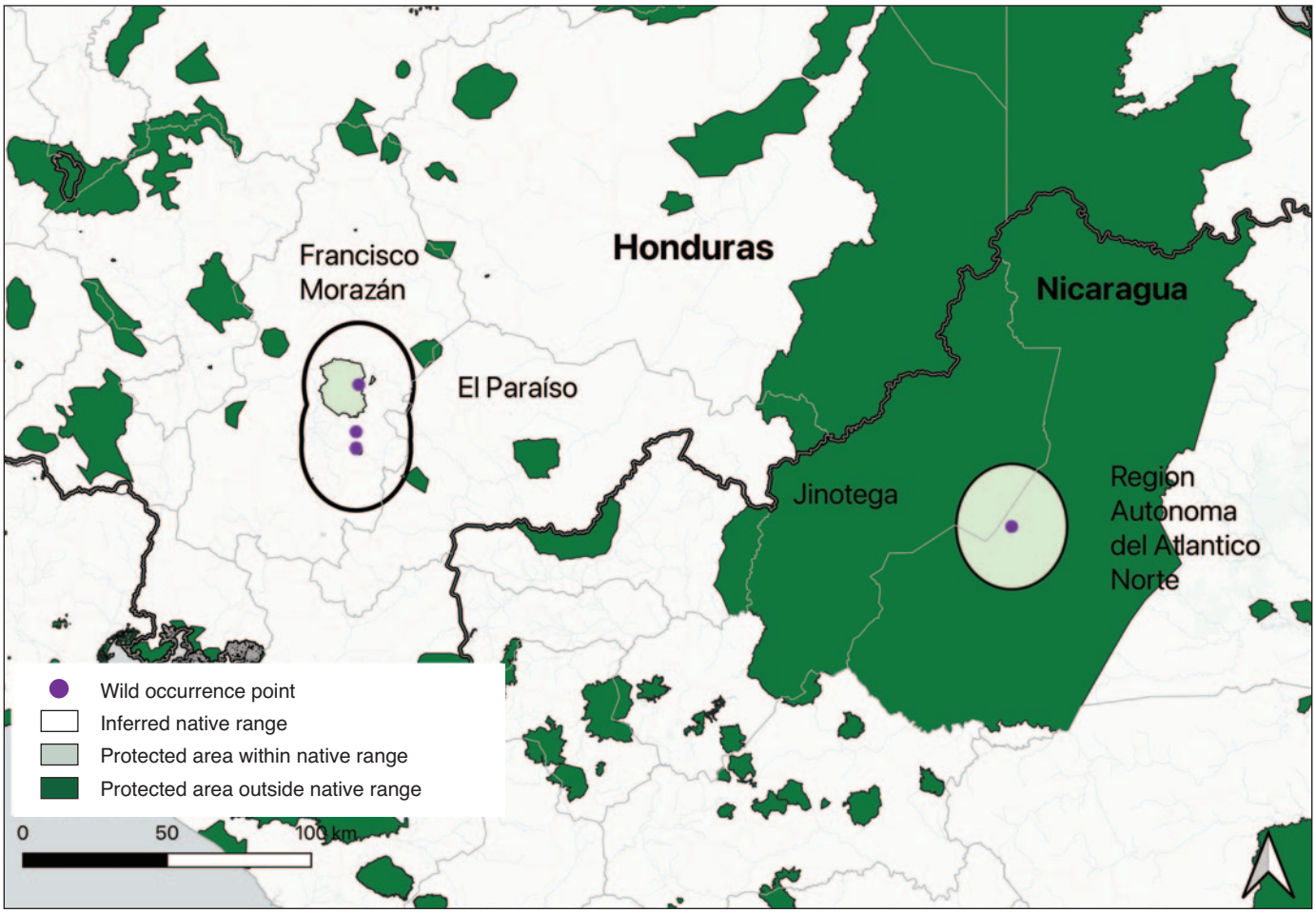


Figure 20. Wild occurrence points and inferred native range in relation to protected areas for *Quercus gracilior*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus grahamii Benth.

DISTRIBUTION AND BIOLOGY

Quercus grahamii is endemic to Mexico, particularly in the Sierra Madre del Sur. It is distributed in the Mexican states of Colima, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Puebla, Oaxaca, Tlaxcala and Veracruz (Figure 21). It occurs in temperate regions at elevations of 1,540–2,480 m in areas with distinct seasonality and high rainfall. Leaves are oblong to lanceolate and subcoriaceous with an aristate margin (Valencia-A et al., 2015).

Historically there has been considerable taxonomic confusion surrounding this species. The name *Q. acutifolia* was at one time applied to this species but it was determined to be a different species of which *Q. conspersa* is a synonym (Valencia-A et al., 2015). More survey work is needed to accurately map the full distribution of this species to reflect this change.

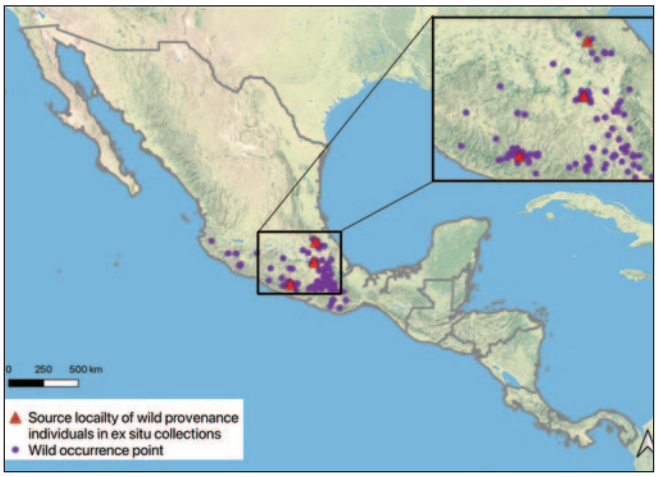


Figure 21. *In situ* (e.g., wild, within native habitat) and ex *situ* (e.g., within living collections) occurrence points for *Quercus grahamii*.

PROTECTED AREAS

Within the inferred native range of *Q. grahamii*, 12% is in protected areas (Figure 22). Protected areas include Tehuacán-Cuicatlán, a UNESCO-MAB Biosphere Reserve in the Sierra Madre del Sur and Humedal de Valsequillo, a State Park in Puebla.

CONSERVATION ACTION SCORE

Quercus grahamii received a final combined Conservation Action Score of 37/100 (Table 11). According to the results of our ex *situ* surveys, wild provenance individuals are currently held in four ex *situ* collections.

Table 11. Conservation gap analysis summary results for *Quercus grahamii*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	5
Ecological coverage	57
Representation	40
Final ex *situ* score	34
***In situ* scores**	
Geographic coverage	12
Ecological coverage	93
Representation	16
Final *in situ* score	40
Final score combined	37

INFORMATION GAPS

Quercus grahamii is currently assessed as Data Deficient due to a lack of information on population size and threats (Jerome, 2018c). There is also taxonomic uncertainty surrounding this species. *Quercus grahamii* was identified as *Q. acutifolia* until as recently as 2015. Many herbarium specimens have not yet been updated to reflect this change.

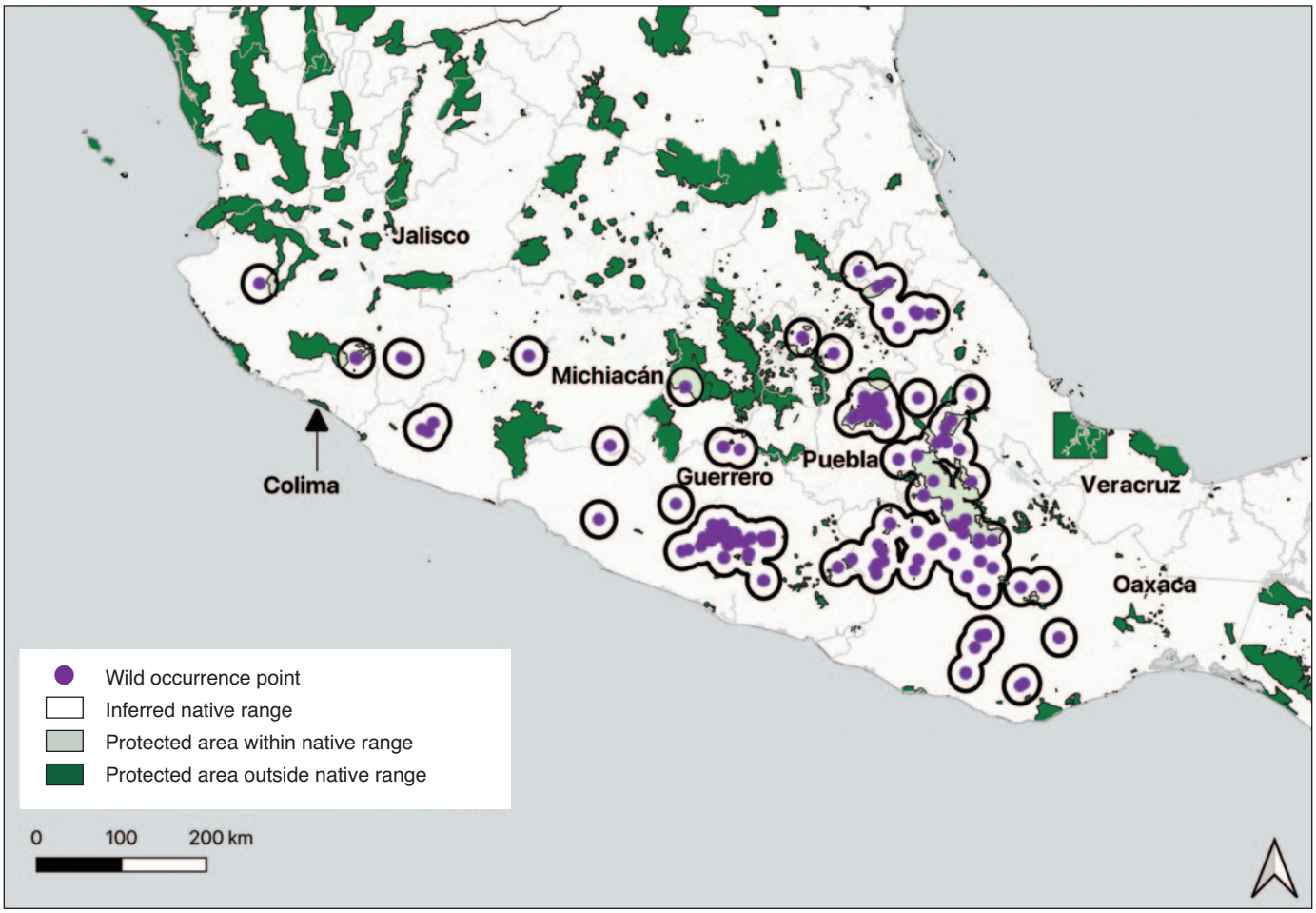


Figure 22. Wild occurrence points and inferred native range in relation to protected areas for *Quercus grahamii*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus ignaciensis C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus ignaciensis is endemic to Mexico, where it occurs in Sonora in the Sierra Madre Occidental (Figure 23). There is very little information available on the distribution, habitat, or ecology of *Q. ignaciensis* and it is only known from its original description. Leaves are oblong-oblanceolate and 11–13 cm long by 2.5–3.5 cm wide. Leaf margins are entire or wavy and crisped (Muller, 1942b).

Figure 23. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus ignaciensis*.

PROTECTED AREAS

There are no protected areas within the inferred native range of *Q. ignaciensis* (Figure 24).

CONSERVATION ACTION SCORE

Quercus ignaciensis received a final combined Conservation Action Score of 0/100 (Table 12). According to the results of our *ex situ* surveys, it is currently not held in any *ex situ* collections.

Table 12. Conservation gap analysis summary results for *Quercus ignaciensis*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *in situ* score	0
Final score combined	0

INFORMATION GAPS

Quercus ignaciensis is currently assessed as Data Deficient due to a lack of information on full distribution, population size/trends, habitat, use, and threats (Carrero, 2020d).

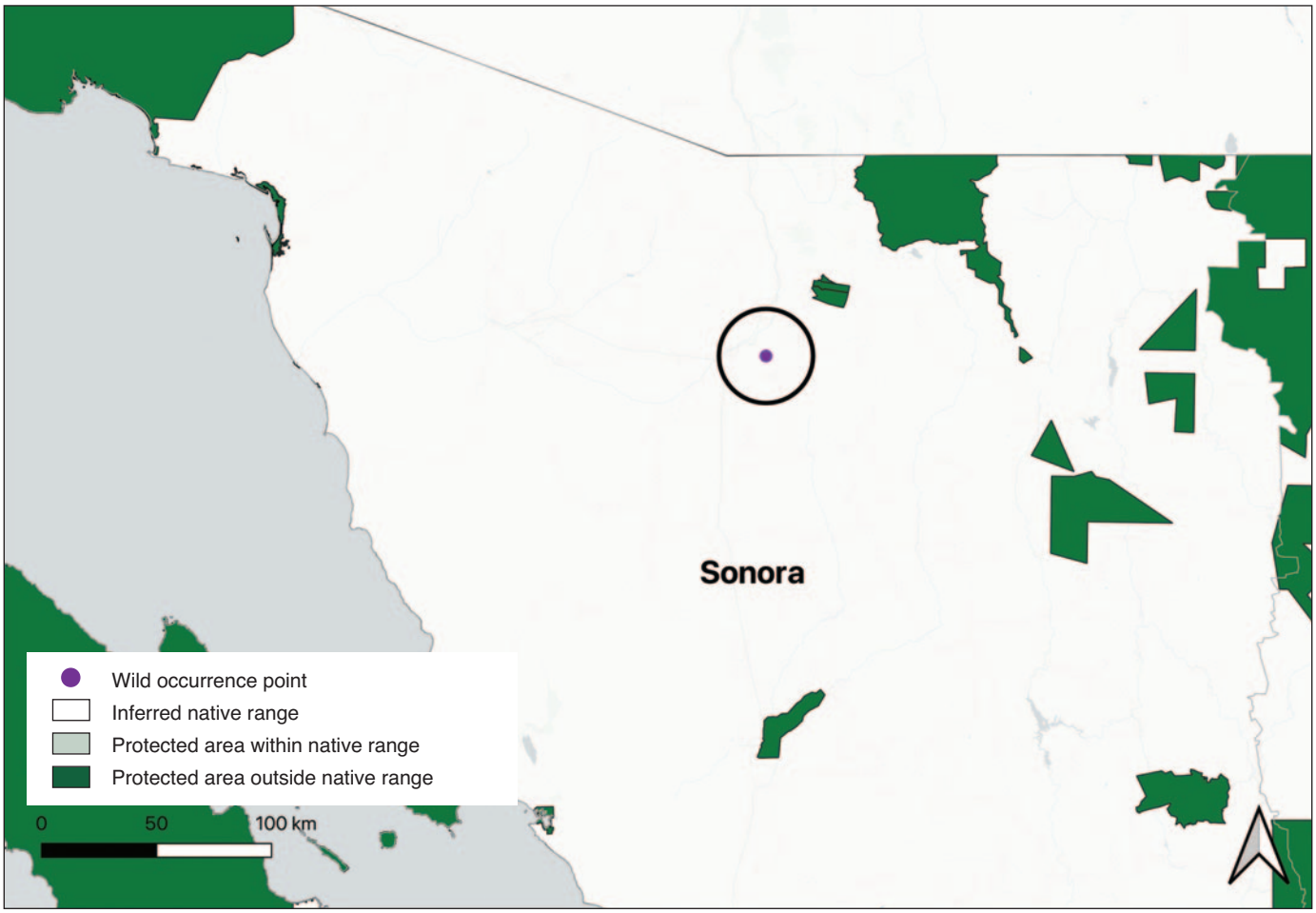


Figure 24. Wild occurrence points and inferred native range in relation to protected areas for *Quercus ignaciensis*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus melissae Nixon & Barrie

