The Red List of Oaks 2020

Christina Carrero, Diana Jerome, Emily Beckman, Amy Byrne, Allen J. Coombes, Min Deng, Antonio González Rodríguez, Hoang Van Sam, Eyen Khoo, Ngoc Nguyen, Iyan Robiansyah, Hernando Rodríguez Correa, Julia Sang, Yi-Gang Song, Joeri Strijk, John Sugau, Weibang Sun, Susana Valencia-Ávalos and Murphy Westwood

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GTSG GLOBAL TREE SPECIALIST GROUP
BOTANIC GARDENS CONSERVATION INTERNATIONAL

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Quercus invaginata, *LC* *(Béatrice Chassé)*

IUCN RED LIST CATEGORIES

- **EX** Extinct
- **EW** Extinct in the Wild
- **CR** Critically Endangered
- **EN** Endangered
- **VU** Vulnerable
- **NT** Near Threatened
- **LC** Least Concern
- **DD** Data Deficient
- **NE** Not Evaluated

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LIST OF ACRONYMS

BGCI	Botanic Gardens Conservation International
CBD	Convention on Biological Diversity
CEPF	Critical Ecosystem Partnership Fund
FFI	Fauna & Flora International
GCCO	Global Conservation Consortium for Oak
GSPC	Global Strategy for Plant Conservation
GTA	Global Threat Assessment
GTC	Global Trees Campaign
GTSG	Global Tree Specialist Group
IOS	International Oak Society
IUCN	International Union for Conservation of Nature
SSC	Species Survival Commission
SIS	Species Information Service

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Quercus engelmannii, *EN* *(Frank McDonough)*

Quercus opaca, *DD* *(Béatrice Chassé)*

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Foreword

What sort of times are these / When talking about trees is almost a crime / As there are so many atrocities left unspoken?

Bertolt Brecht wrote these lines in 1939 in the second stanza of his poem, "To Posterity". And I think he was right – not just for yesterday and the times he was living in but for today and the times we are living in.

But I believe that we can also talk about trees. Indeed, that we must also talk about trees – and whales and butterflies and storks and oceans and deserts and forests and everything that makes this world beautiful and wondrous.

The Red List of Oaks 2020 is about talking about trees in the context of the devastating effects of rapid climate change and massive habitat disruption/destruction, all of which is the result of an economic system that, we are told, is the only possible one. Whether that is true or not, positive change on that front doesn't seem likely in the near future and therefore conservation is one of the active alternatives for those who care.

The Morton Arboretum has been caring about trees for a very long time and this publication is one of the many fruits of their commitment to the genus *Quercus*.

As I have spent the better – and it has indeed been the best – part of nearly the past twenty years traveling around the world looking for oaks and growing them here in Southwest France at the Arboretum des Pouyouleix, I am perpetually in awe of the incredible diversity and adaptability of the species that compose this genus. Leaving no stone unturned, as it were, they are found in nearly every ecosystem on Earth: from deserts to coastal shores and lowlands, from high mountain tops to river valleys, cloud forests, alluvial plains, prairie grasslands, and

Quercus xalapensis, *LC* *(Allen Coombes)*

Quercus brandegeei, *EN* *(The Morton Arboretum)*

tropical jungles. And yet, in spite of their extraordinary evolutionary and ecological success that spans fifty-six million years, today many of them have dubious futures, as the work that has resulted in this publication reveals.

Ex situ collections play a key role in the conservation strategies developed herein. Nevertheless, one can't help thinking: will not the world be a much sadder place if the only oak trees left on Earth are those in collections?

As I write this Foreword, I recall a drawing that I saw many years ago depicting a forest that had been entirely cut down with the exception of one tree left standing in the middle, preserved in a glass cage, with tourists milling around it taking photographs. I asked myself at the time, what is the artist trying to say? Don't be a conservation tourist? Or, in more modern terms, don't be a virtual conservationist?

Similarly, we must not let the information in this publication remain only that, for then it will not serve its purpose, which, it seems to me, is to inspire awareness and action on the broadest possible scale.

In doing so perhaps we can at least hope that we shall have a brighter poem to leave to posterity than the one left to us by Bertolt Brecht.

Béatrice Chassé
Arboretum des Pouyouleix
Editor, *International Oaks*
Former President (2009-2015), International Oak Society

Executive summary

The Red List of Oaks 2020 provides and analyzes IUCN Red List assessments for the estimated 430 species in the genus *Quercus*—the most complete and comprehensive global analysis of extinction risk for oaks. The only previous global assessment of oaks was published in 2007 and included just 175 species (~40% of the genus; Oldfield and Eastwood, 2007). In 2015, The Morton Arboretum established a partnership with the IUCN/SSC Global Tree Specialist Group to assess all oak species by 2020, including reassessments of the species in the 2007 publication, in support of the Global Tree Assessment (GTA) initiative.

Of the 430 oak species assessed, 217 (41%) are of conservation concern. This includes 112 species assessed as Critically Endangered, Endangered, or Vulnerable (i.e., “threatened” according to the IUCN definition), as well as 105 species assessed as Data Deficient or Near Threatened. Thirty-one percent of oaks are estimated to be threatened with extinction, following IUCN’s method for calculating threat proportions incorporating Data Deficient species. Oak species are native to 90 countries, predominantly in the Northern Hemisphere, with highest species richness in Mexico (164 species), China (117), the United States (91), and Vietnam (49). These countries also have the highest number of threatened species at 32, 36, 16, and 20, respectively. Major threats to oak species globally include land use change, a changing climate, and native and non-native pests and diseases. Landscape level changes are often due to habitat conversion for agriculture or urbanization, logging, or alterations in fire regimes.

This publication establishes a baseline for the state of oaks globally, provides insights on patterns of diversity and threats, and presents a survey of global *ex situ* collections of oaks. Conservationists, researchers, and oak enthusiasts should use this information to prioritize species and regions for scientifically informed conservation action. Many collaborative conservation programs and initiatives for oaks are already underway around the world, but more effort and resources are urgently needed to reverse the decline in oak populations and alleviate threats. Through informed, integrated, *in situ* and *ex situ* conservation action targeted in the global centers of diversity for oaks, these iconic and ecologically important trees can be saved.

Quercus glaucoides, *LC* *(Béatrice Chassé)*

Introduction

Quercus, commonly known as oaks, is the largest genus of the Fagaceae family and one of the largest genera of all tree families (Valencia-Ávalos, 2004). There are an estimated 430 species of oaks globally (see the Taxonomy section of Methods), with several new species being described every year. The majority of oaks are large trees growing to 20-30 meters, but there is extraordinary morphological and ecological diversity across the various regions and ecosystems where they grow (Menitsky, 2005). From small shrubs growing on dry, sandy soils in the western United States and montane regions in Mexico, to towering trees in the canopy of the tropical forests of Southeast Asia (Menitsky, 2005; Nixon, 2006), the current global diversity of oaks is the result of geographic and ecological diversification within wide-ranging lineages over 56 million years of evolution (Hipp *et al*., 2020). Oak diversity in North America was shaped by the radiation of oaks in cooler, drier climates as broad-leaved temperate forests evolved during the long global cool-down from the early Eocene onward (Hipp *et al*., 2018; Cavender-Bares, 2019). Within Mexico, oaks diversified later as they migrated southward and into the mountains (Hipp *et al*., 2018). Southeast Asian oak diversity and portions of the European oak flora were driven by changing climate and the uplift of the Himalayas (Hipp *et al*., 2020; Deng *et al*., 2018; Jiang *et al*., 2019). Kremer and Hipp (2020) attribute the high species diversity and success of oaks to: 1) high genetic diversity within populations and species, 2) rapid migration and high adaptability, 3) high rates of ecological diversity within clades and convergent solutions to ecological problems across clades, and 4) hybridization and introgression.

The global distribution of oaks also overlaps substantially with biodiversity hotspots, as recognized by the Critical Ecosystem Partnership Fund (CEPF). CEPF defines biodiversity hotspots as regions that contain at least 1,500 species of vascular plants found nowhere else on Earth and that have lost at least 70% of their native vegetation. There are 36 recognized biodiversity hotspots that meet this criteria (https://www.cepf.net/our-work/biodiversity-hotspots) including at least 18 where oak species are found. Thus, oaks are associated with regions of the planet characterized by rich biodiversity, but also severe habitat loss.

Oaks are a valuable genus ecologically, economically, and culturally. They are keystone species in many ecosystems including the oak-pine woodlands of Mexico, hardwood forests of eastern North America, and the broadleaved forests of Southeast Asia. They contribute countless ecosystem services, providing habitat and food for birds and small mammals as well as providing carbon sources for edible fungi (Logan, 2005; Cavender-Bares, 2016, 2019). In North America alone, oaks support over 500 species of moths and butterflies, making *Quercus* the most ecologically important plant group for Lepidopteran insects (Tallamy and Shropshire, 2009). Oaks are also economically important, used for timber, fuel, furniture, ship building, livestock feed, dyes and tannins, charcoal, and food for local and indigenous peoples. They are also a charismatic and culturally significant tree, commonly found in folklore and mythology, and recognized and loved worldwide for their often large stature, recognizable leaves, and iconic acorns. Oaks appear on the national flags of Mexico, San Marino, and many other counties and states, and are recognized as the national tree of many countries, including the United States.

Box 1: Global Tree Assessment (GTA)

There are nearly 60,000 tree species globally, and the Global Tree Assessment aims to provide conservation assessments of the world's tree species by 2020. Despite the importance of trees, many are threatened by overexploitation and habitat destruction, as well as by pests, diseases, drought and their interaction with global climate change. In order to estimate the impact of such threats to trees there is an urgent need to conduct a complete assessment of the conservation status of the world's tree species – the Global Tree Assessment. The Global Tree Assessment, led by BGCI and the IUCN SSC Global Tree Specialist Group, prioritizes the tree species at greatest risk of extinction. The Global Tree Assessment provides information to ensure that conservation efforts are directed at the right species so that no tree species becomes extinct. www.globaltreeassessment.org.

Despite the global ecological and economic importance of oaks, they are difficult to conserve. Oaks are considered "exceptional species" as they produce seeds that cannot be seed-banked through conventional conditions of low humidity and temperature (Kramer and Pence, 2012; Walters and Pence, 2020). They produce copious amounts of tannins, making tissue culture extremely challenging, and some species are difficult to propagate vegetatively through grafting (Kramer and Pence, 2012; Brennan *et al*., 2017)). Though there is ongoing research to improve conservation methods for oaks, including cryopreservation and *in-vitro* propagation, the primary and most reliable protection for oaks currently is through *ex situ* collections (Westwood *et al*., 2020). Oak species abundance across many biodiversity hotspots, their ecological, economical, and cultural importance, and the challenges encountered in preserving species constitute a compelling case for the urgent and coordinated conservation of oaks globally. The first step toward collaborative conservation is prioritization of species and conservation actions, and *The Red List of Oaks 2020* provides vital information for such conservation planning and action.

The Global Strategy for Plant Conservation (2011-2020), a program of the Convention on Biological Diversity, outlines 16 targets towards collaborative, international plant conservation, including Target 2: "An assessment of the conservation status of all known plant species, as far as possible, to guide conservation action." The Global Tree Assessment (GTA; Box 1) was spearheaded by the IUCN Global Tree Specialist Group (GTSG), and seeks to meet this target by collaborating with partners globally to assess all tree species of the world by the end of 2020. A partnership was established in 2015 between GTSG and The Morton Arboretum to assess all the oaks globally. *The Red List of Oaks* (Oldfield and Eastwood, 2007) was the first effort to evaluate the threat status of the world's oaks, but included just 175 of the 430 oak species. These assessments were never formally published on the IUCN Red List of Threatened Species (iucnredlist.org), and are now out of date. The Morton Arboretum completed assessments for all oaks native to the United States, detailing their extinction risks in the 2017 publication, *The Red List of US Oaks* (Jerome *et al*., 2017), and assisted in completing European oak assessments by the end of 2018. Between 2018 and 2020, the remaining assessment efforts targeted oak species native to Mexico/Central America and Asia.

Box 2: Oaks as a Model System

Translated and adapted from "Introduction; Importance of Oaks" originally written by Susana Valencia-Ávalos for *Manual de propagación de Quercus: Una guía fácil y rápida para cultivar encinos en México y América Central.* (Rodríguez-Acosta and Coombes, 2020).

Species of the genus *Quercus*, known as encinos in Mexico and Central America, have been connected to human development since the time of the caves, playing an important role in folklore, mythology, religion and everyday life. The genus is very broad and comprises more than 400 species worldwide. Its greatest country level diversity is in Mexico, where there are more than 160 species. Many Mexican oak species present a high degree of hybridization and in turn show high variation and rapid radiation, adaptation to new habitats and diversification, and a complicated taxonomy qualifying them as a "model system" to understand evolutionary, biogeographic and ecological aspects in plants.

Since their appearance in the late Paleocene (ca. 55 Ma), the oaks have survived a series of biotic and abiotic changes, showing great diversity and survival to unfavorable periods. Hybridization and introgression in oaks are recurring mechanisms and sources of genetic variation of great importance in the adaptive evolution and diversification of the genus. Related to their adaptation, oaks are studied in order to find evidence of evolutionarily adapted characters in response to drought and marked winters, freezing, as well as to identify adaptive changes that could occur in the future in view of global climate change.

