



Conservation Gap Analysis of Native U.S. Oaks

Species profile: *Quercus tardifolia*

Emily Beckman, Andrew McNeil-Marshall, Shannon M. Still, Abby Meyer, Murphy Westwood

SPECIES OF CONSERVATION CONCERN

CALIFORNIA

Channel Island endemics:
Quercus pacifica, *Quercus tomentella*

Southern region:
Quercus cedrosensis, *Quercus dumosa*,
Quercus engelmannii

Northern region and /
or broad distribution:
Quercus lobata, *Quercus parvula*,
Quercus sadleriana

SOUTHWESTERN U.S.

Texas limited-range endemics
Quercus carmenensis,
Quercus graciliformis, *Quercus hinckleyi*,
Quercus robusta, ***Quercus tardifolia***

Concentrated in Arizona:
Quercus ajoensis, *Quercus palmeri*,
Quercus toumeyii

Broad distribution:
Quercus havardii, *Quercus laceyi*

SOUTHEASTERN U.S.

State endemics:
Quercus acerifolia, *Quercus boyntonii*

Concentrated in Florida:
Quercus chapmanii, *Quercus inopina*,
Quercus pumila

Broad distribution:
Quercus arkansana, *Quercus austrina*,
Quercus georgiana,
Quercus oglethorpensis, *Quercus similis*



Quercus tardifolia C.H.Müll.

Synonyms: N/A Common Names: Lateleaf oak

Species profile co-authors: Andrew McNeil-Marshall, Lady Bird Johnson Wildflower Center, The University of Texas at Austin; Shannon M. Still, UC Davis Arboretum and Public Garden

Contributor: Béatrice Chassé, Arboretum des Pouyouleix

Suggested citation: Beckman, E., McNeil-Marshall, A., Still, S. M., Meyer, A., & Westwood, M. (2019). *Quercus tardifolia* C.H.Müll. In Beckman, E., Meyer, A., Man, G., Pivorunas, D., Denvir, A., Gill, D., Shaw, K., & Westwood, M. *Conservation Gap Analysis of Native U.S. Oaks* (pp. 202-207). Lisle, IL: The Morton Arboretum. Retrieved from <https://www.mortonarb.org/files/species-profile-quercus-tardifolia.pdf>



DISTRIBUTION AND ECOLOGY

Quercus tardifolia, or Lateleaf oak, is a little-known species from the Chisos Mountains of southwestern Texas, U.S. It is only agreed to be found in Big Bend National Park, and is currently under taxonomic debate. Many believe the tree is a rare hybrid occurrence of *Q. gravesii* and either *Q. hypoxantha* or *Q. arizonica* (B. Chassé pers. comm., 2017).¹ One unverified report has been noted by A. M. Powell within the Mexican state of Coahuila, in the 1980s. The Sierra del Carmen mountain range runs through this region, extending south from Big Bend National Park, and is the only other area where further specimens could be discovered. The type specimen of *Q. tardifolia* was found in a semiarid, wooded area along steeply cut canyons at approximately 2,000 meters above sea level (A. McNeil-Marshall pers. comm., 2017).¹ During a 2018 collecting expedition, which visited the type locality, no individuals were confidently identified as *Q. tardifolia* (S. Still pers. comm., 2018).

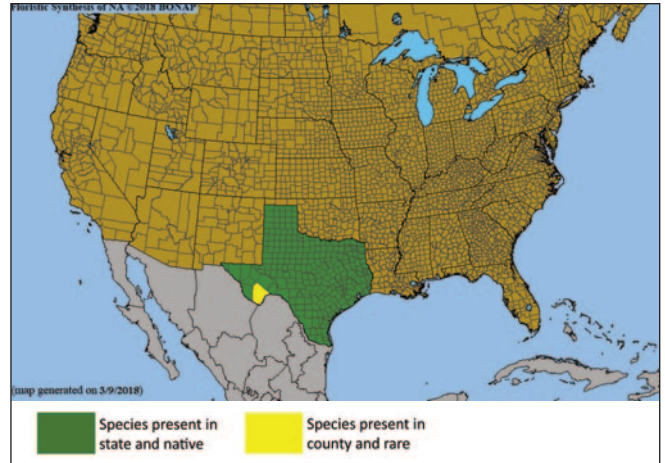


Figure 1. County-level distribution map for the U.S. distribution of *Quercus tardifolia*. Source: Biota of North America Program (BONAP).²