DISTRIBUTION AND BIOLOGY

Quercus melissae occurs in Mexico (Chiapas) and Guatemala (Figure 25). It was only recently described in 2017, and there is little information on this species aside from the original description. It inhabits dry oak and oak-pine forests at an elevation of 700–2,300 m (Nixon and Barrie, 2017). Herbarium specimens of *Q. melissae* were previously identified as *Q. segoviensis*. The two species differ in leaf morphology, cotyledons, and peduncle length. *Quercus melissae* grows up to 20 m tall. Leaves are obovate to broadly elliptic, and 6–17.5 cm x 4–9.5 cm. This species fruits annually, and has an acorn that is ovoid and 18–21 mm x 12–16 mm.

Figure 25. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus melissae*.

PROTECTED AREAS

Within the inferred native range of *Q. melissae*, 2% is in protected areas (Figure 26).

CONSERVATION ACTION SCORE

Quercus melissae received a final combined Conservation Action Score of 8/100 (Table 13). According to the results of our *ex situ* surveys, it is currently not held in any *ex situ* collections.

Table 13. Conservation gap analysis summary results for *Quercus melissae*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	2
Ecological coverage	44
Representation	0
Final *in situ* score	15
Final score combined	8

INFORMATION GAPS

Quercus melissae is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses (Carrero, 2021d)

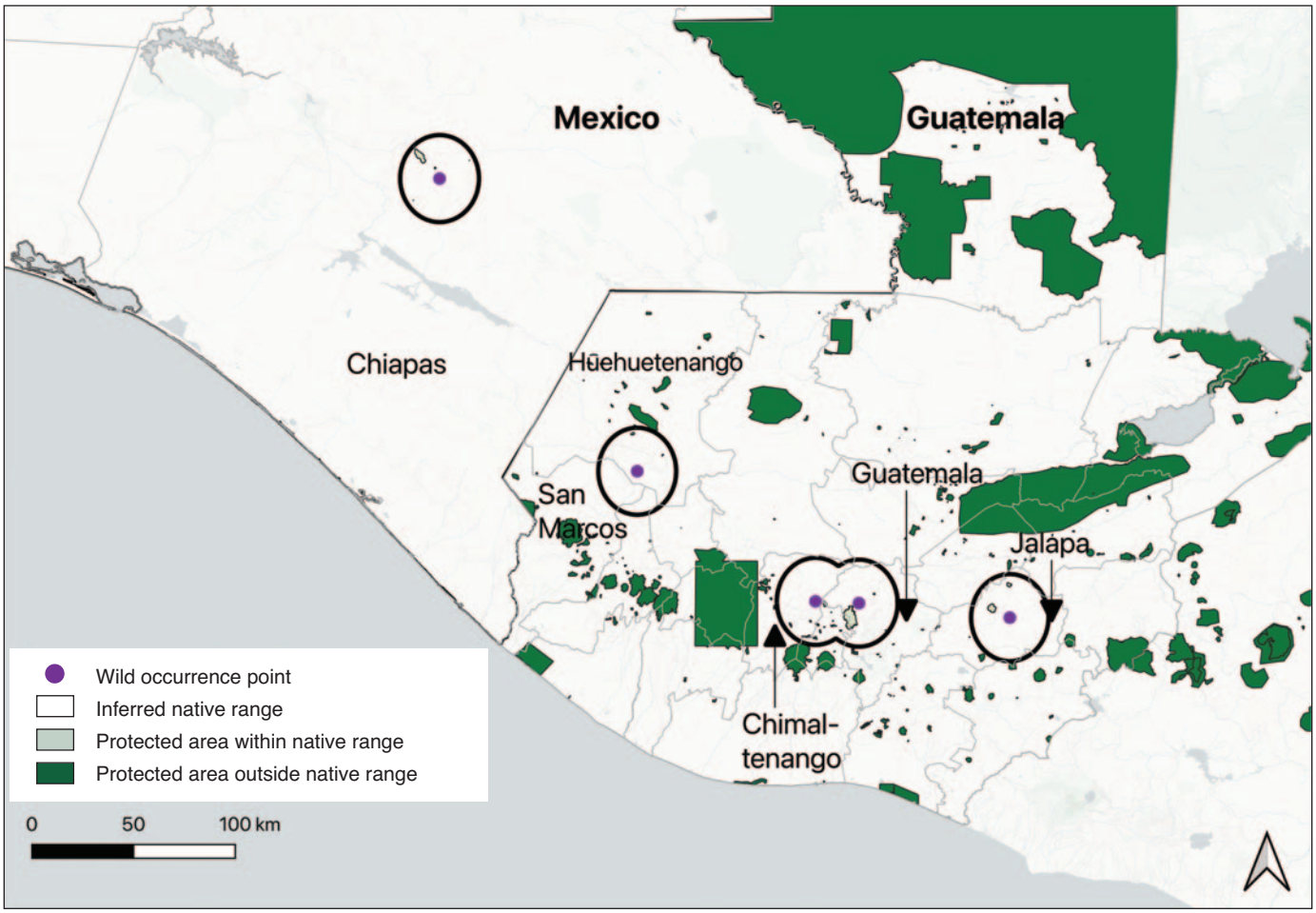


Figure 26. Wild occurrence points and inferred native range in relation to protected areas for *Quercus melissae*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus mexiae L.M. González

DISTRIBUTION AND BIOLOGY

Quercus mexiae is endemic to Mexico, where it occurs with the state of Jalisco on the Pacific slope of the Sierra Madre del Sur (Figure 27). It inhabits humid pine-oak and mesophilic mountain forests at an elevation of 900–2,500 m, where it grows frequently and abundantly. It is a recently described species, and there is little information available aside from the original description (González-Villarreal, 2018). *Quercus mexiae* has been propagated as part of a recent experiment comparing germination rates of oaks growing from humid vs dry environments (Arenas-Navarro, unpublished). The results showed that Q. *mexiae* has a high germination rate.

Quercus mexiae is a small to medium sized tree, growing 10–15 m in height. Leaves are oblong to oblong-elliptic, entire, and up to 10 x 20 cm. Leaves are leathery in texture and densely pubescent when young and becoming almost glabrous as they age. Acorns are ovoid, 10–15 × 6–12 mm, with the cap up to 1/3 of its length. (González-Villarreal, 2018)

Figure 27. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus mexiae*.

PROTECTED AREAS

Within the inferred native range of Q. *mexiae*, 23% is in protected areas (Figure 28). Protected areas include the Sierra de Manantlán, a Biosphere Reserve in Jalisco.

CONSERVATION ACTION SCORE

Quercus mexiae received a final combined Conservation Action Score of 22/100 (Table 14). According to the results of our ex *situ* surveys, it is currently not held in any ex *situ* collections.

Table 14. Conservation gap analysis summary results for *Quercus mexiae*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	23
Ecological coverage	80
Representation	31
Final *in situ* score	45
Final score combined	22

INFORMATION GAPS

Quercus mexiae is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses of this species (Carrero, 2021e).

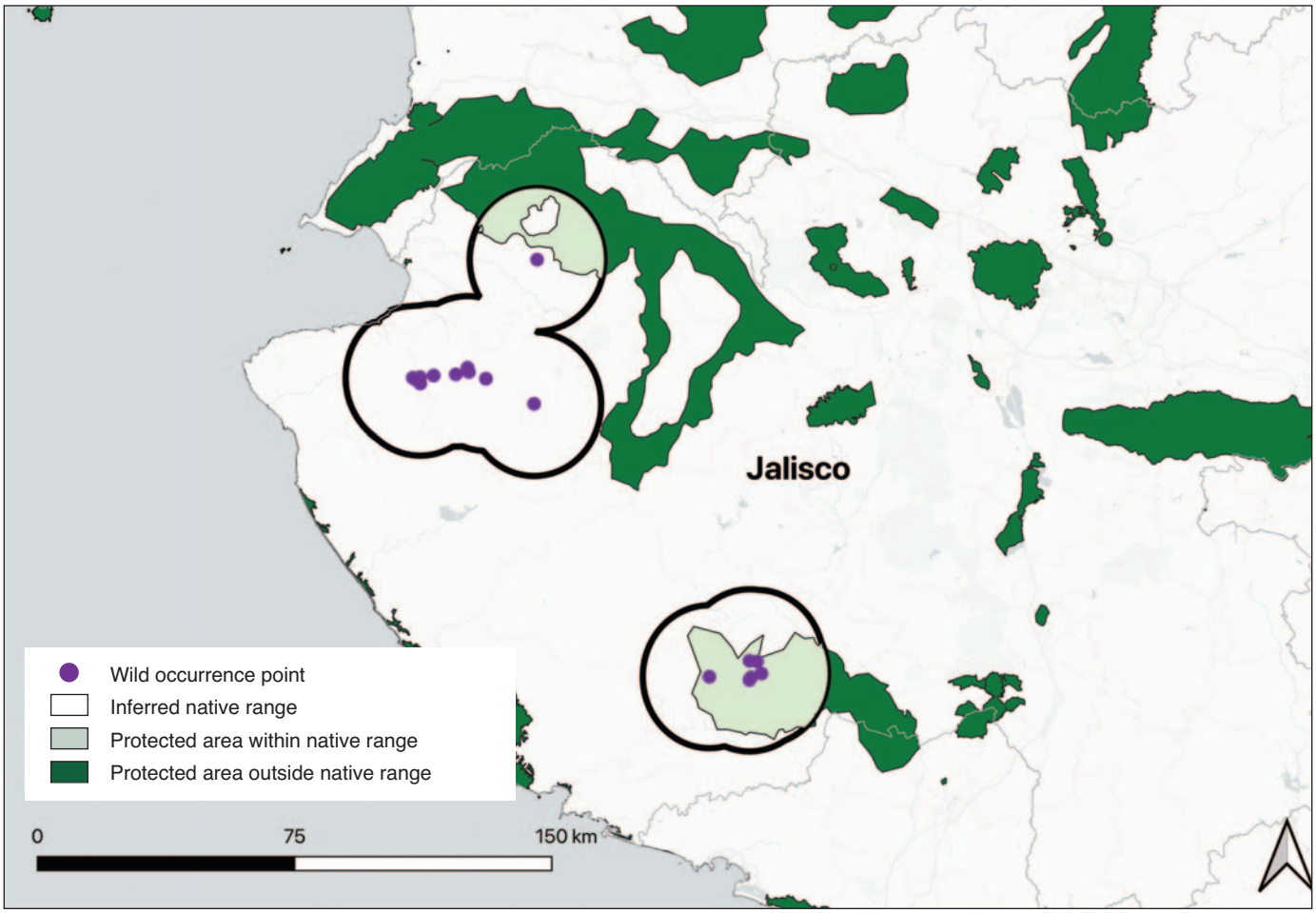


Figure 28. Wild occurrence points and inferred native range in relation to protected areas for *Quercus mexiae*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus opaca Trel.

DISTRIBUTION AND BIOLOGY

Quercus opaca is endemic to Mexico, where it occurs within Nuevo León, Tamaulipas, San Luis Potosí and Hidalgo (Figure 29). The occurrence points in Tamaulipas should be verified, as according to Perez-Mojica and Valencia-A (2017) it is not found within this state and is mis-identified as *Q. porphyrogenita*. In Hidalgo, it inhabits arid tropical scrub. *Quercus opaca* is a shrub that grows up to 1.5 m tall. Leaves are oblong, elliptic or lanceolate, and 2.3–3 x 10–15 cm. Margins are entire, or rarely have short teeth. Acorns are ovoid, and 9 mm long x 8 mm wide, with 1/3 of acorn in the cupule. (Valencia-A et al., 2017)

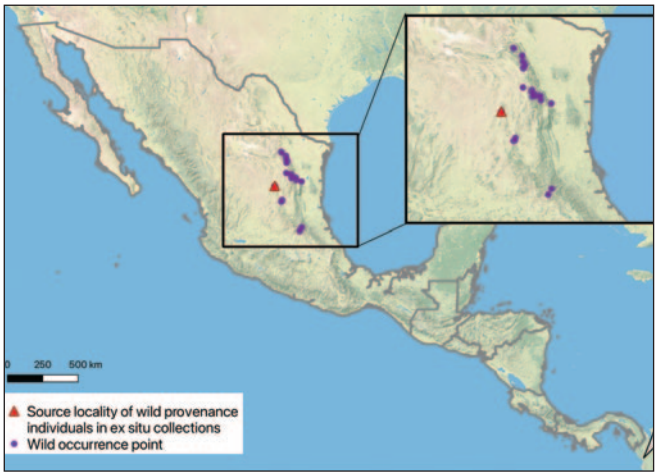


Figure 29. *In situ* (e.g., wild, within native habitat) and ex *situ* (e.g., within living collections) occurrence points for *Quercus opaca*.