The dominance of oaks in many ecosystems has made it possible to know their biogeographic distribution, define areas of high species richness, and to identify barriers to their distribution and possible migration routes, all of which can be extrapolated to many species that are associated with them, and therefore oaks are considered a model clade. Model clades are very well studied lineages from which abundant phylogenetic, genetic, functional, ecological and evolutionary data have been generated, which allow us to understand general concepts and processes (mainly ecological and evolutionary) that can potentially be applied to other groups and systems and thus lead to adequate conservation and ecosystem management decision-making.

The way in which oak species cope with different climatic conditions makes it possible to propose them as candidates for regeneration of communities. Some species can be pioneers in secondary successions, such as the soil-forming *Quercus urbani*, while others can only establish in sites with mature soils, such as species of the mountain rainforest. Therefore, properly choosing the species to regenerate is essential to produce quality results.

Mexico, as the holder of the world's greatest richness of oak species and endemism, has a great commitment in the knowledge and protection of this group. In this commitment, it is necessary to take into account the limited environmental requirements in which most endemic oaks develop, their long life cycle, and the global warming that makes them more vulnerable, suggesting that some of them may be at risk of extinction. Taking into account its predominant role in terrestrial ecosystems, if an oak species disappears, the threat or disappearance will also extend to the species associated with it.

The Red List of Oaks 2020 reevaluates every species from the 2007 report, includes all species from the *Red List of US Oaks*, and assesses for the first time the remaining 60% of the species in the genus *Quercus*. We provide a synthesis of the genus at a global scale, examining geographic trends, patterns of diversity and threat, and an overview of the state of *ex situ* collections of oaks. This study also provides deeper analyses of oak species diversity and conservation at regions of high richness and threat: Mexico/Central America (Box 2), China/Southeast Asia (Box 3), and the United States. Full assessments for reported oak species (excluding 14 species whose assessments will be available in 2021 and are included in all analyses) can be found on the official IUCN Red List website (iucnredlist.org/).

Box 3: Ecology and taxonomy of *Quercus* in Asia: the importance of molecular studies
Joeri Sergej Strijk

The oaks of Asia are important ecological, economical, and cultural elements, occurring in a wide range of habitat types, mostly in mid-high elevation forests, but with significant extensions into the warm tropical lowlands. Continental Asia is home to ~200 species of *Quercus*. Compared to Europe/N. Africa (~30 species) and the Americas (~220 species), it ranks as the world's second hotspot of oak diversity (Govaerts and Frodin, 1998). Temperate and (sub-) tropical forests in greater Southeast Asia and China hold by far the majority of these species (Strijk, 2020), and new species are being reported regularly (Binh *et al*., 2018 a, b, c). Oaks are spread throughout five of the ten major biodiversity hotspots in Asia (most notably in the mountains of Central Asia, the Himalayas, Indo-Burma, Japan and the Western Sundas - Indonesia, Malaysia and Brunei). Their wood, leaves and fruits are sought after for use in construction, as fuel, for industrial use, as ornamentals, in rituals and occasionally for consumption.

Over the past decades, China and tropical Southeast Asia have seen tremendous change, with urbanization, logging and land conversion for monoculture crops (e.g., banana, eucalypts, maize, palm oil, pulses, rice, rubber and teak) taking place at unprecedented scales (Dixon *et al*., 2002; Sodhi *et al*., 2004; Squires, 2014). Asia's rapidly expanding urban population is placing intense pressure on the remaining natural resources, as witnessed by the growing numbers of oaks (and many other regional flagship species) appearing on the IUCN Red List in recent years (IUCN, 2020).

Evolutionary divergence and ecological adaptation of oaks in Asia differs markedly from the radiation in the Americas, where large numbers of species have adapted to temperate and xeric environments (le Hardÿ de Beaulieu and Lamant, 2010). In Asia, species ranges of oaks appear to be smaller, especially in warm wet evergreen forests towards the Equator. Furthermore, species and populations of oaks in Asia are spread out over both continental and insular areas, which provided isolation and opportunities for past speciation, and continues to fragment species' populations today. The complex diversity and geography of Asia poses significant challenges to locate, assess and conserve species and genetic diversity of oaks.

A revision of the infrageneric classification, taking into account much of the recent molecular work in oaks, has resolved many of the issues in the taxonomic and evolutionary framework originally based solely on morphological characters (Loudon, 1838; Ørsted, 1871; Camus, 1939-1954; Menitsky, 2005; Denk *et al*., 2017). The new classification synthesizes morphological traits, molecular-phylogenetics and the evolutionary history of the oaks, resolving the group into two subgenera and eight sections. In China and Southeast Asia, both subgenera (*Quercus* and *Cerris*) are present but only the latter occurs with all sections (sects. *Cyclobalanopsis, Ilex* and *Cerris*). Of subgenus *Quercus*, only section *Quercus* occurs, mostly in the temperate and subtropical zone (Huang *et al*., 1999).

Following a prolonged period of marker-based phylogenetics and reconstruction of historical biogeographic patterns (e.g., Menitsky, 2005; Denk and Grimm, 2010; Hubert *et al*., 2014; Xing *et al*., 2014), rapid technological advances in genome sequencing have now moved studies of oak evolution firmly into the genomic era. Novel genome-wide survey techniques, such as comparative skimming (Hinsinger and Strijk, 2019), MIG-seq (Suyama and Matsuki, 2015; Binh *et al*., 2018 a; Strijk *et al*., 2020) and RADseq analyses (Hipp *et al*., 2015; Fitz-Gibbon *et al*., 2017; Deng *et al*., 2018; Jiang *et al*. 2019) are providing exciting advances into understanding oak and Fagaceae evolution. As whole genomes are being sequenced for each of the oak sections, a comprehensive reconstruction of oak genomic evolution will be within reach (Hipp *et al*., 2020), explaining how geography, time and opportunity led to global diversification of one of the world's most enigmatic tree groups.

Methods

Quercus honbaensis, *CR* (S. Tagane)

Taxonomy

There is no current, comprehensive, single treatment for the genus *Quercus*. As a large, cosmopolitan, morphologically diverse genus, *Quercus* is taxonomically challenging and species delimitations are much debated. As such, the taxonomic backbone for this project is the result of consultation with many taxonomic experts, and largely follows several key floras and checklists: *Flora of North America* (Nixon, 1997), Diversidad del género *Quercus* (Fagaceae) en México (Valencia-Ávalos, 2004), *Oaks of Asia* (Menitsky, 2005), *Flora of China* (Huang *et al*., 1999), The Plant List (2013), NatureServe (2015), *A Checklist of Woody Plants from Eastern Asia* (Ma, 2017), The USDA PLANTS Database (2017), Oaks of the World (Hélardot, 2020), and World Checklist of Selected Plant Families (Govaerts *et al*., 2020).

Our knowledge of the genus *Quercus* continues to evolve with the advent of new technologies in molecular biology and morphological analysis. Many new oak species are being described every year, especially in centers of oak diversity like Mexico/Central America, and China/Southeast Asia. As such, this report represents the state of threat for a consensus checklist of the world's oak species, to the best of our knowledge, with the currently available data.

Country level occurrence

Country level distribution for each oak species was gathered from various sources including *Flora of North America* (Nixon, 1997), *Flora of China* (Huang *et al*., 1999), *A Checklist of Woody Plants from Eastern Asia* (Ma, 2017), GlobalTreeSearch (BGCI, 2020), Oaks of the World (Hélardot, 2020), and World Checklist of Selected Plant Families (Govaerts *et al*., 2020), as well as herbaria records, primarily from Global Biodiversity Information Facility (GBIF; gbif.org/), and peer-reviewed journal articles. Country level occurrence data was recorded based on IUCN's country list, which follows the United Nations Statistics Division. Full methods and the list of countries, territories, and regions recognized by IUCN are available in the assessment tools resource on the IUCN website (iucnredlist.org/resources/country-codes). Countries analyzed in this report align with those listed on the IUCN Red List country codes webpage, and do not necessarily reflect the political opinions of the authors or organizations associated with this report.

Red list assessment process

All species assessments followed the methodology of the IUCN Red List of Threatened Species as outlined in the *IUCN Red List Categories and Criteria*, Version 3.1 (IUCN, 2012) and detailed in the *Guidelines for Using the IUCN Red List Categories and Criteria*, Version 14 (IUCN Standards and Petitions Committee, 2019). Information regarding species distribution, occurrence, population size, habitat and ecology, use and trade, threats, conservation, and ecosystem services was collected from a variety of sources including floras (primarily those listed in the methods sections for taxonomy and country level occurrence), published and unpublished literature, contributions from taxonomic and regional experts, and herbaria and botanic garden records.

All oak species were evaluated for threats according to the standardized codes following the IUCN Red List threats classification scheme (iucnredlist.org/resources/threat-classification-scheme). Occurrence points were gathered from Global Biodiversity Information Facility (GBIF: gbif.org/), iNaturalist (https://www.inaturalist.org/), collections reported in published literature, and herbaria records provided by regional experts. The Extent of Occurrence (EOO) and Area of Occupancy (AOO) as reported in the distribution section of each assessment were calculated using the Geospatial Conservation Assessment Tool (GeoCAT: geocat.kew.org/). All references are cited for each species assessment and available on the Red List website at iucnredlist.org.

Based on the best available data and expert input, every oak species was assessed against the IUCN Red List categories and criteria (Appendix A) and classified into one of the following IUCN Red List categories (Figure 1): Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), or Data Deficient (DD). Species assessed as Critically Endangered, Endangered, and Vulnerable are considered threatened. Species of conservation concern are those assessed as any of the three threatened categories, Near Threatened, or Data Deficient. Near Threatened species are those that meet most but not all of the criteria for a threatened category, while Data Deficient species do not have enough information available to be placed in another category.

Threatened species (i.e., CR, EN, and VU) must meet at least one of five criteria: A) Population reduction; B) Geographic range; C) Small population size and decline; D) Very small or restricted population; or E) Quantitative analysis (Appendix A).

Assessments were completed using the IUCN Species Information Service (SIS), an online portal for recording and managing assessment and taxonomy data. Each completed assessment was reviewed by at least one additional person knowledgeable about the plant group, region, and/or Red List methodology. Assessments were submitted to the Red List through SIS and reviewed by a member of the Red List Unit before being published.

Reporting proportion threatened

Estimates of threatened species are calculated following IUCN's *Guidelines for Reporting on Proportion Threatened* (IUCN, 2016). The mid-point is the "percentage of threatened species among those for which threat status could be determined" and accounts for the estimated proportion of Data Deficient species reassessed as threatened in the future if current Red List category trends for the genus are maintained. The mid-point is reported as the most likely threatened estimate, calculated as [(CR+EN+VU)/(Assessed-DD)]*100. The reported range includes the lower bound and upper bound, which indicate the extreme potentials of threatened species in the genus. The lower bound estimates threat percentages assuming that no Data Deficient species will be reassessed as threatened in the future, whereas the upper bound estimates threat percentages assuming all Data Deficient species

Quercus microphylla, *LC* (Béatrice Chassé)

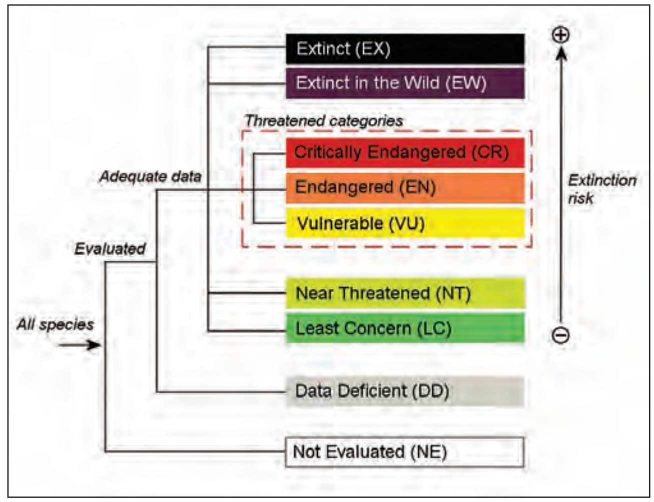


Figure 1. Structure of the IUCN Red List categories (version 3.1; IUCN, 2012).

will be reassessed as threatened. The lower bound is calculated as [(CR+EN+VU)/Assessed]*100 and the upper bound is calculated as [(CR+EN+VU+DD)/Assessed]*100. Unless otherwise noted, all reported threat percentage estimates represent the mid-point calculation.

Phylogenetic analysis

The 430 assessed species were matched to the most recent phylogenetic studies of oaks (Denk *et al*., 2017; Hipp *et al*., 2020). Thirty-five species assessed for this report were not included in either of these phylogenetic studies. For these species, a literature review was conducted to determine their section and/or regional oak experts were consulted to assign a section (A. Coombes and J. Strijk, pers. comm.).

Ex situ collections data

The number of *ex situ* collections for each assessed species was determined by combining existing datasets from four sources: 1) a 2017 *ex situ* survey conducted by The Morton Arboretum for the *Conservation Gap Analysis of Native U.S. Oaks* (Beckman *et al*., 2019); 2) a 2019 survey conducted for a project funded through the Institute of Museum and Library Services (award #MA-30-18-0273-18 to S. Hoban *et al*., results in prep.); 3) a 2020 survey funded by the USDA Forest Service (cooperative agreement #16-CA-11132546-045 to M. Westwood, results in prep.) and Fondation Franklinia to support the conservation work of the Global Conservation Consortium for Oak; and 4) records held in BGCI's PlantSearch database of plants in cultivation (https://tools.bgci.org/plant_search.php; accessed May, 2020). Species records were checked for taxonomic synonyms and organized to remove duplicate institutions. The final combined dataset was analyzed to determine the number of *ex situ* collections holding each oak species.