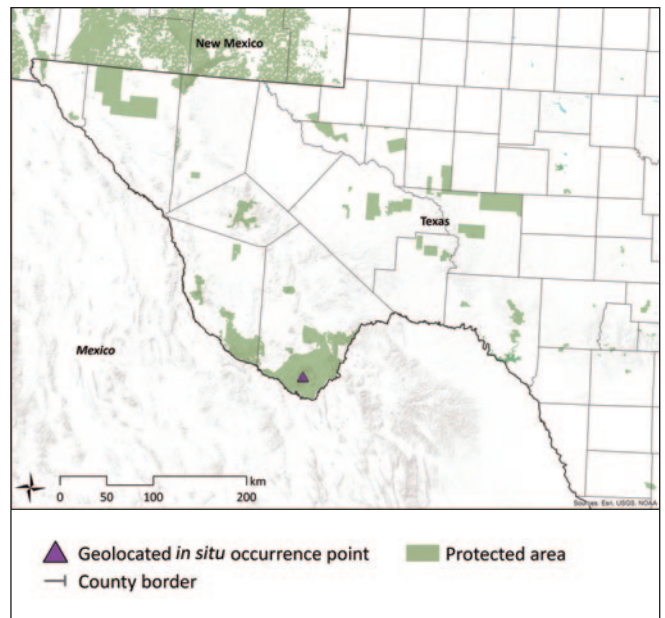


Figure 2. Documented *in situ* occurrence points for the U.S. distribution of *Quercus tardifolia*. Protected areas layer from U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).³

VULNERABILITY OF WILD POPULATIONS

Table 1. Scoring matrix identifying the most severe demographic issues affecting *Quercus tardifolia*. Cells are highlighted when the species meets the respective vulnerability threshold for each demographic indicator. Average vulnerability score is calculated using only those demographic indicators with sufficient data (i.e., excluding unknown indicators).

Demographic indicators	Level of vulnerability						Score
	Emergency Score = 40	High Score = 20	Moderate Score = 10	Low Score = 5	None Score = 0	Unknown No score	
Population size	< 50	< 250	< 2,500	< 10,000	> 10,000	Unknown	40
Range/endemism	Extremely small range or 1 location	E00 < 100 km ² or A00 < 10 km ² or 2-4 locations	E00 < 5,000 km ² or A00 < 500 km ² or 5-9 locations	E00 < 20,000 km ² or A00 < 2,000 km ² or 10+ locations	E00 > 20,000 km ² or A00 > 2,000 km ²	Unknown	40
Population decline	Extreme	>= 80% decline	>= 50% decline	>= 30% decline	None	Unknown	-
Fragmentation	Severe fragmentation	Isolated populations	Somewhat isolated populations	Relatively connected populations	Connected populations	Unknown	0
Regeneration/recruitment	No regeneration or recruitment	Decline of >50% predicted in next generation	Insufficient to maintain current population size	Sufficient to maintain current population size	Sufficient to increase population size	Unknown	-
Genetic variation/integrity	Extremely low	Low	Medium	High	Very high	Unknown	20
Average vulnerability score							25.0
Rank relative to all U.S. oak species of concern (out of 19)							1

THREATS TO WILD POPULATIONS

High Impact Threats

Genetic material loss — inbreeding and/or introgression: Because *Q. tardifolia* is rare and occurs with other oak species nearby, hybridization may be a genetic threat. If a population exists, it is likely extremely small, making inbreeding in the near future very likely and genetic adaptation through natural selection unlikely.