PROTECTED AREAS

Within the inferred native range of *Q. opaca*, 36% is in protected areas (Figure 30). Important protected areas include the Cumbres de Monterrey (National Park) and C.A.D.N.R.026 Bajo Río San Juan (Natural Resources Protection Area) in Nuevo León and the Real de Guadalcázar (State Reserve) in San Luis Potosí.

CONSERVATION ACTION SCORE

Quercus opaca received a final combined Conservation Action Score of 34/100 (Table 15). According to the results of our ex *situ* surveys, this species is held in one ex *situ* collection.

Table 15. Conservation gap analysis summary results for *Quercus opaca*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	8
Ecological coverage	25
Representation	10
Final ex *situ* score	14
***In situ* scores**	
Geographic coverage	36
Ecological coverage	88
Representation	39
Final *in situ* score	54
Final score combined	34

INFORMATION GAPS

Quercus opaca is currently assessed as Data Deficient due to a lack of information on population size, trends, or threats (Jerome, 2018d).


Béatrice Chassé

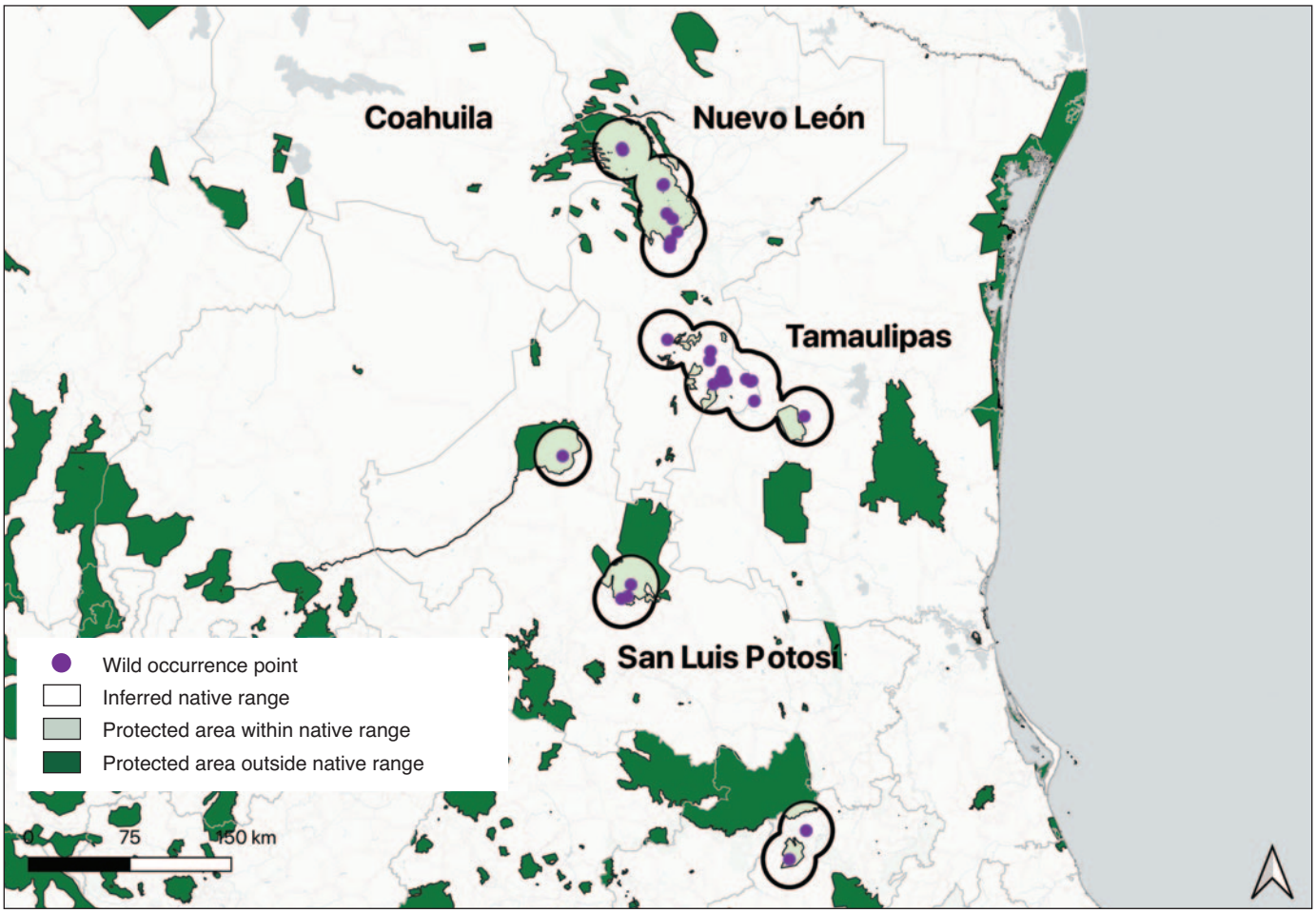


Figure 30. Wild occurrence points and inferred native range in relation to protected areas for *Quercus opaca*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus paxtalensis C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus paxtalensis occurs in the Mexican states of Chiapas, Hidalgo, Oaxaca, Tamaulipas and Veracruz in the Sierra Madre Oriental, Sierra Madre del Sur, and Sierra Madre de Chiapas (Figure 31). As recently as 2019, *Q. paxtalensis* has also been identified from the cloud forests of Guatemala. It grows at elevations of 1,110 to 1,750 m in cloud forest, oak forest, conifer forest and tropical dry forest (González-Espinosa et al., 2011; Valencia-A et al., 2017). The taxonomy of this species is uncertain, with some considering it a synonym of *Q. xalapensis* (Jerome, 2018e). However, according to Perez-Mojica and Valencia-A (2017), *Q. paxtalensis* differs from *Q. xalapensis* in having fruits that ripen annually, leaves with a cuneate base that are somewhat truncated, and an acorn cap that is cuneate.

Quercus paxtalensis is a tree that can grow up to 30 m tall. Leaves are shiny and lanceolate or narrowly elliptic, 12–17 cm x 3.2–5.5 cm. Leaf margin has 9–12 teeth on each side of the blade. Acorns are ovoid and 18–20 mm long × 12–14 *mm in diameter. (Valencia-A et al., 2017)*

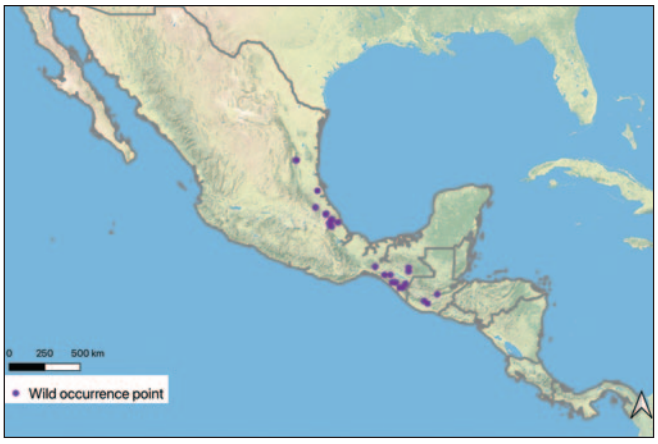


Figure 31. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus paxtalensis*.

PROTECTED AREAS

Within the inferred native range of *Q. paxtalensis*, 22% is in protected areas (Figure 32). Important protected areas include El Triunfo (a Biosphere Reserve) and Pico El Loro-Paxtal (Ecological Conservation Zone) in Chiapas.

CONSERVATION ACTION SCORE

Quercus paxtalensis received a final combined Conservation Action Score of 24/100 (Table 16). According to the results of our *ex situ* surveys, it is not currently held in any *ex situ* collections. In 2023 *Q. paxtalensis* was added to the Puebla University Botanic Garden (BUAP) satellite collection in Teziutlan, Puebla. Because this occurred after our last *ex situ* survey, it is not reflected in the results. In addition, the Global Conservation Consortium for Oak (GCCO) Mexico and Central America is currently engaged in a multinational project "Safeguarding Threatened Tropical Montane Cloud Forest (TMCF) Oaks in Mesoamerica". In Puebla, *Q. paxtalensis* has been identified as a target species of this project and will be the focus of future restoration work (Rodríguez-Acosta and Coombes, 2023).

Table 16. Conservation gap analysis summary results for *Quercus paxtalensis*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	22
Ecological coverage	85
Representation	35
Final *in situ* score	47
Final score combined	24

INFORMATION GAPS

Quercus paxtalensis is currently assessed as Data Deficient due to a lack of information on geographic range, population trends, and potential threats (Jerome, 2018e). There are also taxonomic questions regarding this species, with some considering it a synonym of *Q. xalapensis*. However, *Q. xalapensis* has fruit that ripens biennially.

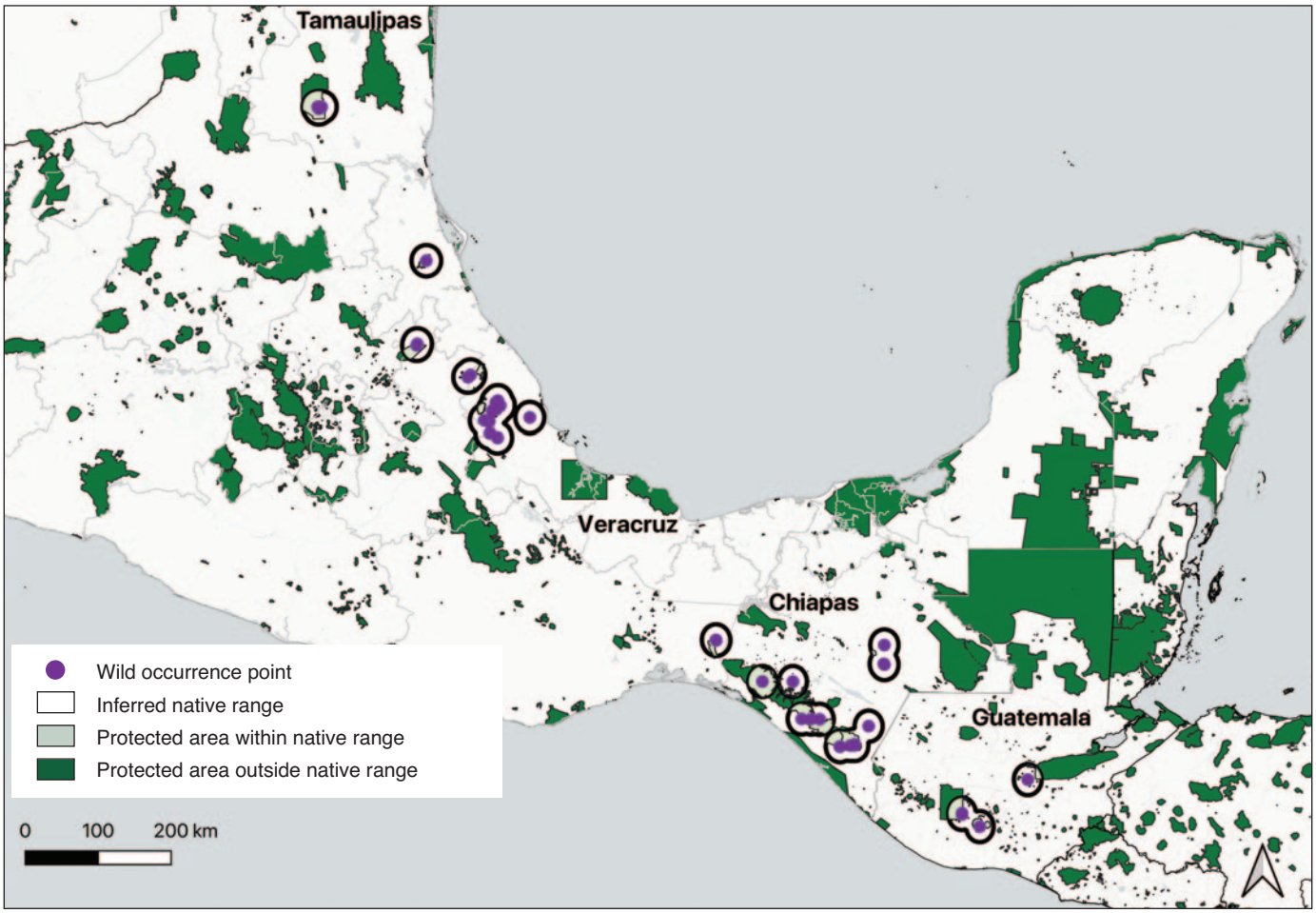


Figure 32. Wild occurrence points and inferred native range in relation to protected areas for *Quercus paxtalensis*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).


Neptalí Ramírez Marcial

Quercus perpallida Trel.

DISTRIBUTION AND BIOLOGY

Quercus perpallida is endemic to Mexico, and occurs in the states of Sonora and Chihuahua in the Sierra Madre Occidental at elevations 1,150–1,650 m (Figure 33) (Carrero, 2020e). Very little is known regarding this species' habitat or full distribution.

Quercus perpallida is a tree that typically grows 6–10 m tall. Leaves are thin and stiff, oblong or elliptic in shape, and 2.5–5 x 0.8–2.2 cm. The adaxial leaf surface is pale green-blue and glabrous. Leaf margins have blunt teeth on both sides, or occasionally entire. Acorns are annual, 15–19 mm long in cups 6–9 mm wide. There are typically 1–2 acorns per cluster. *Quercus perpallida* is very similar to *Q. oblongifolia* and the two are difficult to distinguish in the field (Spellenberg, 2001)

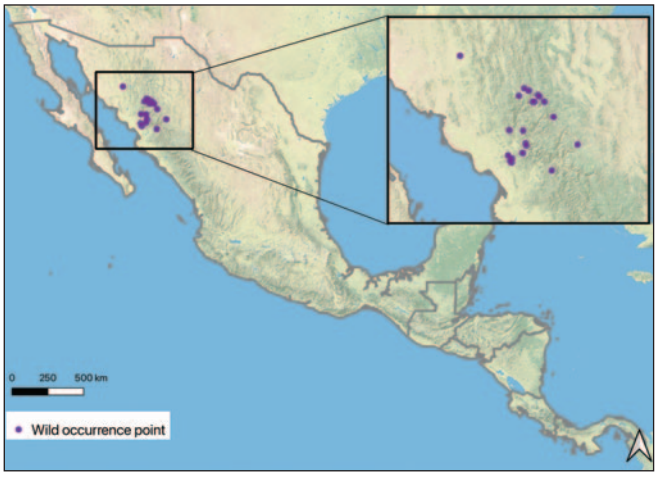


Figure 33. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus perpallida*.