Results

Threat status

This publication reports, for the first time, the most comprehensive, up-to-date Red List status of oaks globally, including about 230 species never before assessed in any publication. A total of 430 species of oaks were evaluated using the IUCN Red List of Threatened Species methodology, and their published assessments can be found here: https://bit.ly/32V1tyV (14 species will be published in the spring 2021 IUCN Red List update).

An estimated 31% of oaks are threatened with extinction (considering Data Deficient species, lower bound: 26%; midpoint estimate 31%; upper bound: 42%). Forty-one percent of oaks are considered to be of conservation concern, assessed as either Critically Endangered, Endangered, Vulnerable, Near Threatened, or Data Deficient (Figure 2; Table 1). The majority of threatened and Near Threatened oak species (122) are assessed under criterion B, which considers geographic range size and reduction as calculated by species' Extent of Occurrence (EOO) and/or Area of Occupancy (AOO; Table 2).

The section of the genus *Quercus* with the highest proportion majority of threatened oaks is *Cyclobalanopsis* (Figure 3), which are exclusively found in east and Southeast Asia (Menitsky, 2005). Nine oaks entered the IUCN Red List already Critically Endangered and possibly extinct or possibly extinct in the wild, all of which are endemic to southern China and Southeast Asia and all but one of which is in section *Cyclobalanopsis*.

IUCN Red List Category	Number of species
Critically Endangered (CR)	32
Endangered (EN)	57
Vulnerable (VU)	23
Near Threatened (NT)	38
Data Deficient (DD)	67
Least Concern (LC)	213
TOTAL	**430**

Table 1. Number of oak species in each IUCN Red List category.

IUCN Red List Criteria	Number of species
Criterion A (Population size reduction)	6
Criterion B (Geographic range in the form of Extent of Occurrence (EOO) and/or Area of Occupancy (AOO)	122
Criterion C (Small population size and decline)	6
Criterion D (Very small or restricted population)	19
Criterion E (Quantitative analysis)	0

Table 2. Number of Critically Endangered, Endangered, Vulnerable, and Near Threatened oak species assessed under each of the five Red List criteria. Some species are assessed under more than one criterion.

Quercus georgiana, *EN* (The Morton Arboretum)

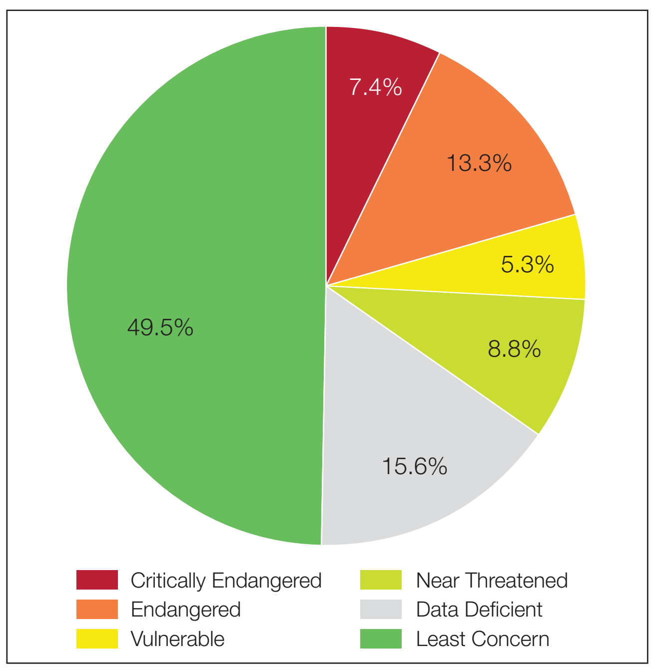


Figure 2. Percentage of 430 oak species assessed in each IUCN Red List category.

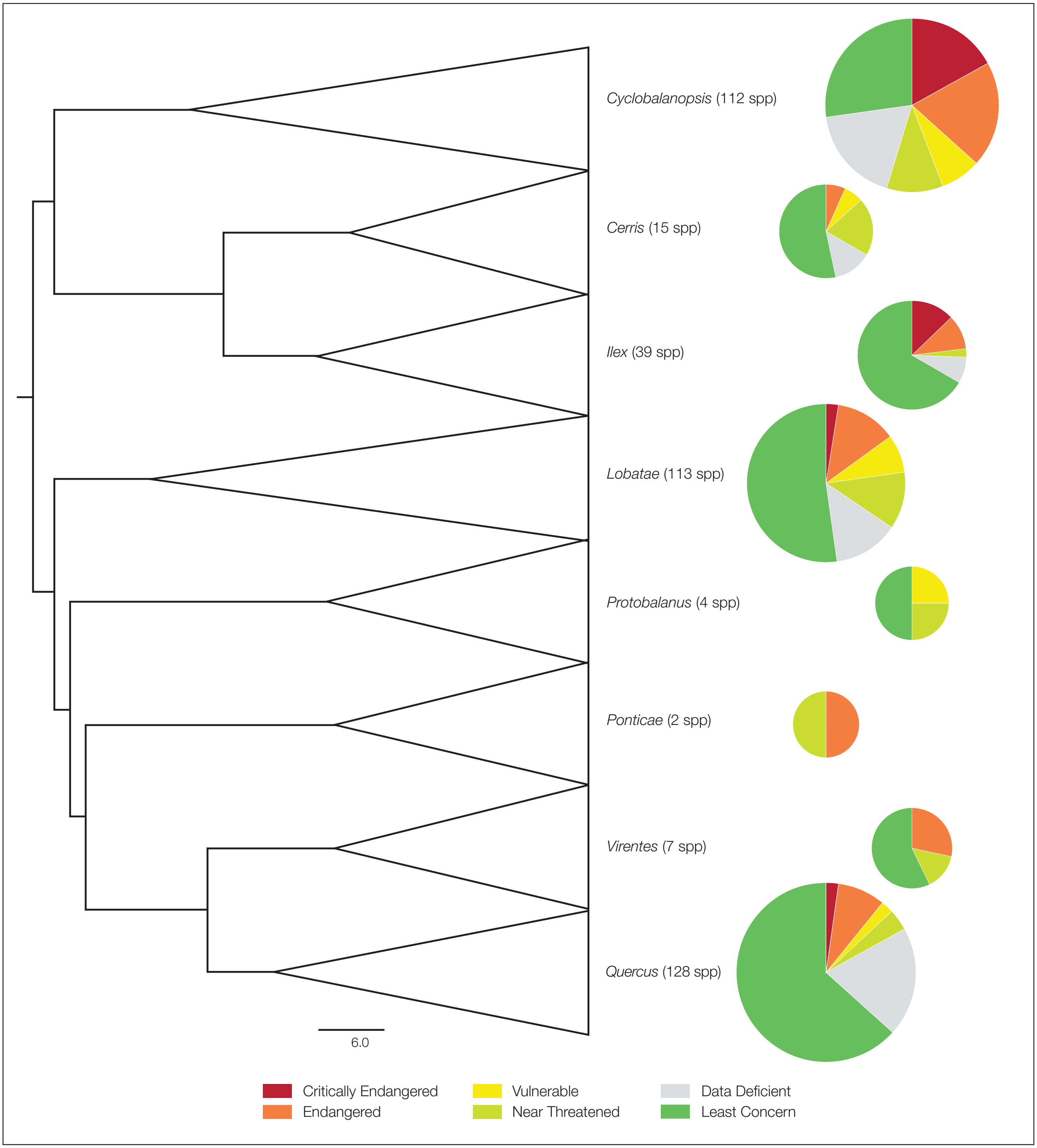


Figure 3. Proportion of species in each IUCN Red List category for the eight sections of the genus Quercus*. Section nomenclature is from* Denk et al. *(2017). Framework phylogeny adapted, with authors' permission, from an analysis of genomic data from* Hipp et al. *(2020), and all sections are supported with high statistical support. Branch lengths are in units of millions of years (based on fossil calibration). In parentheses is the number of species per section assessed for the IUCN Red List. The size of the pie chart is roughly proportional to the size of the section, based on the number of species assessed in this report.*

Geographic analysis

Oaks are native to 90 countries (Figure 4), with 243 endemic oak species occurring in 20 countries (Figure 5). Countries with the highest oak species richness are Mexico (164 species, 99 endemics), China (117 species, 58 endemics), and the US (91 species, 41 endemics). Threatened oak species occur in 31 countries (Figure 6), with the most threatened species in China (36 species), Mexico (32), Vietnam (20), the US (16), and Malaysia (9).

Quercus scytophylla, *LC* *(Béatrice Chassé)*

Quercus liaoi, *DD* *(Béatrice Chassé)*

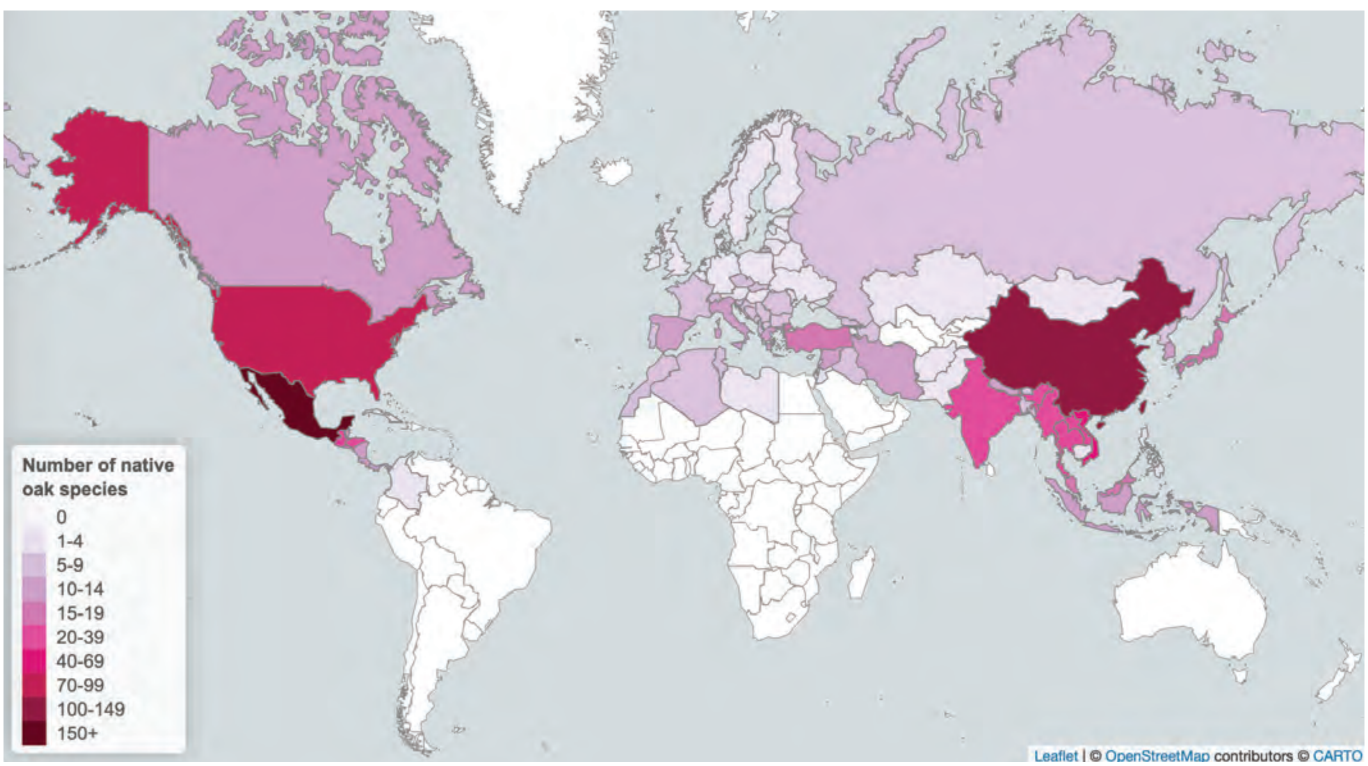


Figure 4. Native oak species richness by country or territory.