Extremely small and/or restricted population: C. H. Müller defined Lateleaf oak in 1936, noting two small clumps. These trees were never successfully relocated aside from one individual at Boot Springs of Big Bend National Park, which has recently died. More exploration would be necessary to confirm the species' extirpation. Mature acorns have never been seen or recorded, so it is unknown if the species could even be propagated for reintroduction.¹ The single known location in Boot Springs was surveyed again during a recent collecting endeavor, but no trees were positively identified as *Q. tardifolia* (S. Still pers. comm., 2017).

Moderate Impact Threats

Climate change — habitat shifting, drought, temperature extremes, and/or flooding: Drought, flood, and fire all pose threats, especially since the population could be wiped out by one extreme event (A. McNeil-Marshall pers. comm., 2016).

Low Impact Threats

Human use of landscape — agriculture, silviculture, ranching, and/or grazing: If the species exists within Mexico, there is no protection of the habitat, and development, ranching, or farming could impact a Lateleaf oak population.

Human use of landscape — tourism and/or recreation: There is some potential of human impact during recreational activities within Big Bend National Park (A. McNeil-Marshall pers. comm., 2016).

Human modification of natural systems — invasive species competition: Invasive plant species pose a significant threat to the unique and rare species within Big Bend National Park, but severe threat has not yet been witnessed for *Q. tardifolia*.⁴

CONSERVATION ACTIVITIES

In 2017 *Quercus* accessions data were requested from *ex situ* collections. A total of 162 institutions from 26 countries submitted data for native U.S. oaks. *Quercus tardifolia* is the only oak species of concern which was not represented in any *ex situ* collections surveyed. Past, present, and planned conservation activities for U.S. oak species of concern were also examined through literature review, expert consultation, and conduction of a questionnaire. Questionnaire respondents totaled 328 individuals from 252 organizations, including 78 institutions reporting on species of concern (Figure 4).

Results of 2017 *ex situ* survey

Number of <i>ex situ</i> collections reporting this species:	0
Number of plants in <i>ex situ</i> collections:	0
Average number of plants per institution:	0
Percent of <i>ex situ</i> plants of wild origin:	0%
Percent of wild origin plants with known locality:	0%



A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections (Figure 3). Only the native U.S. distribution of the species was considered in this analysis, due to availability of ecoregion maps. Fifty-kilometer buffers were placed around each *in situ* occurrence point and the source locality of each plant living in *ex situ* collections. Collectively, the *in situ* buffer area serves as the inferred native range of the species, or “combined area *in situ*” (CAI50). The *ex situ* buffer area represents the native range “captured” in *ex situ* collections, or “combined area *ex situ*” (CAE50). Geographic coverage of *ex situ* collections was estimated by dividing CAI50 by CAE50. Ecological coverage was estimated by dividing the number of EPA Level IV Ecoregions present in CAE50 by the number of ecoregions in CAI50.

Estimated *ex situ* representation

Geographic coverage:	0%
Ecological coverage:	0%

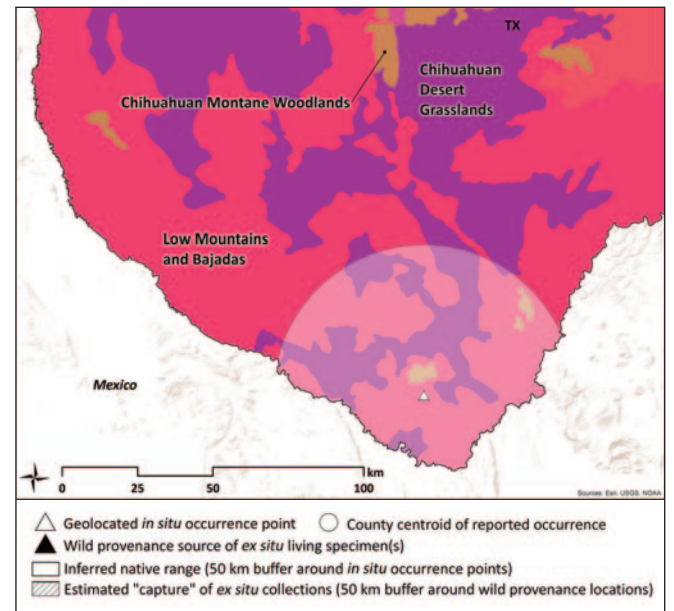


Figure 3. *Quercus tardifolia* *in situ* occurrence points and *ex situ* collection source localities within the United States. U.S. EPA Level IV Ecoregions are colored and labelled.⁵ County centroid is shown if no precise locality data exist for that county of occurrence. Email treeconservation@mortonarb.org for information regarding specific coordinates.