PROTECTED AREAS

Within the inferred native range of *Q. perpallida*, 15% is in protected areas (Figure 34). Important protected areas include two Flora and Fauna Protection Areas: Tutuaca in Chihuahua and Sierra de Álamos-Río Cuchujaqui in Sonora.

CONSERVATION ACTION SCORE

Quercus perpallida received a final combined Conservation Action Score of 22/100 (Table 17). According to the results of our *ex situ* surveys, it is not currently held in any *ex situ* collections.

Table 17. Conservation gap analysis summary results for *Quercus perpallida*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	15
Ecological coverage	67
Representation	53
Final *in situ* score	45
Final score combined	22

INFORMATION GAPS

Quercus perpallida is currently assessed as Data Deficient due to a lack of information on full distribution, population size/trends, habitat, use, and threats (Carrero, 2020e).

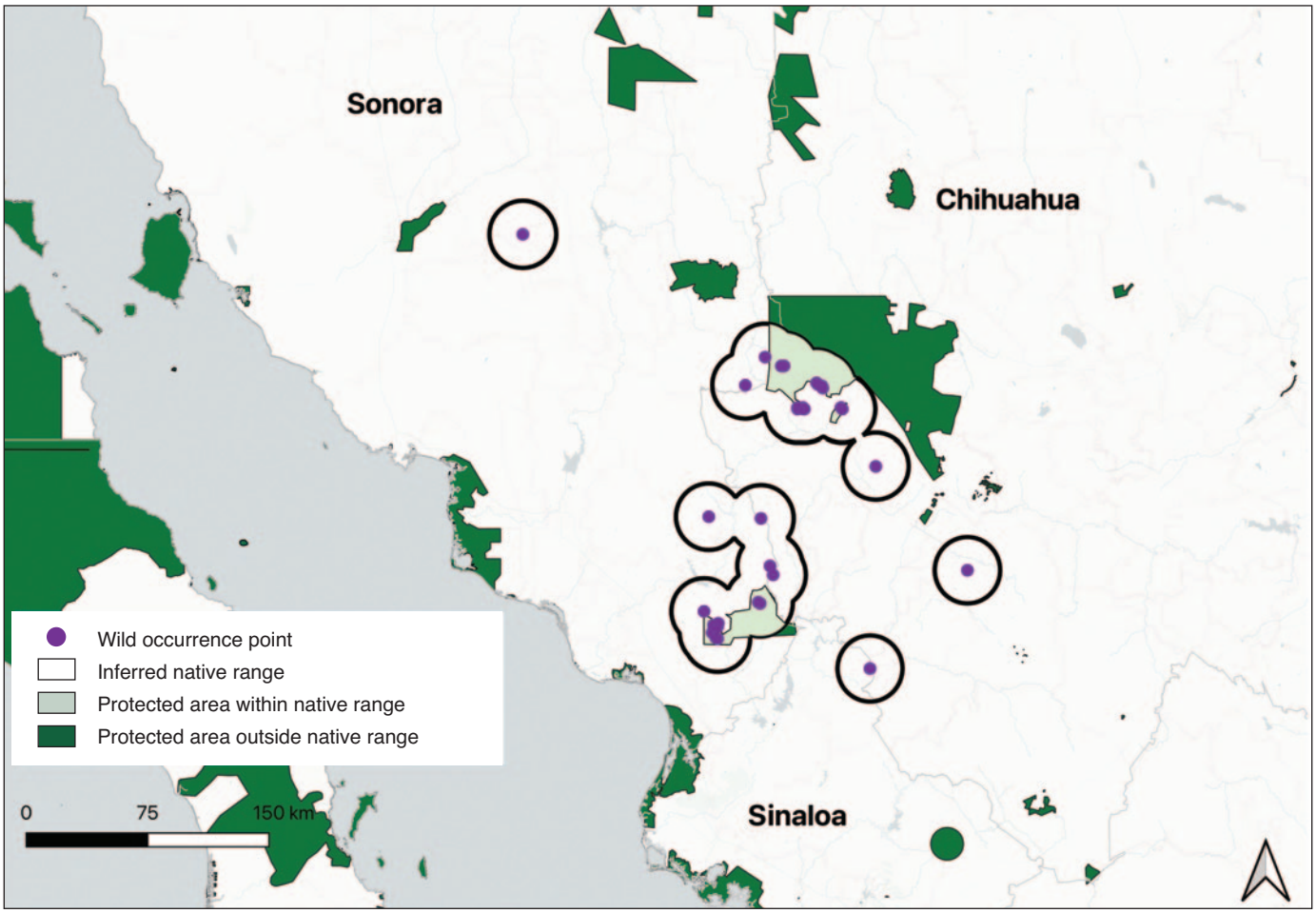


Figure 34. Wild occurrence points and inferred native range in relation to protected areas for *Quercus perpallida*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus porphyrogenita Trel.

DISTRIBUTION AND BIOLOGY

Quercus porphyrogenita is endemic to Mexico, where it occurs in the states of Nuevo León and Tamaulipas in the Sierra Madre Oriental (Figure 35). This species was treated as a synonym of *Q. germana* by Valencia-A and Flores (2006), but has since been recognized as a different species. *Quercus porphyrogenita* inhabits oak and pine-oak forests at elevations of 700–1,350 m. It grows on limestone soils and is associated with *Q. polymorpha, Q. canbyi* and *Q. laeta* (Perez-Mojica and Valencia-A, 2017).

Quercus porphyrogenita is a tree that grows 5–8 m tall. Leaves are leathery, glaucous, oblong, and 2.8–5.2 x 1.1–1.6 cm. The upper surface of the leaf is somewhat glossy. Leaf margin is entire, flat, and sometimes crenate. Fruits are annual in groups of one or two. Acorns are ovoid and 18–21 x 9–11 mm. (Perez-Mojica and Valencia-A, 2017)

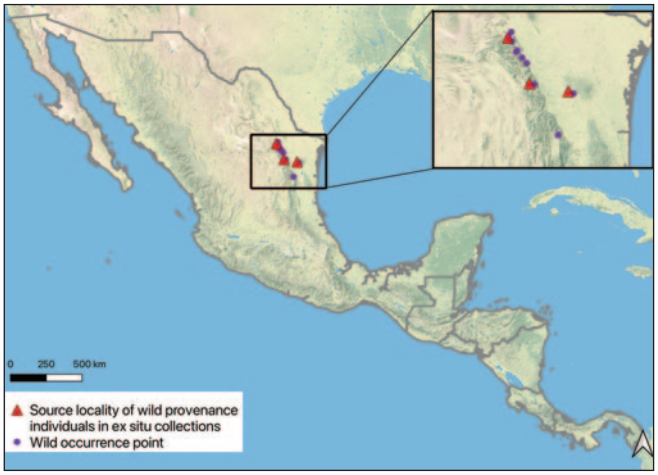


Figure 35. *In situ* (e.g., wild, within native habitat) and ex *situ* (e.g., within living collections) occurrence points for *Quercus porphyrogenita*.

PROTECTED AREAS

Within the inferred native range of *Q. porphyrogenita*, 28% is in protected areas (Figure 36). Important protected areas include Cumbres de Monterrey, a Biosphere Reserve in Nuevo León.

CONSERVATION ACTION SCORE

Quercus porphyrogenita received a final combined Conservation Action Score of 55/100 (Table 18). According to the results of our ex *situ* surveys, wild provenance individuals are currently held within four collections.

Table 18. Conservation gap analysis summary results for *Quercus porphyrogenita*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	42
Ecological coverage	67
Representation	40
Final ex *situ* score	50
***In situ* scores**	
Geographic coverage	28
Ecological coverage	100
Representation	54
Final *in situ* score	61
Final score combined	55

INFORMATION GAPS

Quercus porphyrogenita is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses (Carrero, 2021f).

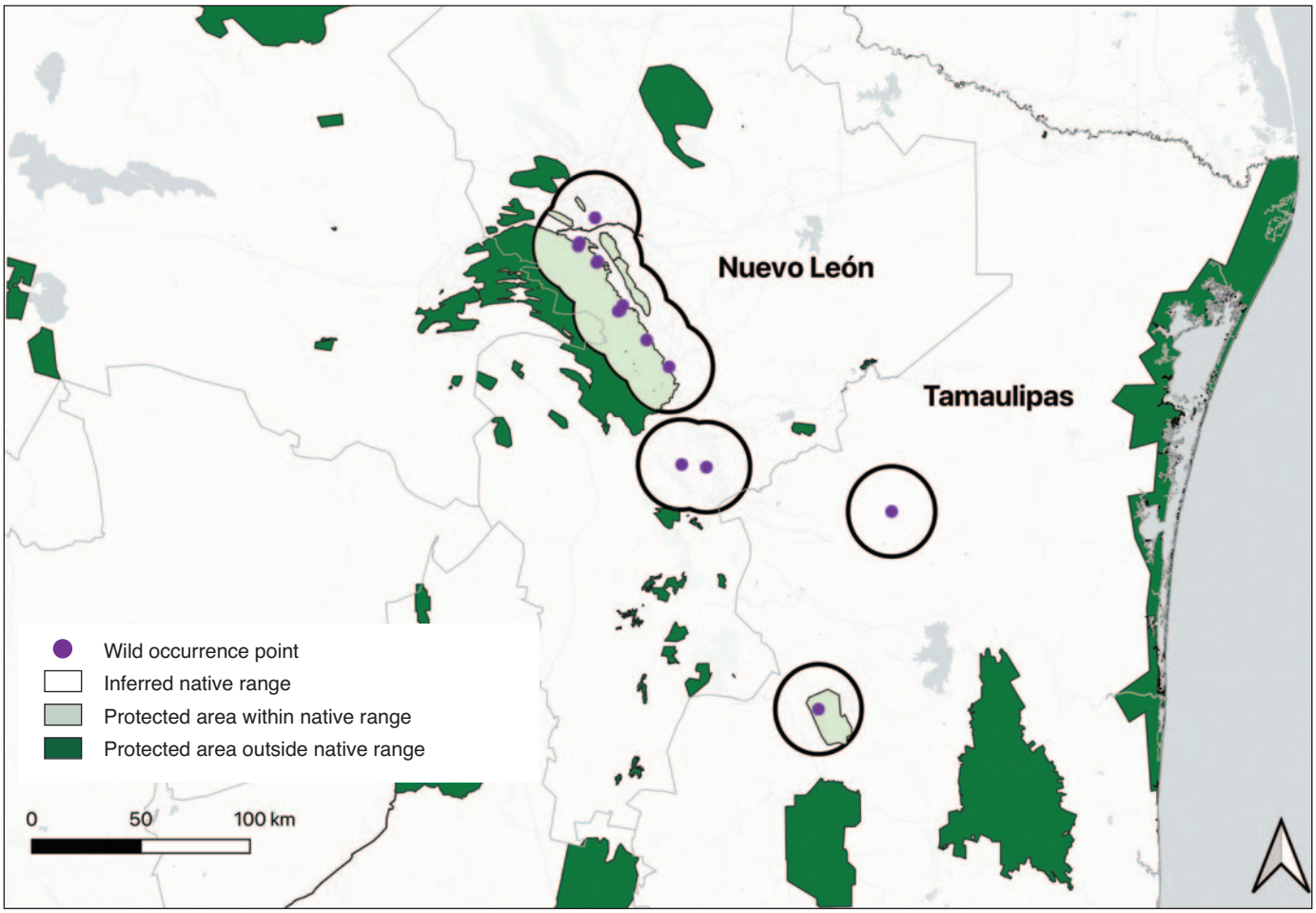


Figure 36. Wild occurrence points and inferred native range in relation to protected areas for *Quercus porphyrogenita*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus rekonis Trel.

DISTRIBUTION AND BIOLOGY

Quercus rekonis is endemic to Mexico. According to Carrero (2020f) it occurs in the states of Oaxaca, Nayarit and Sinaloa although we only have occurrence points for Oaxaca (Figure 37). There is very little information available regarding the habitat preference or full distribution of *Q. rekonis*, as it is only known from the original description.

Leaves of *Q. rekonis* are large (5–6 cm x 17 cm), and oblanceolate. Leaf margins are entire or few toothed. Fruit is annual and acorns are ovoid and small, approximately 10 mm in diameter (Hélardot, 2018d).

Figure 37. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus rekonis*.

PROTECTED AREAS

Within the inferred native range of *Q. rekonis*, 16% is in protected areas (Figure 38). Protected areas include the Cuencas y corales de la zona costera de Huatulco, a Ramsar Site in Oaxaca.

CONSERVATION ACTION SCORE

Quercus rekonis received a final combined Conservation Action Score of 19/100 (Table 19). According to the results of our ex *situ* surveys, it is not currently held in any ex *situ* collections.

Table 19. Conservation gap analysis summary results for *Quercus rekonis*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	16
Ecological coverage	100
Representation	0
Final *in situ* score	39
Final score combined	19

INFORMATION GAPS

Quercus rekonis is currently assessed as Data Deficient due to a lack of information on full distribution, population size/trends, habitat, use, and threats (Carrero, 2020f). In addition, there is taxonomic uncertainty surrounding this species, with some considering it a hybrid, morphological variety, or subspecies of *Q. peduncularis*.