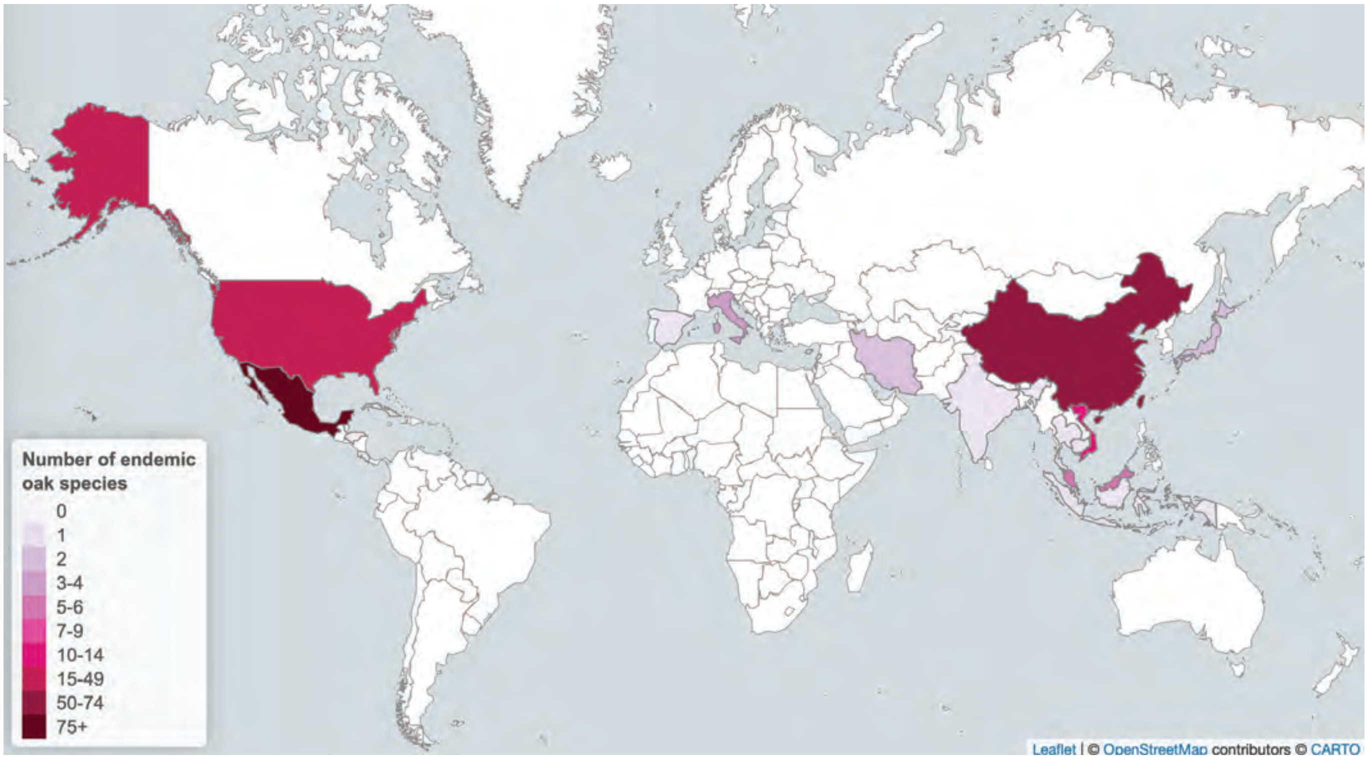


Figure 5. Endemic oak species richness by country or territory.

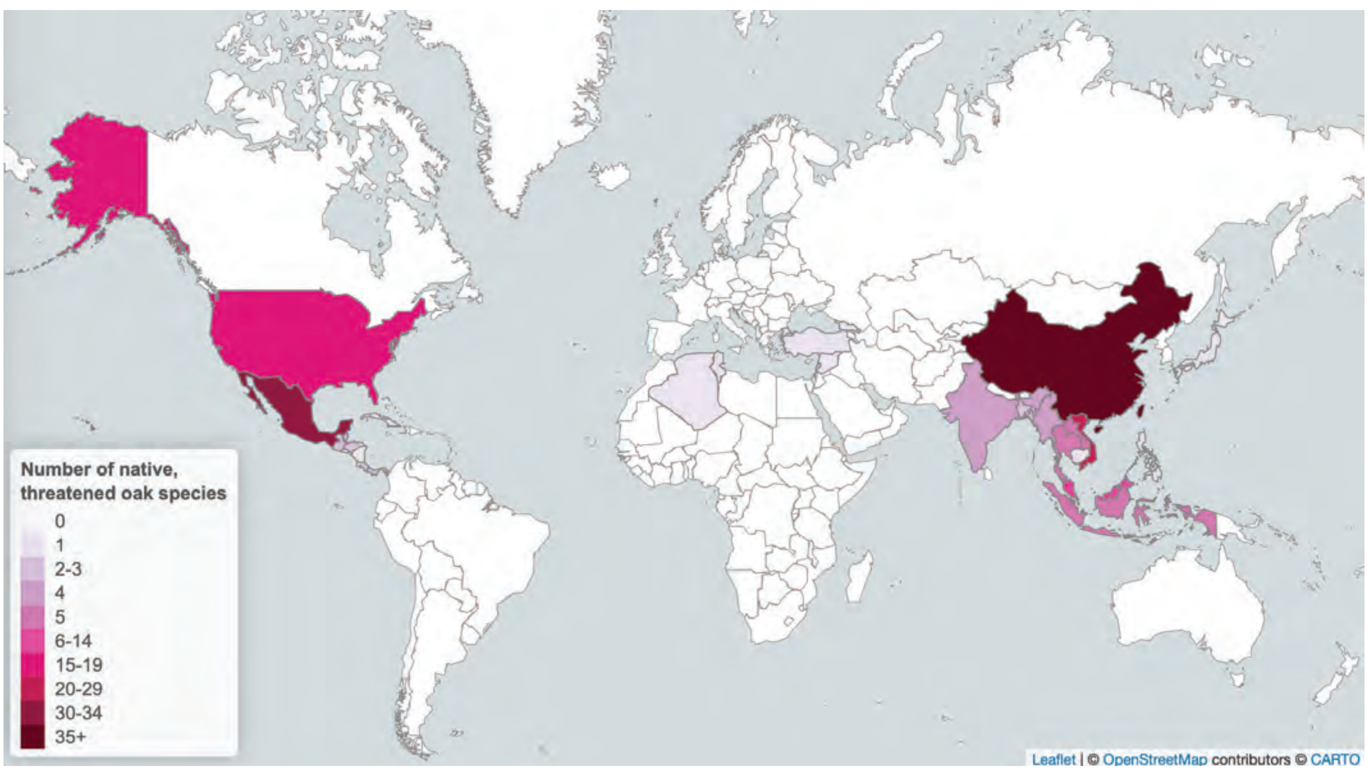


Figure 6. Threatened oak species richness by country or territory. Threatened oaks are those assessed as Critically Endangered, Endangered, or Vulnerable.

Major threats

The most common threats to oaks globally are agriculture and aquaculture (impacting 226 species, including 84 threatened species), biological resource use (144, 63), and residential and commercial development (109, 49; Figure 7). For oaks threatened by biological resource use, this is most commonly the result of logging and wood harvesting. Threat pressures differ in frequency based on region and country; agriculture and aquaculture is the most common threat in Asia, Europe, and Mexico and Central America, whereas invasive pests and diseases is the most common threat in the United States (Figure 8; Table 3).

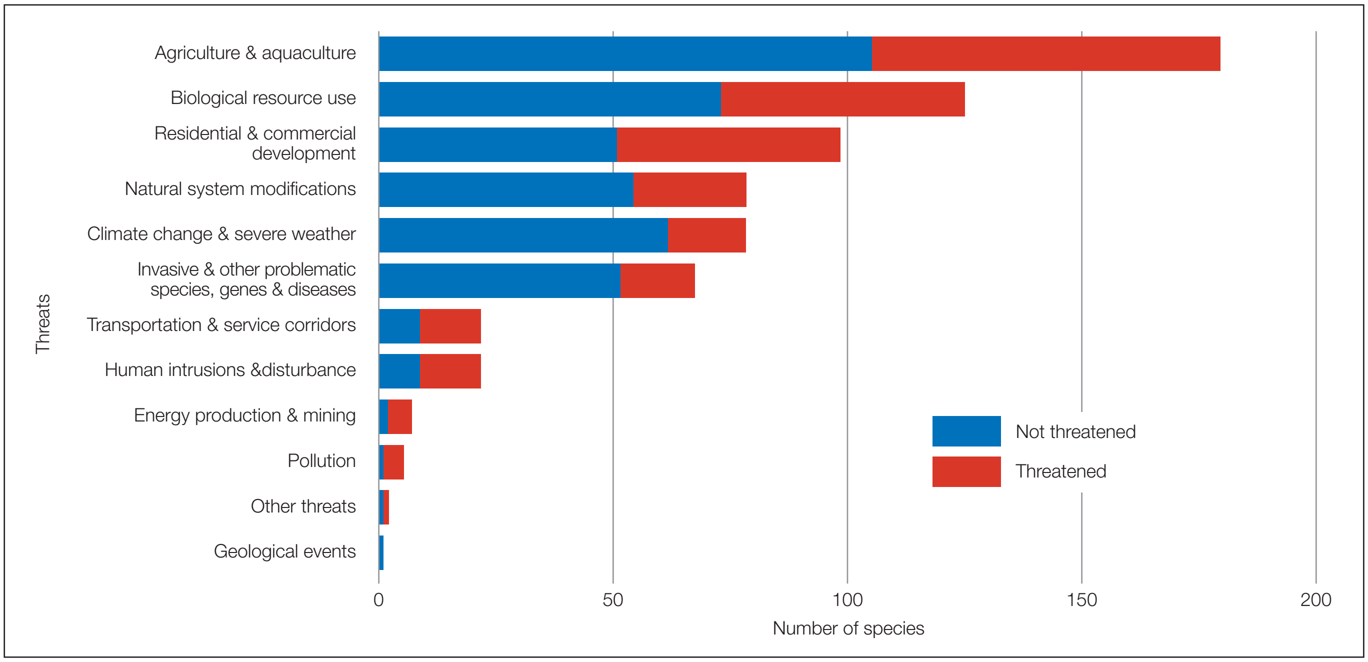


Figure 7. Most common threats to threatened (Critically Endangered, Endangered, or Vulnerable) and not threatened (Near Threatened, Least Concern, and Data Deficient) oak species.

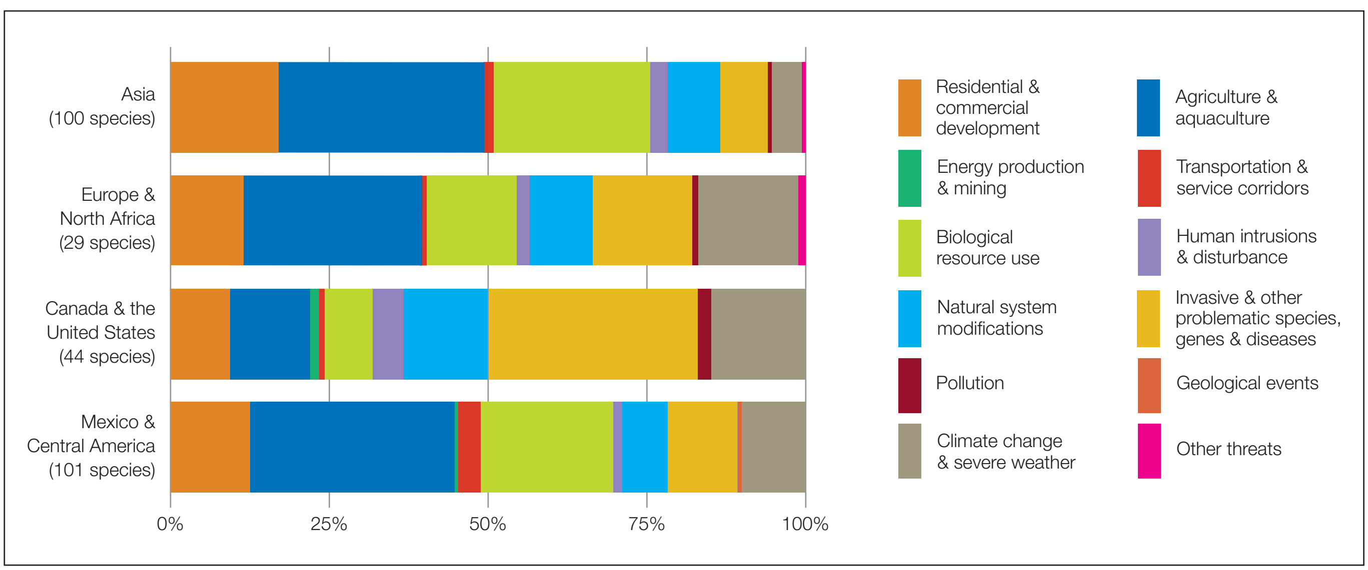


Figure 8. Most common threats to oak species, by geographic region. Species may be coded with more than one threat, but only those species with at least one coded threat are included in this analysis. Some species are included in more than one region. The oaks of Cuba (1 species) and Colombia (1 species) are included in Mexico & Central America.

Country/Territory	Threatened oak species	Total oak species	Most common threat(s)
China	36	117	Agriculture & aquaculture
Mexico	32	164	Agriculture & aquaculture
Vietnam	20	49	Biological resource use
United States	16	91	Invasive & other problematic species, genes & diseases
Malaysia	9	19	Agriculture & aquaculture
Indonesia	5	14	Agriculture & aquaculture
Lao PDR	5	24	Agriculture & aquaculture
Thailand	5	33	Agriculture & aquaculture
India	4	21	Agriculture & aquaculture, Biological resource use
Myanmar	4	27	Agriculture & aquaculture
Lebanon	2	7	Agriculture & aquaculture
Bangladesh	2	9	Agriculture & aquaculture, Biological resource use
Brunei Darussalam	1	5	Agriculture & aquaculture
Bhutan	1	9	Agriculture & aquaculture
Cuba	1	1	Agriculture & aquaculture, Energy production & mining, Natural system modifications
Algeria	1	6	Agriculture & aquaculture
Georgia	1	5	Agriculture & aquaculture, Biological resource use
Japan	1	15	Agriculture & aquaculture
Cambodia	1	3	Biological resource use
Nicaragua	1	10	Agriculture & aquaculture
Costa Rica	3	12	Agriculture & aquaculture, Biological resource use
Hong Kong (China)	3	8	Residential & commercial development, Agriculture & aquaculture, Biological resource use
Honduras	3	20	Agriculture & aquaculture, Biological resource use
Panama	3	10	Biological resource use
Belize	2	11	Agriculture & aquaculture
Guatemala	2	26	Agriculture & aquaculture
Philippines	1	1	Agriculture & aquaculture, Natural system modifications
El Salvador	1	15	Agriculture & aquaculture
Syrian Arab Republic	1	10	Agriculture & aquaculture
Tunisia	1	5	Agriculture & aquaculture
Turkey	1	17	Biological resource use

Table 3. Most common threat(s) to oak species, by country/territory. Of the 90 countries with native oak species, only the 31 countries/territories with at least one threatened species are shown.