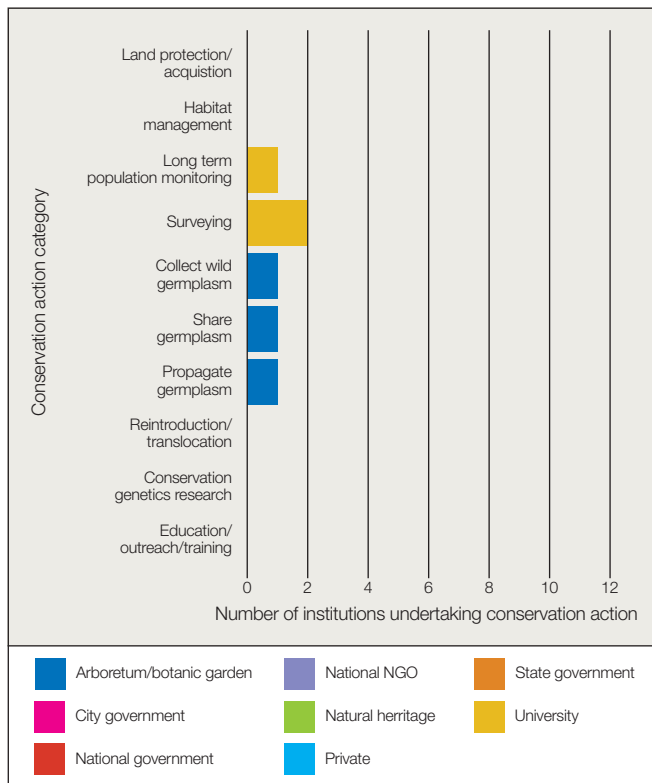


Figure 4. Number of institutions reporting conservation activities for *Quercus tardifolia* grouped by organization type. Three of 252 institutions reported activities focused on *Q. tardifolia* (see Appendix D for a list of all responding institutions).

Land protection: Within the inferred native range of *Q. tardifolia*, 70% of the land is covered by protected areas (Figure 6). However, because this species' distribution is small and well-documented, we know that 100% of the species' potential occurrences within the U.S. are within Big Bend National Park. The park has also determined that *Q. tardifolia* is outside areas where current projects may disturb the species.⁶

Sustainable management of land: The Ecoregional Conservation Assessment of the Chihuahuan Desert ranks Big Bend Triangle as the area with the highest Irreplaceability Index and 9th highest overall conservation priority out of 39 areas of conservation concern in Texas.⁷ The Texas Conservation Action Plan: Chihuahuan Desert and Arizona-New Mexico Mountains Ecoregions Handbook outlines general trends and needs in the region as a whole, including Big Bend National Park. However, there is no specific mention of *Q. tardifolia* outside the "Species of Greatest Conservation Need" list.⁸

Population monitoring and/or occurrence surveys: Although the Texas Parks and Wildlife Department conservation action plan for the Chihuahuan Desert and Arizona-New Mexico mountain regions lists *Q. tardifolia* as a "Species of Greatest Conservation Need," it is unclear whether population monitoring accompanies this listing.⁸ With support from a 2018 APGA-USFS Tree Gene Conservation Program grant, UC Davis Arboretum & Public Garden led expeditions to search for Lateleaf oak in late summer 2016 and 2018. No individuals were confidently identified during either trip. However, a wide range of vouchers were collected within the species' type locality in 2018, in hopes of confirming the species' status through further study. As its name suggests, visiting the Lateleaf oak site when leaves drop or as the tree leafs out in spring could aid in identifying the species (S. Still pers. comm., 2018).⁹

Wild collecting and/or ex situ curation: Collecting trips targeting *Q. tardifolia* were lead by UC Davis Arboretum & Public Garden in 2016 and 2018, with funding from the APGA-USFS Tree Gene Conservation Partnership. No individuals were confidently identified (S. Still pers. comm., 2018).⁹

Propagation and/or breeding programs: One institution reported this activity in the conservation action questionnaire; but, no other details are currently known.