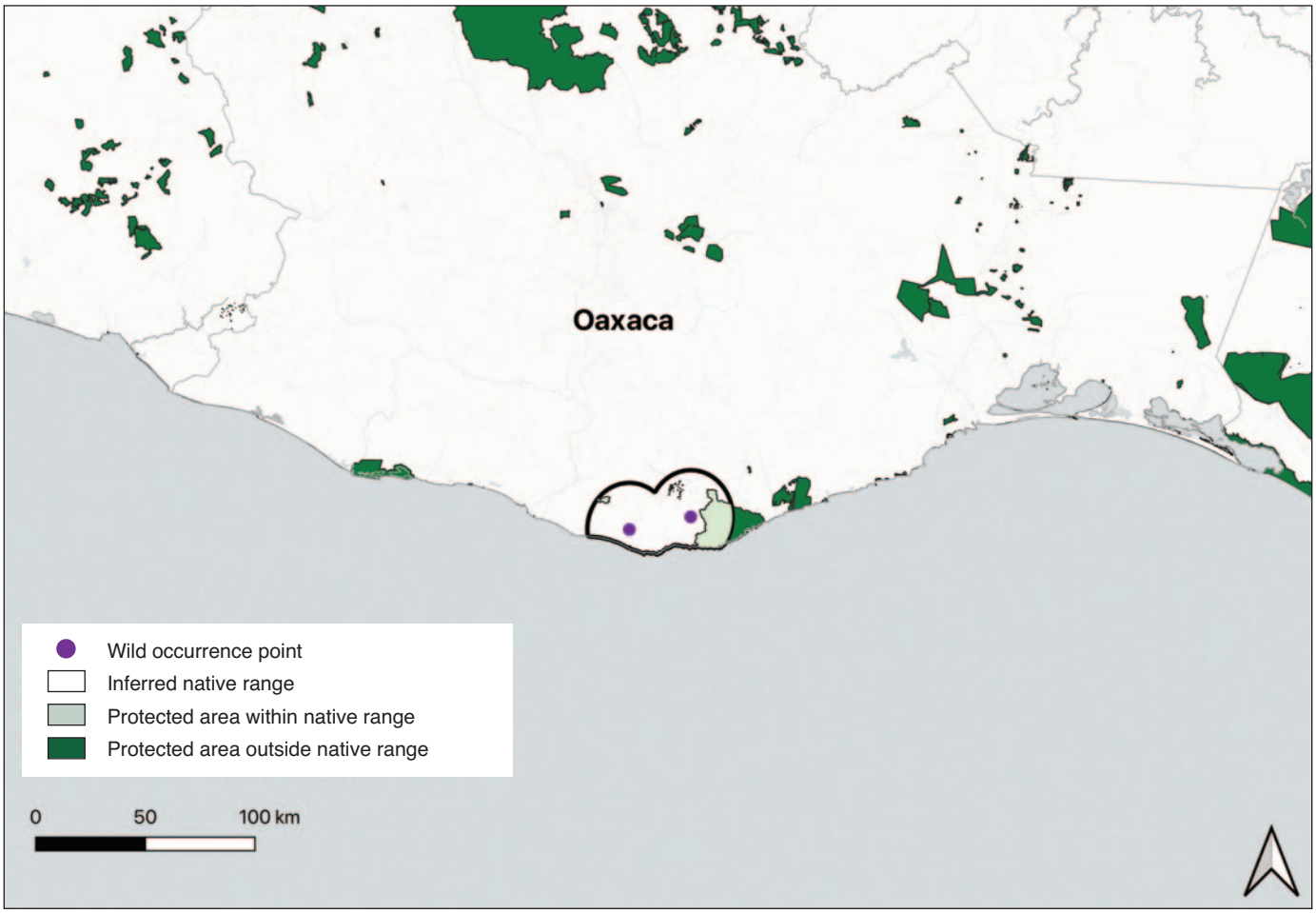


Figure 38. Wild occurrence points and inferred native range in relation to protected areas for *Quercus rekonis*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus sarahmariae Nixon & Barrie

DISTRIBUTION AND BIOLOGY

Quercus sarahmariae is native to Costa Rica (Figure 39). There is one occurrence point in western Panama from 1983 that should be verified. This species has a narrow range and inhabits wet premontane or cloud forests at a typical elevation of 700–1,900 m (Nixon and Barrie, 2017). Little is known from this species aside from its original description.

Quercus sarahmariae is a large tree that can reach heights of 45 m or greater. Leaves are narrowly elliptic to elliptic, 6–22 cm x 2.5–8.5 cm. The upper surface of the leaf is dull-green and the lower surface is green-bronze. Leaf margins are entire, occasionally with 1–5 teeth. Acorns are typically cylindric and 21–26 mm x 23–25 mm. (Nixon and Barrie, 2017)

Figure 39. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus sarahmariae*.

PROTECTED AREAS

Within the inferred native range of *Q. sarahmariae*, 58% is in protected areas (Figure 40). Major protected areas include La Amistad (Biosphere Reserve) and Turberas de Talamanca (Ramsar Site, Wetland of International Importance).

CONSERVATION ACTION SCORE

Quercus sarahmariae received a final combined Conservation Action Score of 41/100 (Table 20). According to the results of our ex situ surveys, it is currently not held in any *ex situ* collections.

Table 20. Conservation gap analysis summary results for *Quercus sarahmariae*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	58
Ecological coverage	100
Representation	86
Final *in situ* score	81
Final score combined	41

INFORMATION GAPS

Quercus sarahmariae is currently assessed as Data Deficient due to a lack of information on population dynamics, threats, and uses of this species (Carrero, 2021g).

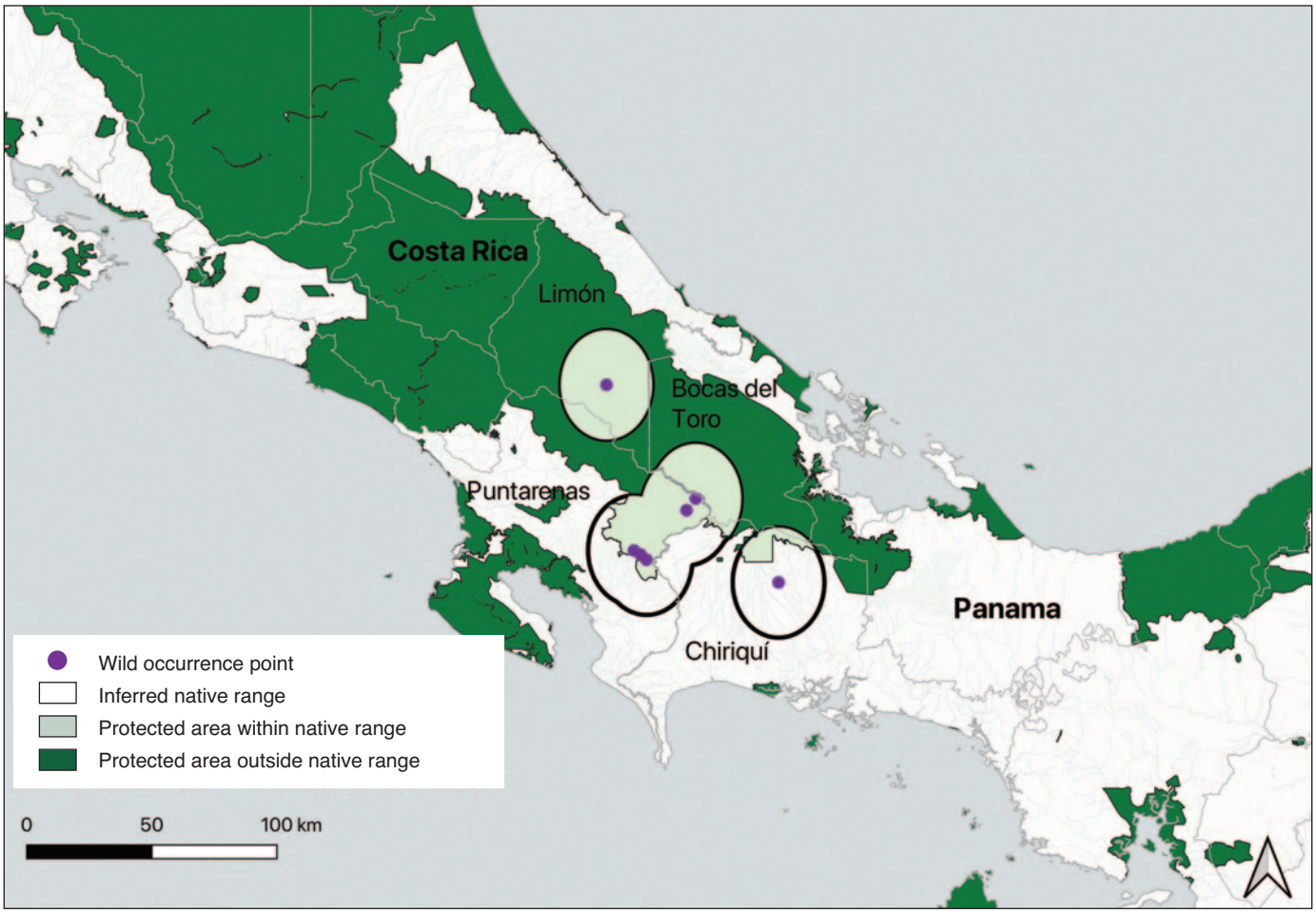


Figure 40. Wild occurrence points and inferred native range in relation to protected areas for *Quercus sarahmariae*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus supranitida C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus supranitida is endemic to Mexico, where it occurs in the state of Nuevo León (Figure 41). Very little information is known regarding distribution, ecology, and habitat of this species. There is also taxonomic uncertainty surrounding *Q. supranitida*, with Valencia-A (2004) considering it a synonym of *Q. repanda*. Leaves are oblong to lance-elliptic and small, at 3–5 cm long and 1–2 cm wide, with entire or shallowly toothed margins (Muller, 1942b). According to Oaks of the World, it is a shrub less than 3 m tall (Hélardot, 2018e).

Figure 41. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus supranitida*.

PROTECTED AREAS

Within the inferred native range of *Q. supranitida*, 33% is in protected areas (Figure 42). Protected areas include the C.A.D.N.R.026 Bajo RÍo San Juan, a Natural Resources Protection Area in Nuevo León.

CONSERVATION ACTION SCORE

Quercus supranitida received a final combined Conservation Action Score of 31/100 (Table 21). According to the results of our *ex situ* surveys, it is currently held in no *ex situ* collections.

Table 21. Conservation gap analysis summary results for *Quercus supranitida*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	33
Ecological coverage	100
Representation	50
Final *in situ* score	61
Final score combined	31

INFORMATION GAPS

Quercus supranitida is currently assessed as Data Deficient due to a lack of information on population size and trends (Jerome, 2018f).

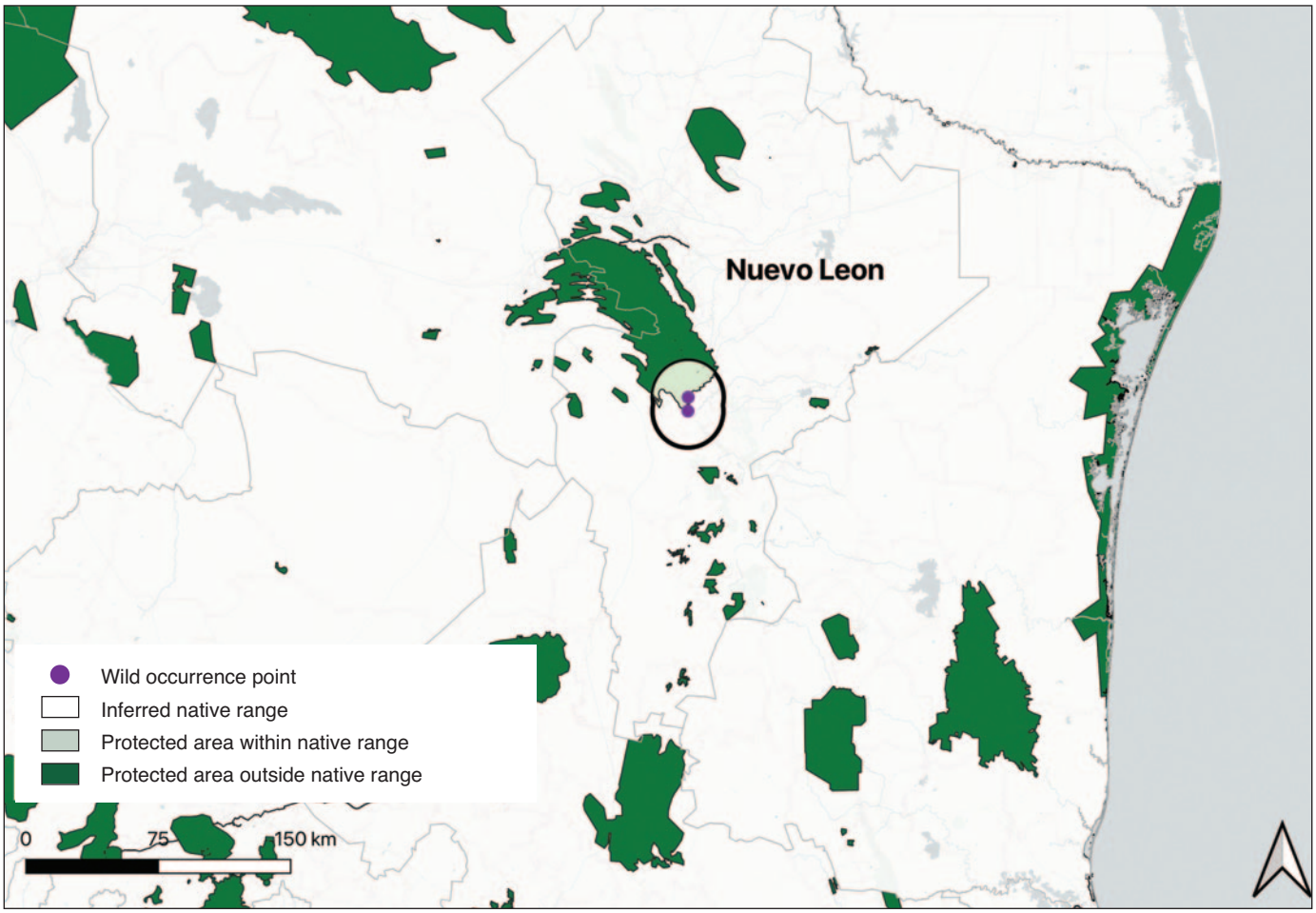


Figure 42. Wild occurrence points and inferred native range in relation to protected areas for *Quercus supranitida*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus tinkhamii C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus tinkhamii is endemic to Mexico, and occurs in the states of Hidalgo, Nuevo León, San Luis Potosí and Tamaulipas in the Sierra Madre Oriental and towards the margins of the Mexican plateau (Figure 43). According to Perez-Mojica and Valencia-A (2017), this species also occurs in Chihuahua, although we do not have occurrences for this state. This species inhabits oak-pine and xerophilous scrub forest at an elevation of 1,760–2,400 m (Perez-Mojica and Valencia-A, 2017; Valencia-A et al., 2017).