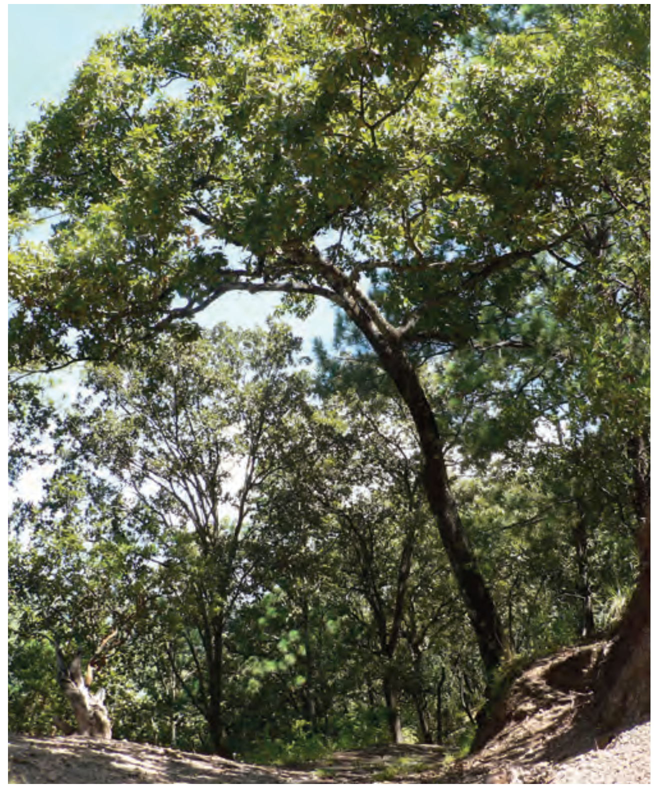
Quercus kingiana, EN *(S. Sirimongkol)*

Quercus lobbii, EN *(Jean-Louis Hélardot)*

Ex situ representation

There are 296 oak species reported in the *ex situ* collections of botanic gardens and arboreta globally, with the majority of species (165) held in 20 collections or fewer (Figure 9). Nearly one-third of oak species (134) are not reported in any *ex situ* collection globally, including 58 species (51%) of threatened oaks (Table 4).

Quercus glabrescens, *LC* *(Béatrice Chassé)*



Quercus planipocula, *LC* *(Béatrice Chassé)*

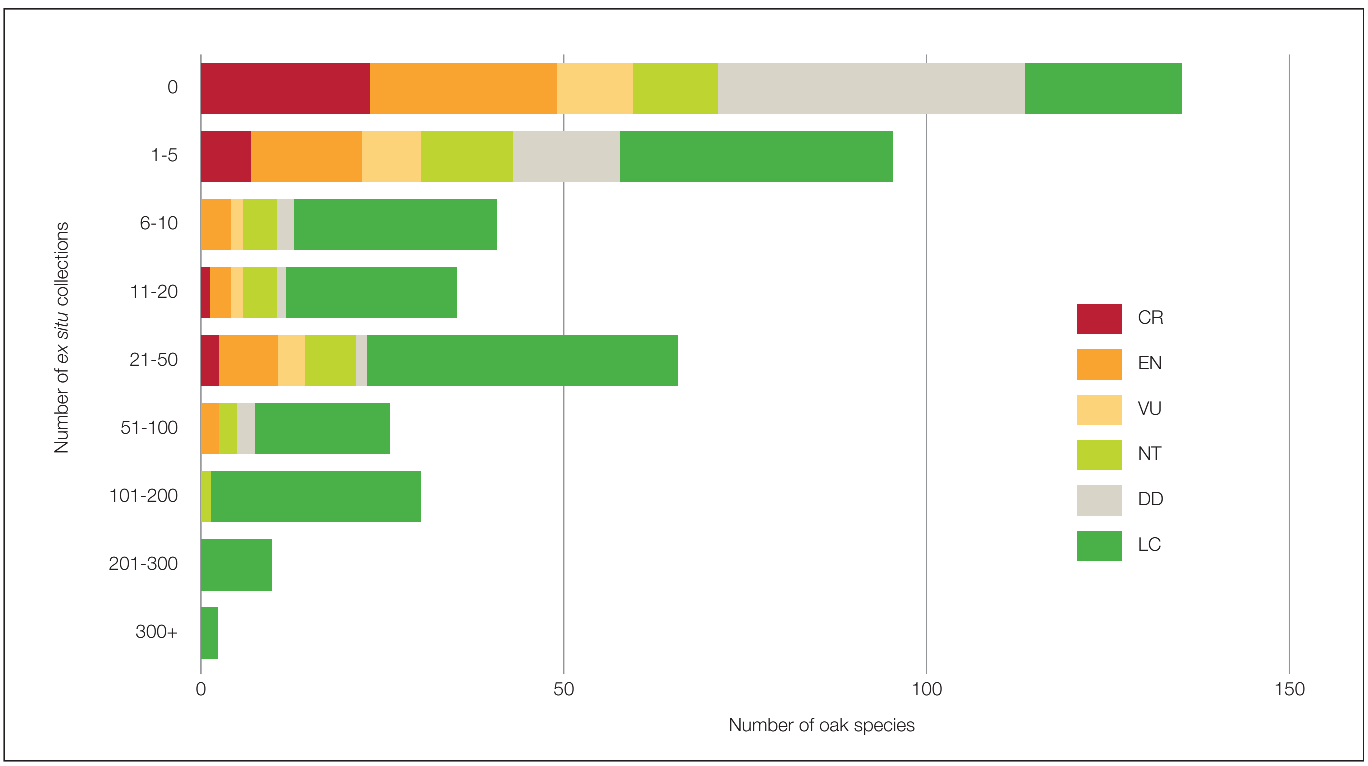


Figure 9. Number of oak species in ex situ *collections, by IUCN Red List category.*

Country/ Territory	Threatened oak species	Total oak species	Most common threat(s)
China	36	117	Agriculture & aquaculture
Mexico	32	164	Agriculture & aquaculture
Vietnam	20	49	Biological resource use
United States	16	91	Invasive & other problematic species, genes & diseases
Malaysia	9	19	Agriculture & aquaculture
Indonesia	5	14	Agriculture & aquaculture
Lao PDR	5	24	Agriculture & aquaculture
Thailand	5	33	Agriculture & aquaculture
India	4	21	Agriculture & aquaculture, Biological resource use
Myanmar	4	27	Agriculture & aquaculture
Costa Rica	3	12	Agriculture & aquaculture, Biological resource use
Honduras	3	20	Agriculture & aquaculture, Biological resource use
Hong Kong (China)	3	8	Residential & commercial development, Agriculture & aquaculture, Biological resource use
Panama	3	10	Biological resource use
Bangladesh	2	9	Agriculture & aquaculture, Biological resource use
Belize	2	11	Agriculture & aquaculture
Guatemala	2	26	Agriculture & aquaculture
Lebanon	2	7	Agriculture & aquaculture
Algeria	1	6	Agriculture & aquaculture
Bhutan	1	9	Agriculture & aquaculture
Brunei Darussalam	1	5	Agriculture & aquaculture
Cambodia	1	3	Biological resource use
Cuba	1	1	Agriculture & aquaculture, Energy production & mining, Natural system modifications
El Salvador	1	15	Agriculture & aquaculture
Georgia	1	5	Agriculture & aquaculture, Biological resource use
Japan	1	15	Agriculture & aquaculture
Nicaragua	1	10	Agriculture & aquaculture
Philippines	1	1	Agriculture & aquaculture, Natural system modifications
Syrian Arab Republic	1	10	Agriculture & aquaculture
Tunisia	1	5	Agriculture & aquaculture
Turkey	1	17	Biological resource use

Table 4. Threatened oak species (Critically Endangered, Endangered, and Vulnerable) not reported in any ex situ *collections. *Species assessment to be published in the first IUCN Red List update of 2021.*

Quercus confertifolia, *LC* *(Béatrice Chassé)*

Quercus praeco, *LC* *(Béatrice Chassé)*

Conclusions and conservation recommendations

Quercus kiukangensis, EN *(Béatrice Chassé)*

Nearly one-third of all oak species are threatened with extinction and more than forty percent are considered of conservation concern. Regions with high numbers of native and threatened species include Mexico & Central America, China & Southeast Asia, and the United States. More specifically, China, Mexico, Vietnam, and the United States contain the highest number of threatened oaks. Although conservation of oaks in all parts of the world is necessary, conservation in these centers of diversity is the highest priority to ensure efficient, strategic protection for as many species as possible.

Analyses of global oak assessments show increasing current and projected threats to species, populations, and habitats. Pressures from land use change for agriculture, housing and urban area development, logging, natural system modifications, climate change, and invasive pests and diseases are identified as serious threats. Different regions require different strategies for protection based on threat; oak species in the United States show higher threats from climate change and invasive species, whereas concerns in Asia and Mexico and Central America are primarily due to deforestation from logging (coded as biological resource use), urbanization (residential and commercial development), and agriculture.

Living *ex situ* collections are an important method of oak conservation because oaks are "exceptional species" and cannot be seed banked through convention methods. Yet, the botanical garden community is severely lacking in *ex situ* collections of high conservation quality. More than half of threatened oaks (58 species), predominantly from China and Southeast Asia, are not currently found in any *ex situ* collections globally. More than 130 of all oak species are not found in any *ex situ* collections and 34 species are only found in one collection. All threatened oak species not currently present in *ex situ* collections are listed in (Table 4) to help prioritize species for future collecting efforts. Without active and coordinated conservation efforts to increase oak richness and diversity in *ex situ* collections globally, many threatened species will face extinction.

It is helpful to classify centers of oak richness for native and threatened species both by region (following the natural distribution patterns of oaks) and country (as this is often thepolitical unit at which conservation policies are made). The most common conservation recommendations across all Red List assessments for oaks include increasing *ex situ* collections, designating land and government protections for species *in situ*, and increased surveying of oaks in the wild to monitor populations, habitat, and threat trends. A preliminary summary of conservation efforts in the global centers of diversity – Mexico & Central America, China & Southeast Asia, and the United States – are provided below. Additional syntheses of current oak conservation initiatives and needs in the United States can be found in *The Red List of US Oaks* (Jerome *et al*., 2017) and the *Conservation Gap Analysis of Native U.S. Oaks* (Beckman *et al*., 2019).

Mexico and central america

Mexico and Central America host the highest concentration of oak species in the world, with an estimate of 160 species, from which approximately 100 are endemic to Mexico, six are endemic to Central America, and 27 are shared between the two regions (the remaining species are shared between Mexico and the United States). Approximately 53% of these species are considered to have intermediate or large distributional range sizes (presence in three or more Mexican states), while about 60 species are restricted to only one or two Mexican states (Valencia-Á., 2004). This restricted distribution makes them particularly vulnerable to threats including habitat loss due to land use conversion, climate change, direct logging, and pest and diseases.

According to the recently published Global Forest Resources Assessment by the Food and Agriculture Organization of the United Nations (2015), the rate of annual loss of primary forest in Mexico has been decreasing over the last three decades. However, deforestation is still more than one hundred thousand hectares per year. This puts some oak species at risk, particularly those in areas such as Michoacán state where forest conversion to avocado orchards is rampant.

Box 4: Oaks of the Americas Conservation Network

The Oaks of the Americas Conservation Network (OACN) was born out of the International Workshop on Oak Conservation held in March 2016 in Morelia, Mexico, as a collaborative effort between The Morton Arboretum, the National Autonomous University of Mexico (UNAM), and University of Minnesota, in partnership with BGCI and FFI. OACN is a consortium of researchers and conservationists at universities, botanical gardens, arboreta, non-governmental organizations, and government agencies working to conserve threatened oak species throughout the Americas, with a focus on Latin America as a global hotspot for oak diversity. With an integrated approach to oak conservation in Mexico and Central America in mind, OACN pursues research and conservation projects that span a variety of species, audiences, and methodologies. These projects involve international collaboration across different sectors to maximize efficiency and effectiveness. Together, these projects will forge new partnerships, strengthen the network of engaged conservationists in an oak diversity hotspot, build knowledge and capacity, and result in direct conservation action for rare and threatened oak species (Denvir *et al*., 2018).