Reintroduction, reinforcement, and/or translocation: No known initiatives at the time of publication.

Research: No known initiatives at the time of publication.

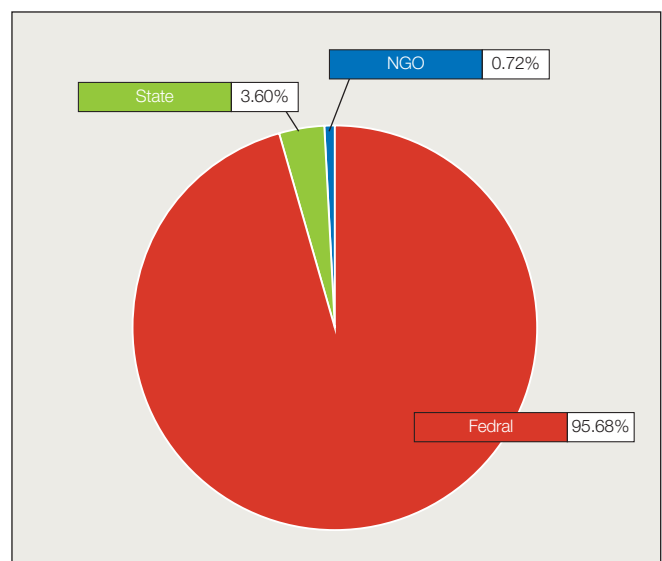


Figure 5. Management type of protected areas within the inferred native range of *Quercus tardifolia*. Protected areas data from the U.S. Geological Survey Gap Analysis Program (GAP) 2016 Protected Areas Database of the U.S. (PAD-US).³



Education, outreach, and/or training: No known initiatives at the time of publication.

Species protection policies: In 2009, a petition was submitted to the U.S. Fish and Wildlife Service to list 475 species in the southwestern U.S. as Threatened or Endangered under the Endangered Species Act. *Quercus tardifolia* was determined to have an inadequate amount of threat information provided in the petition, and was subsequently rejected.¹⁰ In addition to listing species as endangered or threatened, Texas maintains a list of more than 1,300 Species of Greatest Conservation Need (SGCN), including *Q. tardifolia*. These species are “declining or rare and in need of attention to recover or to prevent the need to list under state or federal regulation...[and are] the focus of Texas Parks and Wildlife Department’s Texas Conservation Action Plan;” though SGCN are not provided the same protections as endangered or threatened species.¹¹

PRIORITY CONSERVATION ACTIONS

Several groups have visited the Chisos Mountains in search of Lateleaf oak during the past few years. However, none of the expeditions have returned with definitive proof of the presence or absence of the species. Some individual trees have been found that may be *Q. tardifolia*, and vouchers were collected, but the identification is unclear. With so little known about this species, few conservation recommendations can be made other than further study. Sustained efforts are needed to locate *Q. tardifolia* in the Chisos Mountains. Communication with plant professionals from the area, past and present, might illuminate questions regarding when and where, and in how many locations, this plant has been observed. Until this plant is located in its single recorded site and further documentation is made, there is little else that can be said about *ex or in situ* conservation.

The putative loss of this plant from the wild, and the paucity of information regarding its place in a more general *Quercus* taxonomy, underscores the need for study and appreciation of the morphological diversity of oaks in the Chisos Mountains. Even if this species were to lose its species status in the future, it is still a unique botanical occurrence and there is no reason to let similar occurrences escape study in the future.

Conservation recommendations for *Quercus tardifolia*

Highest Priority

- Population monitoring and/or occurrence surveys
- Research (taxonomy/phylogenetics)

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