Quercus tinkhamii is a shrub 1.5–3 m high. Leaves are leathery, oblong to elliptical, and 2.7–5 x 1.2–3 cm. The leaf margin is toothed, with (2–) 3–6 short teeth distributed above the middle of the leaf. The leaf surface is glossy, smooth, and glabrous. Fruits are annual and solitary or in groups of 2–3. Acorns are ovoid and 12–15 x 17–19 mm. (Perez-Mojica and Valencia-A, 2017)

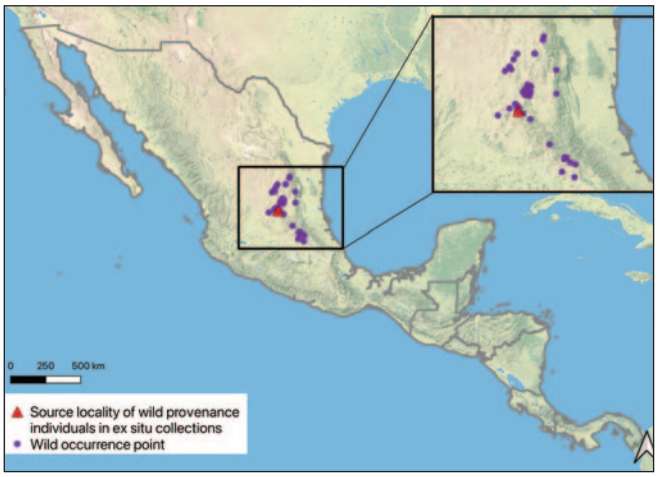


Figure 43. *In situ* (e.g., wild, within native habitat) and ex *situ* (e.g., within living collections) occurrence points for *Quercus tinkhamii*.

PROTECTED AREAS

Within the inferred native range of Q. *tinkhamii*, 20% is in protected areas (Figure 44). Protected areas include Real de Guadalcázar, a State Reserve in San Luis Potosí and Sierra Gorda, a UNESCO-MAB Biosphere reserve in Querétaro.

CONSERVATION ACTION SCORE

Quercus tinkhamii received a final combined Conservation Action Score of 37/100 (Table 22). According to the results of our ex *situ* surveys, wild provenance individuals are currently held in one ex *situ* collection.

Table 22. Conservation gap analysis summary results for *Quercus tinkhamii*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	5
Ecological coverage	57
Representation	10
Final ex *situ* score	24
***In situ* scores**	
Geographic coverage	20
Ecological coverage	71
Representation	60
Final *in situ* score	51
Final score combined	37

INFORMATION GAPS

Quercus tinkhamii is currently assessed as Data Deficient due to a lack of information on distribution, population size/trends, habitat, use, and threats for this species (Carrero, 2020g).

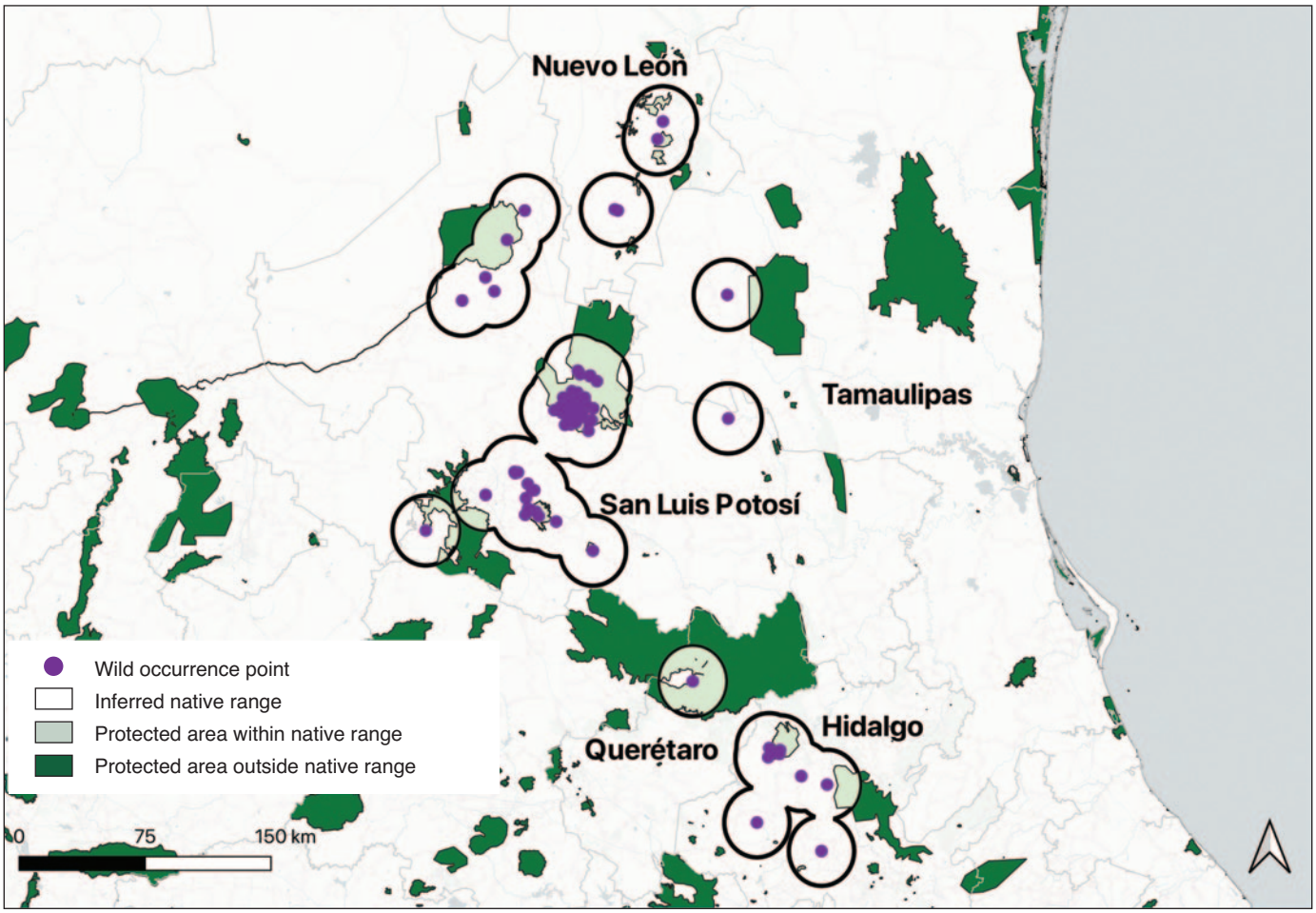


Figure 44. Wild occurrence points and inferred native range in relation to protected areas for *Quercus tinkhamii*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus toumeyi Sarg.

DISTRIBUTION AND BIOLOGY

Quercus toumeyi occurs in the Mexican states of Sonora and Chihuahua and crosses the border into the United States primarily in the states of Arizona and New Mexico (Figure 45). The occurrence point in Western Texas was also recently verified (Tim Thibault, Personal Communication, 2023). The range of this species is somewhat uncertain. What was previously thought to be the southernmost portion of this species range in Chihuahua has recently been updated to reflect the recognition of *Q. barrancana* as a new species (Spellenberg, 2014). *Quercus toumeyi* occurs in oak woodlands, pine-oak forests, and chaparral habitat. It prefers rocky, dry slopes and is a characteristic species of the Madrean Encinal shrubland of the Sierra Madre Occidental (Beckman et al. 2019).

Quercus toumeyi is a shrub or a small tree that grows 4–25 m tall. Leaves are stiff and flat or undulate and oblong, oval, or obovate in shape. Leaves are 1–3.5 cm x 0.5–2.5 cm with margins that are entire or with small teeth on each side. Acorns are annual, 13–14 mm long in cups that are 8–9 mm wide. (Spellenberg 2001)

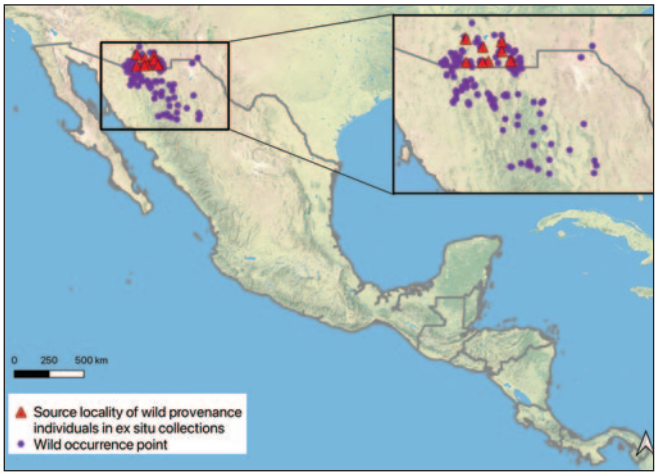


Figure 45. *In situ* (e.g., wild, within native habitat) and ex *situ* (e.g., within living collections) occurrence points for *Quercus toumeyi*.

PROTECTED AREAS

Quercus toumeyi received a final combined Conservation Action Score of 46/100 (Table 23). According to the results of our ex *situ* surveys, wild provenance individuals are currently held in six ex *situ* collections.

CONSERVATION ACTION SCORE

Quercus toumeyi is currently assessed as Data Deficient due to a lack of information on density of the Mexican population, as well as taxonomic confusion with *Q. barrancana* (Beckman and Jerome, 2017).

Table 23. Conservation gap analysis summary results for *Quercus toumeyi*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	13
Ecological coverage	63
Representation	60
Final ex *situ* score	45
***In situ* scores**	
Geographic coverage	17
Ecological coverage	100
Representation	27
Final *in situ* score	48
Final score combined	46

INFORMATION GAPS

Quercus toumeyi is currently assessed as Data Deficient due to a lack of information on density of the Mexican population, as well as taxonomic confusion with *Q. barrancana* (Beckman and Jerome, 2017).

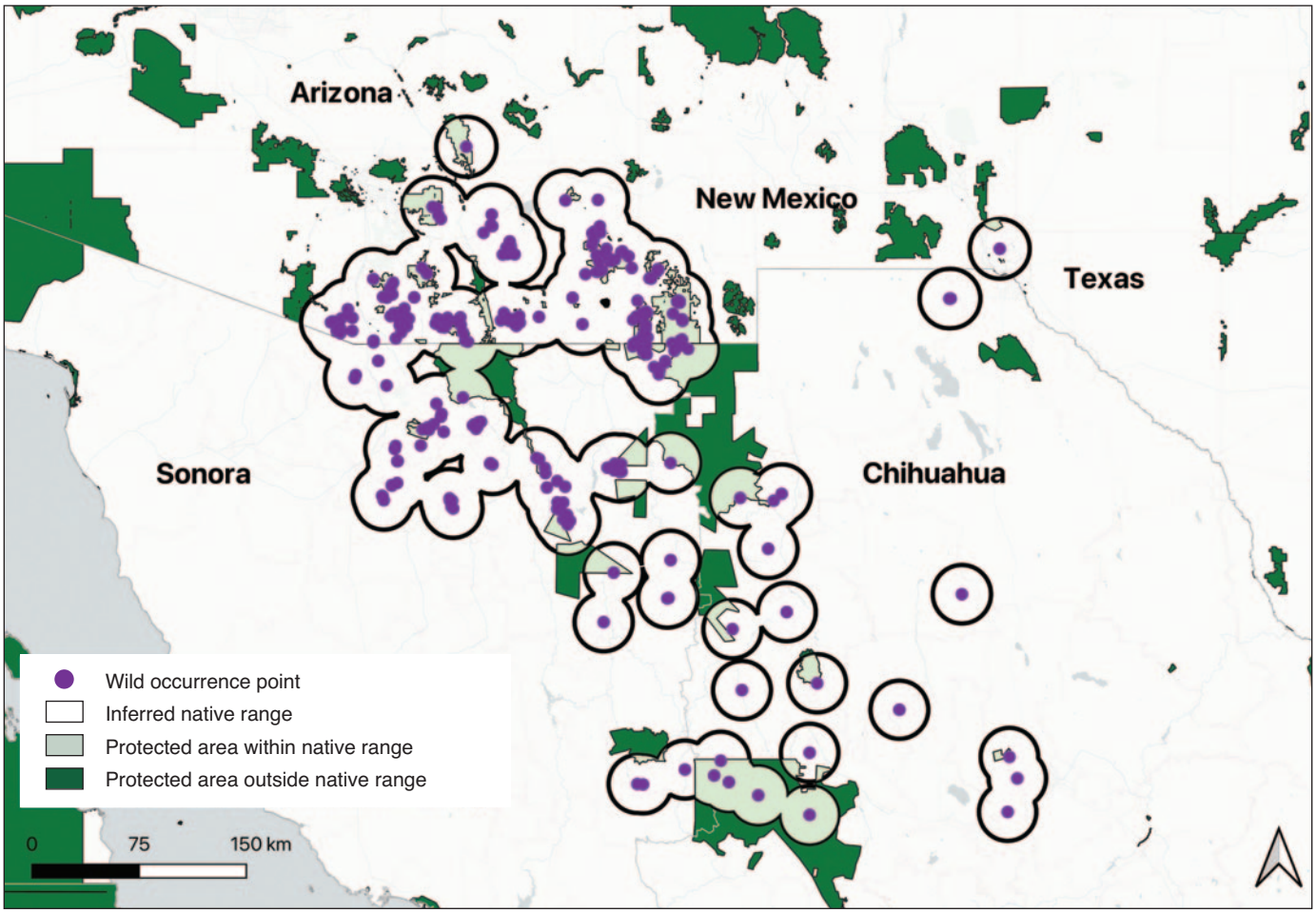


Figure 46. Wild occurrence points and inferred native range in relation to protected areas for *Quercus toumeyi*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus toxicodendrifolia Trel.