Climate change is also a significant threat. All modeling studies in Mexico have found that areas climatically suitable for oaks will decrease in extents that vary from slight to dramatic, depending on the species (Gómez-Mendoza and Arriaga, 2007; Ramírez-Preciado *et al*., 2019). Particularly worrisome are the possible interactions between climate change and emergent pests and diseases, such as those caused by the pathogen *Phytophthora cinnamomi* or the gall wasp *Andricus quercuslaurinus*, which seem to have had an increasing impact over the last decade (Sáenz-Romero *et al*., 2020).

Quercus deserticola, *LC* *(Béatrice Chassé)*

Current, innovative technologies allow enhanced oak conservation efforts. Recent findings have provided a clear phylogenetic framework (Hipp *et al*., 2020) to incorporate an evolutionary perspective on oak studies. Also, several authors have focused on the importance of *in situ* conservation strategies for oak diversity preservation; for example, Natural Protected Areas harbor ~84% of the Mexican oak species (Torres–Miranda *et al*., 2011; Ramírez-Toro *et al*., 2017). Finally, *ex situ* conservation strategies are prioritized, particularly by botanic gardens who protect ~36% of the oak species native to Mexico.

Highly threatened species and habitats have been identified and studied collaboratively with local communities using ecosystems management approaches (Montes-Hernández and López-Barrera, 2013). However, there is still a lot of work to do. The drivers for environmental degradation and diversity loss do not need to be coordinated to continue threatening biodiversity. Unlike such effects, the scientific community, decision-making actors, and invested citizens must act as a whole. Despite the development of several recent initiatives, including those from the Oaks of the Americas Conservation Network (OACN; Box 4), BGCI, and the Global Trees Campaign, current conservation actions are not enough.

Therefore, a new conservation science is urgently needed. We must find ways to enhance, improve, and merge current ecological and evolutionary knowledge, while also considering the needs of local communities, in order to achieve multidisciplinary approaches for oak conservation.

China

One-third of Fagaceae species (~300) are distributed in China and account for 13.7% of the total area of natural forests in the country. Chinese oaks occur in a diversity of habitats including tropical rainforests, subtropical broadleaved evergreen forest, temperate deciduous broadleaved forest, and conifer forests, and range in elevation from 0 to 4500 meters.

Quercus species in China play an important role in regulating ecosystem function and maintaining community stability. Local people harvest Chinese oaks for timber, charcoal, the production of dyes, and starchy food. Currently, many Chinese oaks are threatened with extinction, primarily due to land use changes, unsustainable harvesting, climate change, soil erosion, and habitat destruction. During the last few hundred years and increasing in the last one hundred years, large areas of the oak forest in China have been cleared for agricultural crops, commercial crops, and monocrop economic forests. Additionally, oaks growing near the top of mountains with limited populations (e.g., *Quercus arbutifolia* and *Q. litseoides*) are especially threatened from habitat destruction, soil erosion, and climate change.

China is in need of increased conservation actions for oaks, as well as all genera of the Fagaceae family. However, the List of National Key Protected Wild Plants (First Group) issued by the National Forestry Bureau and Agriculture Ministry of China in 1999, only included three Fagaceae species: *Castanopsis concinna, Fagus hayatae* and *Formanodendron* (*Trigonoabalanus*) *doichangensis*. Only *C. concinna, Cyclobalanopsis sichourensis* (= *Quercus sichourensis*) and *Quercus bawanglingensis* are included in a draft list for promulgating (*Formanodendron doichangensis* and *Fagus hayatae* were deleted from the list in 1999). In 2004, Wang and Xie published the China Species Red List which included 93 oak species with limited occurrence data (less than 5). China later developed the conservation action concept of Plant Species with Extremely Small Populations (PSESP) in 2005, and national conservation actions have been launched based on the National 120 PSESP List released in 2012. Unfortunately, there were no Fagaceae species included in the list, and only *Cyclobalanopsis sichourensis* was included in the Provincial 62 PSESP List of Yunnan approved by the government in 2010. Huang (2014) reported that 207 Fagaceae species have been cultivated *ex situ* in China's major botanical gardens. Among these species, only eight are nationally evaluated as threatened: *Castanopsis kawakamii, Castanopsis rockii, Cyclobalanopsis dinghuensis* (= *Quercus dinghuensis*), *Cyclobalanopsis disciformis* (= *Quercus disciformis*), *Cyclobalanopsis sichourensis, Lithocarpus crytocarpus*, *Lithocarpus fordianus* and *Formanodendron doichangensis* (Qin *et al*., 2017). Based on the report, only two species, *Cyclobanopsis sichourensis* and *Formanodendron doichangensis*, are effectively conserved by *in situ* protection, *ex situ* preservation, and population reinforcement and reintroduction in the country (Sun, 2013; Sun *et al*., 2011, 2016, 2019, and 2020; Xia *et al*., 2016; Yang *et al*., 2019). For the other threatened Fagaceae species, effective protective actions are urgently needed. Botanical gardens and nature reserves need to take immediate action to protect Chinese Fagaceae species.

Box 5: Southeast Asian Botanic Garden Network

The Southeast Asian Botanic Garden (SEABG) Network, established in 2004 with BGCI as secretariat, works to coordinate and promote the work of botanic gardens in the region. The goals of SEABG are to set standards among Southeast Asian botanic gardens, promote the exchange of technical expertise, connect members of the botanic garden community, and guide members in implementing the Convention on Biological Diversity (CBD), specifically the Global Strategy for Plant Conservation (GSPC), as well as the International Agenda for Botanic Gardens. For more information see bgci.org/our-work/where-we-work/asia/botanic-garden-networks-in-asia/

Quercus acerifolia, *EN* *(Béatrice Chassé)*

SOUTHEAST ASIA

Southeast Asia is a regional hotspot of species richness with high species endemism (Koh *et al*., 2013). The tropical climate, varied topography, and expansive land cover make this area ideal for development of rich and diverse plant life. For these reasons, it is also a region of high oak diversity and richness. Oaks in Southeast Asia occur from sea level to elevations of more than 3,000 meters, with the majority of species in mid-upper montane wet evergreen forests. Locally, oaks and other Fagaceae dominate the lower and middle forest strata in varying species assemblages over large areas. Similar to other Fagaceae in Asia, oaks are generally absent from areas with seasonal climate, although certain species have ranges that extend into high elevation summit zones (e.g., *Quercus lineata* and *Q. gemelliflora*). Soil type does not appear to be a major determining factor for oak presence as they are found on a wide variety of substrates. However, some species have a specific preference for podzolized soils (kerangas) or soils derived from ultrabasic bedrock, whereas calcareous soils are mostly lacking oak and other Fagaceae elements (Soepadmo and van Steenis, 1972).

There are an estimated 86 oak species native to the 11 countries comprising Southeast Asia (this definition excludes southern China). Nine of the 31 countries with threatened oak species are located in this region (Vietnam, Malaysia, Thailand, Lao PDR, Indonesia, Myanmar, the Philippines, Cambodia, and Brunei). With 36 threatened species (an estimated 48%), Southeast Asia is the most threatened region for oaks globally. Additionally, nine oak species have been assessed for the first time as Critically Endangered and possibly extinct or possibly extinct in the wild, and all are native to southern China and Southeast Asia (Appendices B and C).

Quercus scytophylla, *LC* (Béatrice Chassé)

These species have very small populations and/or restricted ranges and are primarily threatened by land conversion for logging, agriculture, and urbanization. They are listed as possibly extinct due to one or a combination of the following: few, unreadable, and/or misidentified herbaria records, inaccessible herbaria records due to a lack of capacity for local botanical communities, little to no recent surveying capacity, lack of strategic surveying due to minimal ecology/habitat knowledge, and/or doubt about species presence due to increased deforestation in the species' suspected locality. For example, a great proportion (≥ 75%) of the herbaria collection data for Southeast Asian oaks came from the 1960s - 1990s, an era where active logging and land development led to greater accessibility and facilitated specimen collections. However, this poses a potential problem of collection locality bias, showing certain areas to have high number of species representation, while areas with similar habitat conditions but difficult accessibility showed low representation.

Southeast Asia is reported to have the highest relative rate of deforestation of any major tropical region (Sodhi *et al*., 2004). Threats to forest areas in Southeast Asia are primarily a result of logging and rapid clearing for urbanization (Hughes, 2017). These threats also extend to oaks in the region, as seen in the results of this publication. Despite these severe threats, there has been minimal coordinated conservation action in the region to preserve threatened oak species. Though there have been changes in regulations in some regions of Southeast Asia to protect species, such as the prohibition of logging Fagaceae species in Sabah (Malaysia) and the increase of Totally Protected Areas (TPAs) by Sabah and Sarawak (Malaysia), challenges from a lack of shared information, funding, human resources, and collection bias (fertile specimens only) slow the progress of oak research, prioritization, and conservation action. Though much effort is invested in the management of *in situ* habitats where the majority of recorded species are found, there is still a need for the establishment of regional oak *ex situ* collections. At present, there is no regional *ex situ* effort focused specifically on the Southeast Asian oaks to secure a significant proportion of their species and genetic diversity. For many species, propagation and growing requirements remain unknown, further complicating both studies of shrinking populations and *ex situ* conservation efforts. Conservation actions to protect oaks in this region must be collaborative, considerate of local expertise, and focus on increasing the survey of oaks in the wild, with the goal of monitoring populations, habitat, and threat trends and increasing oak *ex situ* collections in regional botanic gardens (Box 5).

THE UNITED STATES

With 91 native oak species, the US is a diversity center for *Quercus*. The *Conservation Gap Analysis of Native U.S. Oaks* (Beckman *et al*., 2019) identified 28 of the 91 native oaks (31%) as species of conservation concern based on extinction risk, vulnerability to climate change, and lack of representation in *ex situ* collections (Beckman *et. al*., 2019). While some oak species of conservation concern have been the focus of collecting efforts, many are underrepresented in *ex situ* collections. Nine species of conservation concern are represented by fewer than 15 plants in collections and four species of concern are not found in any collections in North America (Beckman *et. al*., 2019). Fortunately, the US has resources and networks in place that provide a strong foundation to conduct oak conservation and research. *The Red List of US Oaks* (Jerome, *et al*., 2017), which contains additional threat analyses for species in the US, and the *Conservation Gap Analysis of Native U.S. Oaks* (Beckman *et al*., 2019), provides a roadmap for action, outlining priority conservation and research activities for the oak species of conservation concern. Botanic gardens and arboreta are the champions for native US oaks, with strong, well-resourced networks providing coordination and guidance, including support for *ex situ* collection and coordination through the American Public Gardens Association Plant Collections Network *Quercus* Multisite, guidelines available through the Center for Plant Conservation, and the recently established Global Conservation Consortium for Oak (GCCO; Box 6). These networks and resources provide a valuable base for the continued conservation of oaks in the US.

Quercus obtusata, *LC* (Béatrice Chassé)

Box 6: The Global Conservation Consortium for Oak

By Amy Byrne

Since no single institution can conserve all of the world's threatened oak species, a coordinated global network is needed to ensure that threatened species are represented in *ex situ* collections and conserved in the wild, and that the institutions and experts in the global centers of diversity for oaks have the resources and conservation capacity to adequately conserve priority oak species. For these reasons, the Global Conservation Consortium for Oak (GCCO) was created. The GCCO is led by The Morton Arboretum (Illinois, USA) in collaboration with BGCI and dozens of other partners. The goal of the GCCO is to mobilize a coordinated network of institutions and experts who work collaboratively to develop and implement a comprehensive conservation strategy to prevent extinction of the world's oak species.

The objectives of the GCCO are to:

- Establish and foster a global network of oak experts
- Identify and prioritize species of greatest conservation concern through the IUCN Red List
- Establish and manage coordinated *ex situ* collections of high conservation value to support *in situ* action
- Undertake and facilitate applied research (e.g., conservation biology, population genetics, taxonomy)
- Ensure that threatened species are conserved *in situ*
- Build capacity to empower and mobilize in-country partners in centres of diversity to act for target species in these areas
- Increase public awareness and engagement in tree conservation
- Raise funding to scale up conservation action for target groups

Through the GCCO, partners and collaborators will have the tools and support needed to efficiently and effectively overcome challenges, catalyze action, and build capacity to conserve threatened oak species around the world.

Since launching in 2019, the GCCO has become well-established in the US, with five year work plan outlining goals and objectives for the US region, and working groups established to address key oak conservation activities such as cryopreservation, propagation, collecting, curation and conservation grove design. Virtual meetings have provided an opportunity for closer collaboration between members. As momentum builds in the US, the GCCO is working to replicate this model in Mexico, China, and Southeast Asia. For more information see bgci.org/our-work/projects-and-case-studies/a-global-conservation-consortium-for-oak/.

Quercus obtusata, *LC* *(Béatrice Chassé)*

Quercus repanda, *LC* *(Béatrice Chassé)*

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Appendix A:

Summary of the IUCN Red List Criteria for Threatened Categories (Version 3.1; IUCN)

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [except A3]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality

(d) actual or potential levels of exploitation

(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10

(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals

(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2 An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D1 Number of mature individuals	< 50	< 250	D1. < 1,000
D2 *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.			D2. typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Appendix B:

Full list of evaluated *Quercus* species and Red List category: listed alphabetically

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus acatenangensis	LC	GT,MX,SV	0	-	*Lobatae*
Quercus acerifolia	EN	US	44	3.2,2.3.2,7.1.2,5.3.4,1.3,8.4.1,6.1,1.2,9.4	*Lobatae*
Quercus acherdophylla	DD	MX	13	-	*Lobatae*
Quercus acrodonta	LC	CN	3	-	*Ilex*
Quercus acuta	LC	CN,JP,KR,TW	46	-	*Cyclobalanopsis*
Quercus acutifolia	VU	BZ,GT,HN,MX	34	2.3.4,11.2,11.1,2.1.4,5.3.4	*Lobatae*
Quercus acutissima	LC	BT,CN,IN,JP,KP,KR,LA,MM,NP,TH,VN	201	5.3.2	*Cerris*
Quercus aerea	DD	MX	0	-	*Lobatae*
Quercus afares	VU	DZ,TN	18	2.1.1,6.3,1.2,2.3.2,4.1	*Cerris*
Quercus affinis	LC	MX	23	2.1.2,5.3.3	*Lobatae*
Quercus agrifolia	LC	MX,US	94	2.3.3,1.1,7.1.3,5.3.2,2.1.3,8.4.2	*Lobatae*
Quercus ajoensis	VU	MX,US	5	11.2,8.2	*Quercus*
Quercus alba	LC	CA,US	234	7.1.2,8.2.2,1.1	*Quercus*
Quercus albicaulis	CR	CN	0	2.2.3,5.3.1,5.3.4	*Cyclobalanopsis*
Quercus albocincta	LC	MX	3	-	*Lobatae*
Quercus aliena	LC	CN,JP,KP,KR,LA,MM,TH,TW	101	7.1.3,2.2.1	*Quercus*
Quercus alnifolia	LC	CY	48	11.1,7.1.1	*Ilex*
Quercus alpescens	DD	MX	1	-	*Quercus*
Quercus annulata	LC	CN,IN,MM,NP,VN	0	-	*Cyclobalanopsis*
Quercus aquifolioides	LC	BT,CN,MM	6	-	*Ilex*
Quercus arbutifolia	EN	CN,VN	0	11.1,1.1	*Cyclobalanopsis*
Quercus argentata	LC	ID,MY,SG	3	-	*Cyclobalanopsis*
Quercus argyrotricha	CR	CN	4	6.3	*Cyclobalanopsis*
*Quercus ariifolia**	NT	MX	1	11.2,11.3	*Quercus*
Quercus aristata	LC	MX	0	5.3.4,5.3.1,1.1,2.3.4,2.1.4	*Lobatae*
Quercus arizonica	LC	MX,US	31	-	*Quercus*
Quercus arkansana	VU	US	48	2.1.3,1.3,5.3.4,7.3,7.1.1,8.1.2,9.3.3, 11.1,11.2	*Lobatae*
Quercus asymmetrica	EN	CN,VN	0	1.1,1.2,5.3.4,6.3	*Cyclobalanopsis*
Quercus aucheri	LC	GR,TR	13	6.1,5.3.5,11.1,1.3,1.1	*Ilex*
Quercus augustini	LC	CN,MM,TH,VN	4	-	*Cyclobalanopsis*
Quercus auricoma	LC	CN,TH,VN	0	-	*Cyclobalanopsis*
Quercus austrina	VU	US	25	2.1.2,2.1.3,3.1,5.3.1,8.2.1,11.2,6.1	*Quercus*
Quercus austrocochinchinensis	VU	CN,LA,TH,VN	0	8.2.2,1.1,5.3.3	*Cyclobalanopsis*
Quercus baloot	LC	AF,PK	7	-	*Ilex*
Quercus bambusifolia	EN	CN,HK,VN	4	12.1,2.1.3	*Cyclobalanopsis*
Quercus baniensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus baolamensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus baronii	LC	CN	16	-	*Ilex*
Quercus barrancana	DD	MX	0	-	*Quercus*
Quercus bawanglingensis	CR	CN	0	2.2.3,5.3.3	*Ilex*
Quercus bella	NT	CN,VN	1	2.2.2	*Cyclobalanopsis*
Quercus benthamii	NT	CR,GT,HN,MX,NI,PA,SV	15	5.3.1,2.1.3,2.3.3	*Lobatae*
Quercus berberidifolia	LC	MX,US	43	8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus bicolor	LC	CA,US	220	7.1.1,5.3.5,8.2.2,8.2.2,11.1	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus bidoupensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus blakei	LC	CN,HK,LA,VN	1	5.3.5	*Cyclobalanopsis*
Quercus blaoensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus boyntonii	CR	US	21	9.4,1.3,5.3.1,6.1	*Quercus*
Quercus braianensis	VU	LA,VN	0	2.1.4	*Cyclobalanopsis*
Quercus brandegeei	EN	MX	9	2.3.2,1.3,11.2,5.3.1	*Virentes*
Quercus brandisiana	LC	LA,MM,TH	0	2.1.1,5.3.1	*Cyclobalanopsis*
Quercus brantii	LC	IQ,IR,SY,TR	23	5.3.3,8.4.1	*Cerris*
*Quercus breedloveana**	DD	MX	0	-	*Lobatae*
Quercus brevicalyx	DD	CN,LA,TH	0	2.1.1	*Cyclobalanopsis*
Quercus buckleyi	LC	US	51	8.2.2,8.4.2	*Lobatae*
Quercus bumelioides	LC	CR,GT,HN,MX,NI,PA	1	2.3.4,2.1.4,5.3.5	*Lobatae*
Quercus calophylla	LC	GT,MX	16	2.1.2,1.1	*Lobatae*
Quercus cambodiensis	CR	KH	0	1.1,5.3.5	*Lobatae*
Quercus camusiae	CR	VN	0	-	*Cyclobalanopsis*
Quercus canariensis	DD	DZ,ES,MA,PT,TN	83	7.1.1,5.3.2,2.2.2,11.2	*Quercus*
Quercus canbyi	LC	MX	39	2.1.2,7.1.1,2.3.2	*Lobatae*
Quercus carduchorum	DD	IR	0	8.1.1,11.3,11.2	*Cerris*
Quercus carmenensis	EN	MX,US	3	8.2.2,2.3.2	*Quercus*
Quercus castanea	LC	GT,MX,SV	25	1.1,2.3.4,2.1.4	*Lobatae*
Quercus castaneifolia	NT	AZ,IR	105	2.1.4,2.3.4	*Cerris*
Quercus cedrosensis	VU	MX,US	2	6.2,7.1.3,4.1,5.3.1	*Protobalanus*
*Quercus centenaria**	DD	MX	0	-	*Quercus*
Quercus cerris	LC	AL,AT,BA,BG,CH,CZ,ES,FR,GR,HR,HU, IT,LB,ME,MK,PT,RO,RS,SI,SK,SY,TR	211	2.1.1	*Cerris*
Quercus championii	LC	CN,TW	6	-	*Cyclobalanopsis*
Quercus chapensis	DD	CN,VN	3	-	*Cyclobalanopsis*
Quercus chapmanii	LC	US	16	7.1.2,6.1,1.1	*Quercus*
Quercus chenii	NT	CN	38	2.1.4,1.1,5.3.5	*Cerris*
Quercus chevalieri	DD	CN,VN	0	-	*Cyclobalanopsis*
Quercus chihuahuensis	LC	MX,US	5	2.3.2,6.1,7.1.3	*Quercus*
Quercus chrysocalyx	DD	CN,KH,LA,TH,VN	1	5.3.1	*Cyclobalanopsis*
Quercus chrysolepis	LC	MX,US	82	1.1,7.1.2	*Protobalanus*
Quercus chrysotricha	EN	MY	0	5.3.5	*Cyclobalanopsis*
Quercus chungii	LC	CN	1	-	*Cyclobalanopsis*
Quercus ciliaris	LC	CN	10	-	*Cyclobalanopsis*
Quercus coahuilensis	DD	MX	0	-	*Lobatae*
Quercus coccifera	LC	AL,BA,BG,CY,DZ,ES,FR,GR,HR,IL,IT,JO, LB,LY,MA,ME,MK,PS,PT,RS,SI,SY,TN,TR	131	2.3.4,2.2.3,7.1.1	*Ilex*
Quercus cocciferoides	LC	CN	2	-	*Ilex*
Quercus coccinea	LC	US	216	8.4.2	*Lobatae*
Quercus coffeicolor	DD	MX	0	-	*Lobatae*
Quercus conduplicans	DD	CN	0	-	*Cyclobalanopsis*
Quercus confertifolia	LC	MX	0	2.1.2,2.3.2,4.2	*Lobatae*
Quercus congesta	LC	IT	0	7.1.1,2.3.4,2.1.4,1.1	*Quercus*
Quercus convallata	LC	MX	0	-	*Quercus*
Quercus conzattii	LC	MX	1	-	*Lobatae*
Quercus cornelius-mulleri	LC	MX,US	15	6.1	*Quercus*
Quercus corrugata	LC	BZ,CR,GT,HN,MX,SV	14	-	*Quercus*
Quercus cortesii	NT	BZ,CR,GT,HN,MX,NI,PA,SV	0	1.2,2.1.3	*Lobatae*
Quercus costaricensis	VU	CR,HN,PA	2	5.3.1,4.1,11.1,7.1.1,10.3,5.3.1,4.1	*Lobatae*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus crassifolia	LC	GT,MX	36	1.1,2.3.4,11.1	*Lobatae*
Quercus crassipes	LC	MX	32	5.3.1,2.3.3	*Lobatae*
Quercus crispifolia	NT	GT,MX	0	3.3,2.1.3	*Lobatae*
Quercus crispipilis	NT	GT,MX	7	5.3.2,11.1,2.3.3	*Lobatae*
Quercus cualensis	EN	MX	1	3.2,1.3,2.3.2,5.3.5	*Lobatae*
Quercus cupreata	EN	MX	4	1.1,2.3.2,5.3.1	*Lobatae*
Quercus daimingshanensis	EN	CN	0	1.1,2.1.4,4.1,5.3.1	*Cyclobalanopsis*
Quercus dalechampii	DD	IT	21	-	*Quercus*
Quercus dankiaensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus delavayi	LC	CN	2	-	*Cyclobalanopsis*
Quercus delgadoana	EN	MX	9	2.1.2,5.3.1,5.3.3	*Lobatae*
Quercus delicatula	EN	CN	0	1.1	*Cyclobalanopsis*
Quercus deliquescens	DD	MX	3	2.3.2,1.1,1.2,4.2	*Quercus*
Quercus dentata	LC	CN,JP,KR,MN,RU,TW	168	-	*Quercus*
Quercus depressa	LC	MX	2	1.2,2.3.2,4.1,11.1,11.2,5.3.3	*Lobatae*
Quercus depressipes	LC	MX,US	1	5.3.5	*Quercus*
Quercus deserticola	LC	MX	9	-	*Quercus*
Quercus devia	EN	MX	0	2.3.2	*Lobatae*
Quercus dilacerata	CR	VN	0	-	*Cyclobalanopsis*
Quercus dinghuensis	CR	CN	1	1.1,5.3.1	*Cyclobalanopsis*
Quercus disciformis	EN	CN	2	1.1	*Cyclobalanopsis*
Quercus diversifolia	EN	MX	3	1.2,1.1	*Quercus*
Quercus dolicholepis	LC	CN	14	-	*Ilex*
Quercus dongfangensis	DD	CN	0	2.2.2	*Cyclobalanopsis*
Quercus donnaiensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus douglasii	LC	US	63	2.3.2,11.2,8.1.1,1.1,7.1.2,8.2.2,8.2.2	*Quercus*
Quercus dumosa	EN	MX,US	30	1.3,7.1.3,1.1,6.1,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus durata	LC	US	37	-	*Quercus*
Quercus durifolia	NT	MX	10	2.1.4,2.3.4,5.3.1	*Lobatae*
Quercus edithiae	EN	CN,HK,VN	0	1.1,5.3.1	*Cyclobalanopsis*
Quercus eduardi	LC	MX	7	5.3.1,2.3.4,11.1,2.1.4	*Lobatae*
Quercus edwardsiae	DD	MX	3	-	*Quercus*
Quercus elevaticostata	DD	CN	0	-	*Cyclobalanopsis*
Quercus ellipsoidalis	LC	CA,US	115	8.4.2,11.1	*Lobatae*
Quercus elliptica	LC	BZ,GT,HN,MX,NI,SV	5	8.4.2	*Lobatae*