DISTRIBUTION AND BIOLOGY

Quercus toxicodendrifolia is endemic to Mexico, where it occurs in the states of Puebla, Hidalgo, and Veracruz (Figure 47). Its range also includes Chiapas, although we do not have occurrence points from this state. It is found at elevations of 1,580–2,210 m in conifer-oak forest, humid oak forest, and mountain mesophyllous forest. It can reach heights of 10–20 m. Leaves are dull and obovate to oblanceolate with crenate to dentate margins. (Valencia-A and Coombes, 2020)

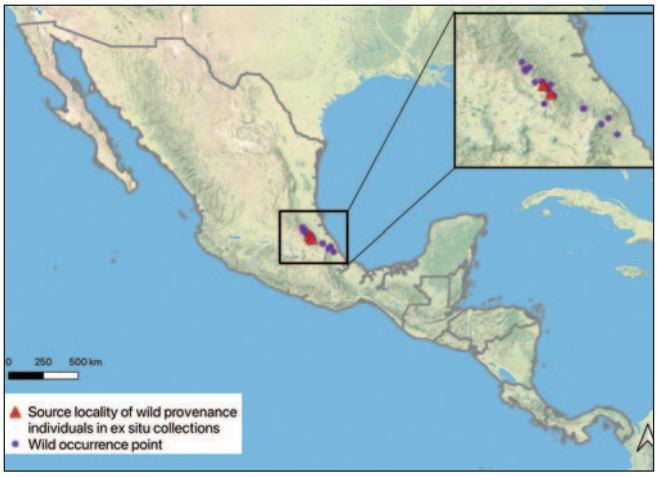


Figure 47. *In situ* (e.g., wild, within native habitat) and *ex situ* (e.g., within living collections) occurrence points for *Quercus toxicodendrifolia*.

PROTECTED AREAS

Within the inferred native range of *Q. toxicodendrifolia*, 10% is within protected areas (Figure 48). Important protected areas include the Sistema de Represas y Corredores biológicos de la Cuenca Hidrográfica del Río Necaxa, a Ramsar Site, Wetland of International Importance in Puebla.

CONSERVATION ACTION SCORE

Quercus toxicodendrifolia received a final combined Conservation Action Score of 35/100 (Table 24) . According to the results of our *ex situ* surveys, it is currently held in three *ex situ* collections with wild provenance. The Global Conservation Consortium for Oak (GCCO) Mexico and Central America is currently engaged in a multinational project called "Safeguarding Threatened Tropical Montane Cloud Forest (TMCF) Oaks in Mesoamerica". In Puebla, *Q. toxicodendrifolia* has been identified as a target species for this project and will be the focus of future restoration work (Rodríguez-Acosta and Coombes, 2023).

Table 24. Conservation gap analysis summary results for *Quercus toxicodendrifolia*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	18
Ecological coverage	45
Representation	30
Final *ex situ* score	31
***In situ* scores**	
Geographic coverage	10
Ecological coverage	82
Representation	22
Final *in situ* score	38
Final score combined	35

INFORMATION GAPS

Quercus toxicodendrifolia is assessed as Data Deficient due to a lack of information on distribution, population size, and threats (Jerome, 2018g).

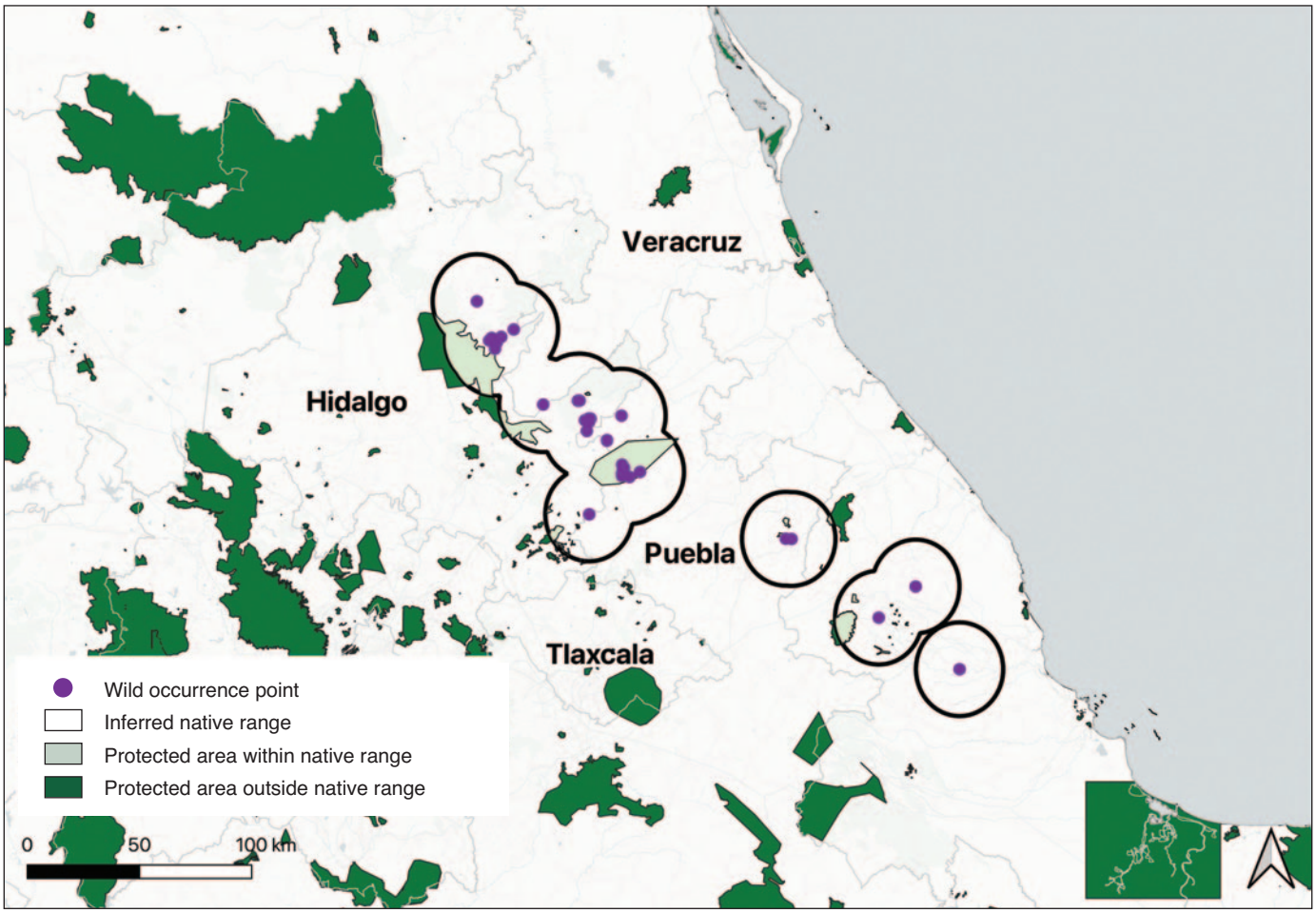


Figure 48. Wild occurrence points and inferred native range in relation to protected areas for *Quercus toxicodendrifolia*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus trinitatis Trel.

DISTRIBUTION AND BIOLOGY

Quercus trinitatis occurs in the Mexican states of Hidalgo, Veracruz, and Puebla (Figure 49). It has also been reported in Oaxaca, Chiapas, and as far south as El Salvador, although we do not have occurrence points for these locations (Ramírez-Toro et al., 2017; Jerome 2018h). An understanding of this species' true range is complicated by previous taxonomic confusion with *Q. ocoteifolia* (Jerome, 2018h). In Hidalgo, this species inhabits cloud forests, pine-oak forests and moist oak forests at an elevation of 1,800–2,250 meters (Valencia-A et al., 2017).

Quercus trinitatis is a tree that grows 10–30 m tall. Leaves are lanceolate, occasionally oblong or elliptic, 7–18 cm × 2–6.7 cm. Leaf margins are entire and crispate. Acorns are ovoid, and 7–21 mm long × 12.4–17 mm wide. (Valencia-A et al., 2017)

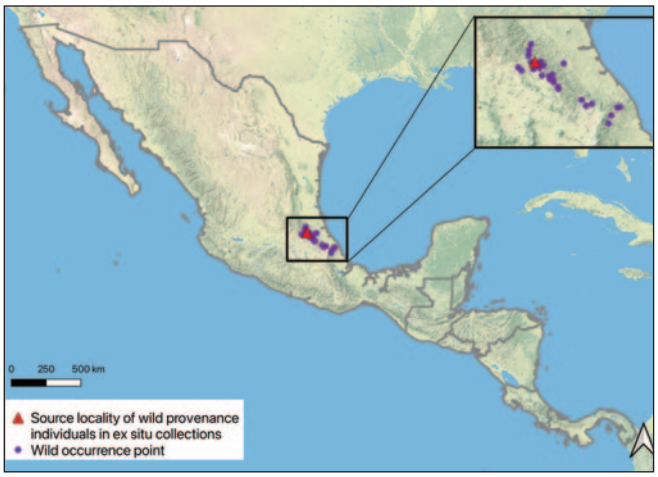


Figure 49. *In situ* (e.g., wild, within native habitat) and *ex situ* (e.g., within living collections) occurrence points for *Quercus trinitatis*.

PROTECTED AREAS

Within the inferred native range of *Q. trinitatis*, 10% is within protected areas (Figure 50). Major protected areas include Barranca de Metztitlán (a Biosphere Reserve) in Hidalgo and Z.P.F.V. la Cuenca Hidrográfica del Río Necaxa in Puebla (a Natural Resources Protection Area).

CONSERVATION ACTION SCORE

Quercus trinitatis received a final combined Conservation Action Score of 32/100 (Table 25). According to the results of our *ex situ* surveys, this species is held in one *ex situ* collection. There are also three accessions of *Quercus trinitatis* in an arboretum in France, which were collected from Hidalgo in 2019. However, these accessions were not part of our *ex situ* surveys and are therefore not reflected in the results.

Table 25. Conservation gap analysis summary results for *Quercus trinitatis*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	8
Ecological coverage	60
Representation	10
Final *ex situ* score	26
***In situ* scores**	
Geographic coverage	10
Ecological coverage	90
Representation	12
Final *in situ* score	37
Final score combined	32

INFORMATION GAPS

Quercus trinitatis is assessed as Data Deficient due to a limited understanding of the species true distribution, making the calculation of Extent of Occurrence (EOO) and Area of Occupancy (AOO) difficult (Jerome, 2018h). This species has also historically been misidentified as *Q. ocoteifolia*, resulting in few collections of *Q. trinitatis*.

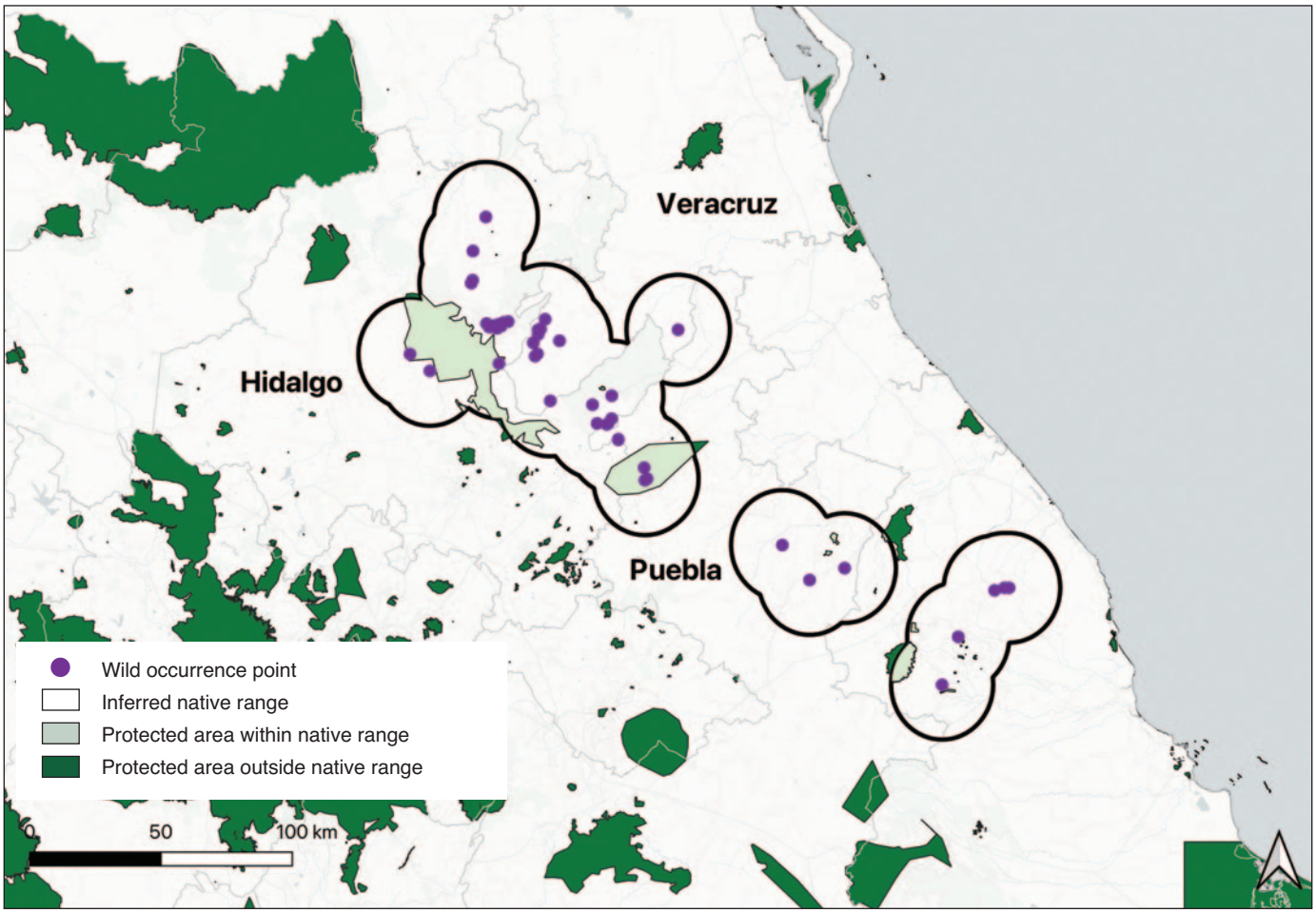


Figure 50. Wild occurrence points and inferred native range in relation to protected areas for *Quercus trinitatis*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

Quercus undata Trel.

DISTRIBUTION AND BIOLOGY

Quercus undata is endemic to Mexico, where it occurs in the states of Durango and México (Figure 51). It has been noted to also occur in Chihuahua, although we have no occurrences from this state (Bacon et al., 2011). It is typically found at an elevation near 2,500 m in low oak woodlands of the Sierra Madre Occidental (Carrero, 2020h). *Quercus* undata grows in hybrid swarms, and Bacon et al. (2011) hypothesize that this species belongs to a population of *Q. chihuahuensis* that has been influenced by hybridization in the past. Oaks of the World consider this species to be a hybrid between *Q. chihuahuensis* and *Q. grisea* or *Q. arizonica* (Hélardot, 2018f).

Quercus undata is a small evergreen shrub up to 4 m tall. Leaves are thick and leathery, (2.5–) 3–6 (–7) cm long x 1–4 cm wide. Leaves are elliptical and entire or shallowly toothed (Bacon et al., 2011). Acorns are ellipsoid and 1 cm in diameter.

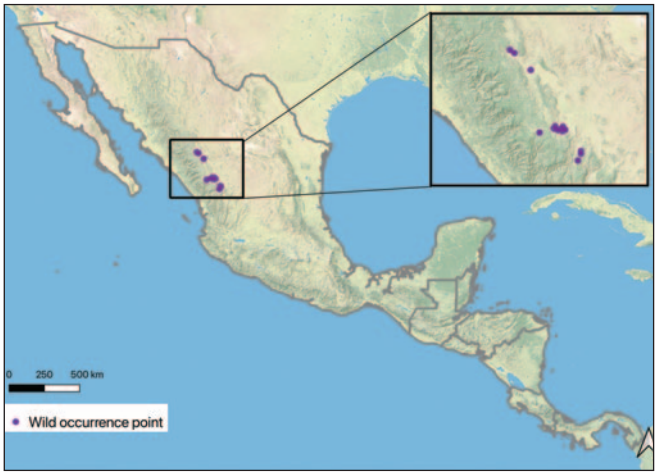


Figure 51. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus undata*.

PROTECTED AREAS

Within the inferred native range of *Q. undata*, 20% is within protected areas (Figure 52). Important protected areas include the C.A.D.N.R.043 Estado de Nayarit, a Natural Resources Protection Area.

CONSERVATION ACTION SCORE

Quercus undata received a final combined Conservation Action Score of 19/100 (Table 26). According to the results of our ex situ surveys, it is currently not held in any ex situ collections.

Table 26. Conservation gap analysis summary results for *Quercus undata*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final *ex situ* score	0
***In situ* scores**	
Geographic coverage	20
Ecological coverage	71
Representation	24
Final *in situ* score	38
Final score combined	19

INFORMATION GAPS

Quercus undata is currently assessed as Data Deficient due to a lack of information on this species' range, population size, population trends, habitat quality, and threats (Carrero, 2020h).

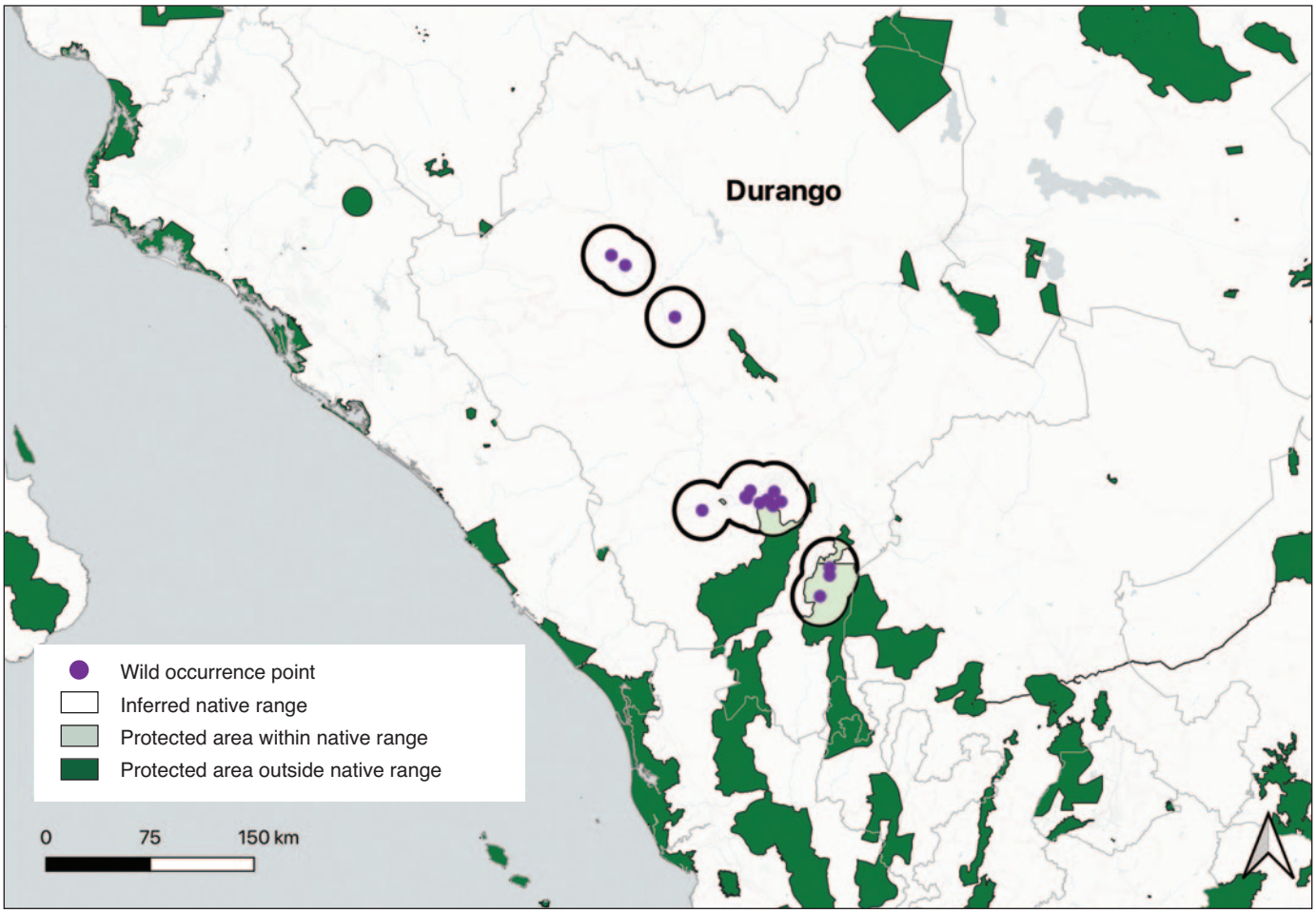
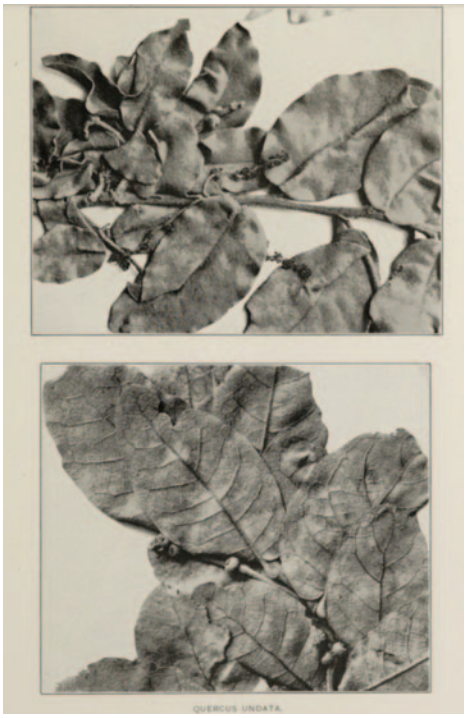


Figure 52. Wild occurrence points and inferred native range in relation to protected areas for *Quercus undata*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).



Quercus verde C.H. Müll.

DISTRIBUTION AND BIOLOGY

Quercus verde is a Mexican endemic that has been observed in the state of Nuevo León in the Sierra Madre Oriental at an elevation of 2,100–2,500 m (Figure 53; Valencia-A, 2004). It is described as a small tree with slender, gnarled branches. Leaves are oblong to ovate, and entire or with a few wide and short teeth (Muller, 1936). There is very little known about this species. It has not been recollected since its original description, and it is possible that it is of hybrid origin (García-Morales, 2016).

Figure 53. *In situ* (e.g., wild, within native habitat) occurrence points for *Quercus verde*.

PROTECTED AREAS

Within the inferred native range of *Q. verde*, 8% is within protected areas (Figure 54). Protected areas include C.A.D.N.R.026 Bajo Río San Juan, a Natural Resources Protection Area in Nuevo León.

CONSERVATION ACTION SCORE

Quercus verde received a final combined Conservation Action Score of 15/100 (Table 27). According to the results of our ex *situ* surveys, it is currently not held in any ex *situ* collections.

Table 27. Conservation gap analysis summary results for *Quercus verde*, with all scores ranging from 0–100. A final score of 100 indicates comprehensive conservation, and a score of 0 represents poor conservation.

Ex situ scores	
Geographic coverage	0
Ecological coverage	0
Representation	0
Final ex *situ* score	0
***In situ* scores**	
Geographic coverage	8
Ecological coverage	80
Representation	0
Final *in situ* score	29
Final score combined	15

INFORMATION GAPS

Quercus verde is currently assessed as Data Deficient due to a lack of information on the species' distribution, population size/trends, habitat, use, and threats (Carrero, 2020i).

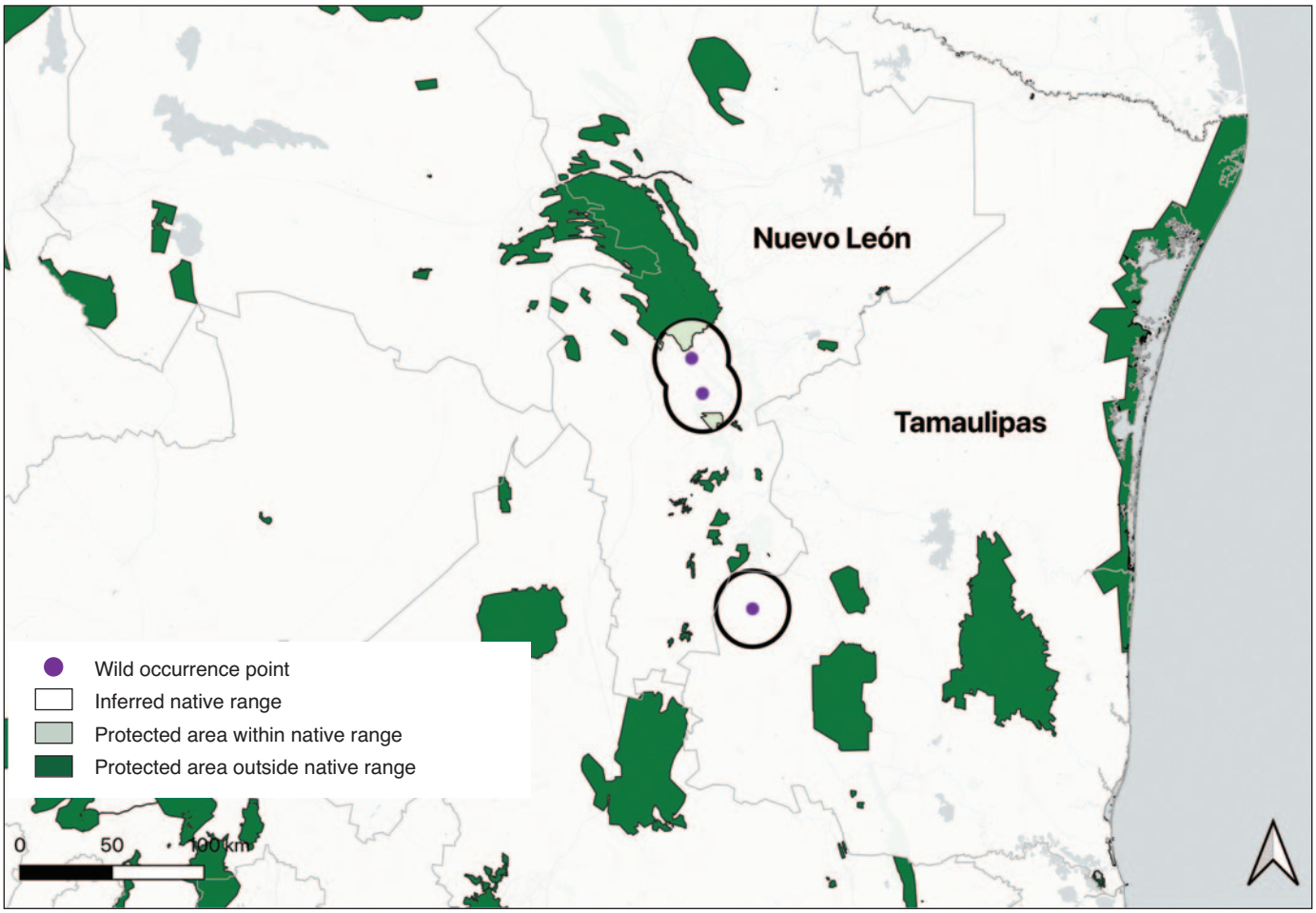


Figure 54. Wild occurrence points and inferred native range in relation to protected areas for *Quercus verde*. Protected areas are from Protected Planet (UNEP-WCMC and IUCN, 2023).

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