Quercus elmeri	NT	BN,ID,MY	1	2.1.4,7.1.3	*Cyclobalanopsis*
Quercus emoryi	LC	MX,US	30	5.3.1,8.2.2,2.3.2,6.1,5.2.1,8.2.2, 7.1.2,11.1	*Lobatae*
Quercus engelmannii	EN	MX,US	36	1.2,1.1,2.3.4,7.1.1,8.2.2,11.1,8.2.2	*Quercus*
Quercus engleriana	LC	CN	15	-	*Ilex*
Quercus eumorpha	DD	MM,TH	0	-	*Cyclobalanopsis*
Quercus fabrei	LC	CN,HK	31	-	*Quercus*
Quercus faginea	LC	ES,MA,PT	88	2.1.4,11.2,8.2,11.3,1.3	*Quercus*
Quercus falcata	LC	US	111	8.4.2	*Lobatae*
Quercus fimbriata	CR	CN	0	1.1	*Ilex*
Quercus flocculenta	EN	MX	3	1.1,5.3.3	*Lobatae*
Quercus floribunda	LC	AF,IN,NP,PK	3	-	*Ilex*
Quercus frainetto	LC	AL,BA,BG,CZ,GR,HR,IT,MK,RO, RS,SK,TR	132	2.1.4,8.3,5.3.1	*Quercus*
Quercus franchetii	LC	CN,TH	17	-	*Ilex*
Quercus frutex	LC	MX	8	8.4.1,11.5	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus fuliginosa	DD	CN	0	2.1.4	*Cyclobalanopsis*
Quercus fulva	LC	MX	2	-	*Lobatae*
Quercus furfuracea	VU	MX	5	5.3.4,5.3.1,2.3.3	*Lobatae*
Quercus fusiformis	LC	MX,US	39	5.3.3,2.3.4,8.2,8.4.2	*Virentes*
Quercus gaharuensis	VU	ID,MY	0	2.2.3,5.3.5,1.1	*Cyclobalanopsis*
Quercus galeanensis	EN	MX	8	2.1.2,5.3.2,1.1,2.3.2	*Lobatae*
Quercus gambelii	LC	MX,US	76	-	*Quercus*
Quercus gambleana	LC	BD,CN,IN	0	-	*Cyclobalanopsis*
Quercus garryana	LC	CA,US	79	2.3.2,8.2.2,8.2.2,8.2.2,8.1.2	*Quercus*
Quercus gemelliflora	LC	BN,ID,MY	5	2.2.2	*Cyclobalanopsis*
Quercus geminata	LC	US	28	-	*Virentes*
Quercus georgiana	EN	US	55	11.1,11.2,6.1,8.2.2	*Lobatae*
Quercus germana	LC	MX	27	2.3.3,2.3.2,5.3.1	*Quercus*
Quercus ghiesbreghtii	DD	MX	0	-	*Lobatae*
Quercus gilliana	LC	CN	0	-	*Ilex*
Quercus gilva	LC	CN,JP,KR,TW	35	-	*Cyclobalanopsis*
Quercus glabrescens	LC	MX	16	5.3.2,2.3.3	*Quercus*
Quercus glauca	LC	AF,BT,CN,HK,IN,JP,KP,KR,LA, MM,NP,TW	111	2.1.1	*Cyclobalanopsis*
Quercus glaucescens	LC	MX	0	7.1.3,5.3.5,2.1.4	*Quercus*
Quercus glaucoides	LC	MX	20	2.1.1,1.1,8.1.2	*Quercus*
Quercus gomeziana	DD	BD,CN,MM,VN	0	-	*Cyclobalanopsis*
Quercus gracilenta	DD	CN	0	-	*Cyclobalanopsis*
Quercus graciliformis	CR	MX,US	21	6.1,7.2.8,8.2.2,7.1.3	*Lobatae*
*Quercus gracilior**	DD	HN	0	-	*Lobatae*
Quercus grahamii	DD	MX	3	-	*Lobatae*
Quercus gravesii	LC	MX,US	36	7.2.2,2.3.2,11.2	*Lobatae*
Quercus greggii	LC	MX	27	-	*Quercus*
Quercus griffithii	LC	BT,CN,IN,LA,MM,NP,TH,VN	26	2.1.1	*Quercus*
Quercus grisea	LC	MX,US	39	2.3.2,2.1.2,5.3.1,11.1	*Quercus*
Quercus gulielmi-treleasei	VU	CR,PA	2	5.3.5	*Lobatae*
Quercus guyavifolia	LC	CN	10	-	*Ilex*
Quercus hartwissiana	DD	BG,GE,RU,TR	53	7.1.3,5.3.1,1.2	*Quercus*
Quercus havardii	EN	US	19	3.1,2.3.3,9.3.3	*Quercus*
Quercus helferiana	LC	CN,IN,LA,MM,TH,VN	0	5.3.1	*Cyclobalanopsis*
Quercus hemisphaerica	LC	US	48	8.2.2	*Lobatae*
Quercus hinckleyi	CR	MX,US	12	8.2.2,8.2.2,11.1,2.3.4,4.1,1.3,8.2.1	*Quercus*
Quercus hintonii	EN	MX	3	2.1.2,1.1,2.3.2,4.1,5.3.1,7.1.1	*Lobatae*
Quercus hintoniorum	VU	MX	6	7.1.1,1.1,2.1.2	*Lobatae*
Quercus hirtifolia	EN	MX	7	5.3.3,1.2,4.1,2.3.2,11.2,11.1	*Lobatae*
Quercus honbaensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus hondae	VU	JP	2	2.1.4	*Cyclobalanopsis*
Quercus humboldtii	LC	CO,PA	7	1.1,4.1,5.3.1	*Lobatae*
Quercus hypargyrea	NT	CN	21	1.1,5.3.5	*Cyclobalanopsis*
Quercus hypoleucoides	LC	MX,US	27	-	*Lobatae*
Quercus hypophaea	NT	TW	1	1.1,4.1	*Cyclobalanopsis*
Quercus hypoxantha	LC	MX	5	-	*Lobatae*
Quercus ichnusae	LC	IT	0	2.3.4,7.1.1	*Quercus*
Quercus ignaciensis	DD	MX	0	-	*Lobatae*
Quercus ilex	LC	AL,BA,CH,DZ,ES,FR,GR,HR,IT,LY, MA,ME,MT,RS,SI,TN,TR	212	1.2,1.1,9.5.4,7.1.3,5.3.1,11.2,2.3.3, 2.1.3,8.2	*Ilex*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus ilicifolia	LC	CA,US	101	7.1.2,11.1	*Lobatae*
Quercus iltisii	NT	MX	0	5.3.4,4.1,1.1,2.3.4,2.1.4	*Lobatae*
Quercus imbricaria	LC	US	190	8.4.2,11.1	*Lobatae*
Quercus incana	LC	US	43	7.1.2,11.1	*Lobatae*
Quercus infectoria	LC	AZ,CY,GR,IL,IQ,IR,LB,PS,SY,TR	51	5.3.5,2.1.4,2.3.4	*Quercus*
Quercus inopina	LC	US	7	7.1.2,1.2,1.1,2.1.4	*Lobatae*
Quercus insignis	EN	BZ,CR,GT,HN,MX,NI,PA	27	2.1.2,2.3.2,5.3.1	*Quercus*
Quercus intricata	LC	MX,US	5	2.3.2,1.2,5.2.2,7.1.2,11.2	*Quercus*
Quercus invaginata	LC	MX	9	-	*Quercus*
Quercus ithaburensis	LC	AL,GR,IL,IT,LB,SY,TR	84	5.3.1,2.3.4,1.3,1.1	*Cerris*
Quercus jenseniana	NT	CN	3	5.3.5,2.1.4	*Cyclobalanopsis*
Quercus jinpinensis	DD	CN	0	-	*Cyclobalanopsis*
Quercus john-tuckeri	LC	US	22	1.1,7.1.2,2.3.2	*Quercus*
Quercus jonesii	LC	MX	2	-	*Lobatae*
Quercus kelloggii	LC	MX,US	68	5.3.2,7.1.2,7.1.1,8.2.2,8.2.2	*Lobatae*
Quercus kerangasensis	VU	BN,ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus kerrii	LC	CN,KH,LA,MM,TH,VN	1	-	*Cyclobalanopsis*
Quercus kinabaluensis	EN	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus kingiana	EN	CN,LA,MM,TH	0	1.1,2.1.4,2.2.3,5.3.1,5.3.3	*Ilex*
Quercus kiukiangensis	EN	CN	4	5.3.5,7.1.3	*Cyclobalanopsis*
Quercus kotschyana	EN	LB	0	2.3.2,5.3.1,11.1	*Quercus*
Quercus kouangsiensis	EN	CN	0	2.1.3,4.1,5.3.4	*Cyclobalanopsis*
Quercus laceyi	LC	MX,US	33	11.1	*Quercus*
Quercus laeta	LC	MX	25	11.1	*Quercus*
Quercus laevis	LC	US	29	2.2.2,8.4.2,11.1	*Lobatae*
Quercus lamellosa	NT	BT,CN,IN,MM,NP,TH	11	2.1.4,5.3.3,5.3.4,7.1.3	*Cyclobalanopsis*
Quercus lanata	LC	BT,CN,IN,MM,NP,TH,VN	7	-	*Ilex*
Quercus lancifolia	LC	BZ,CR,GT,HN,MX,NI,PA,SV	10	1.2,2.3.3	*Quercus*
Quercus langbianensis	NT	VN	0	-	*Cyclobalanopsis*
Quercus laurifolia	LC	US	70	8.4.1,8.4.2	*Lobatae*
Quercus laurina	LC	GT,MX,SV	30	7.1.1,5.3.5,2.3.1	*Lobatae*
Quercus lenticellata	EN	TH	0	5.3.5,7.1.3	*Cyclobalanopsis*
Quercus liaoi	DD	TW	1	-	*Cyclobalanopsis*
Quercus libani	LC	IQ,IR,SY,TR	88	8.4.1	*Cerris*
Quercus liboensis	EN	CN	2	1.1,2.1.3	*Cyclobalanopsis*
Quercus liebmannii	LC	MX	8	2.3.2	*Quercus*
Quercus lineata	LC	BD,CN,ID,IN,LA,MY,TH,VN	1	2.2.2	*Cyclobalanopsis*
Quercus litseoides	VU	CN,HK	1	11.1,1.3	*Cyclobalanopsis*
Quercus lobata	NT	US	82	1.1,2.1.1,7.1.2,2.3.2,11.1	*Quercus*
Quercus lobbii	EN	BD,CN,IN	0	5.3.5	*Cyclobalanopsis*
Quercus lodicosa	EN	CN,IN,MM	0	5.3.5	*Ilex*
Quercus longinux	LC	TW	12	-	*Cyclobalanopsis*
Quercus longispica	LC	CN	5	-	*Ilex*
Quercus look	EN	LB,SY	16	2.3.2,11.1	*Cerris*
Quercus lowii	NT	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus lungmaiensis	CR	CN	1	2.1.4	*Cyclobalanopsis*
Quercus lusitanica	LC	ES,MA,PT	33	-	*Quercus*
Quercus lyrata	LC	US	111	11.1	*Quercus*
Quercus macdougallii	EN	MX	0	2.3.2,5.3.4,7.1.1	*Quercus*
Quercus macranthera	LC	AM,AZ,GE,IQ,IR,LB,RU,SY,TR	100	11.2,2.3.1,8.1.1,8.2	*Quercus*
Quercus macrocalyx	LC	CN,LA,VN	6	-	*Cyclobalanopsis*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus macrocarpa	LC	CA,US	261	7.1.2,2.3.4	*Quercus*
Quercus magnoliifolia	LC	MX	5	11.1,7.1.1,5.3.2	*Quercus*
Quercus margarettae	LC	US	28	11.1	*Quercus*
Quercus marilandica	LC	US	101	8.4.1	*Lobatae*
Quercus marlipoensis	CR	CN	1	1.1,5.3.1	*Ilex*
Quercus martinezii	LC	MX	1	-	*Quercus*
Quercus mcvaughii	NT	MX	1	1.1,2.3.4,2.1.4	*Lobatae*
Quercus meavei	VU	MX	1	5.3.3,1.2,4.1,2.3.2,11.1,11.2	*Lobatae*
*Quercus melissae**	DD	GT,MX	0	-	*Quercus*
Quercus merrillii	VU	ID,MY,PH	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus mespilifolia	DD	BD,IN,LA,MM,TH,VN	1	-	*Cyclobalanopsis*
*Quercus mexiae**	DD	MX	0	-	*Lobatae*
Quercus mexicana	LC	MX	43	1.1,2.3.4,11.1,2.1.4	*Lobatae*
Quercus michauxii	LC	US	115	8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus microphylla	LC	MX	11	7.1.2	*Quercus*
Quercus minima	LC	US	12	7.1.2,1.1,2.3.3,2.2.2	*Virentes*
Quercus miquihuanensis	EN	MX	12	5.3.1,2.3.2	*Lobatae*
Quercus miyagii	LC	JP	0	-	*Cyclobalanopsis*
Quercus mohriana	LC	MX,US	18	-	*Quercus*
Quercus mongolica	LC	CN,JP,KP,KR,MN,RU	150	5.3.2	*Quercus*
Quercus monimotricha	LC	CN,MM	10	-	*Ilex*
Quercus monnula	CR	CN	0	1.1,2.1.3	*Quercus*
Quercus montana	LC	US	165	8.1.2,8.2.2,8.2.2,8.2.2,8.2.2,11.1	*Quercus*
Quercus morii	LC	TW	18	-	*Cyclobalanopsis*
Quercus motuoensis	CR	CN	0	1.1,2.1.3	*Cyclobalanopsis*
Quercus muehlenbergii	LC	CA,MX,US	184	8.2.2,7.1.1,8.1.2,8.2.2,8.2.2,11.1	*Quercus*
Quercus mulleri	CR	MX	0	5.3.4,4.1,2.2.3,2.1.4	*Lobatae*
Quercus myrsinifolia	LC	CN,HK,JP,KR,LA,TH,TW,VN	108	8.2.2	*Cyclobalanopsis*
Quercus myrtifolia	LC	US	24	7.1.2,1.2,1.1	*Lobatae*
Quercus nigra	LC	US	128	8.4.1	*Lobatae*
Quercus ningangensis	DD	CN	3	-	*Cyclobalanopsis*
Quercus ningqiangensis	DD	CN	0	-	*Quercus*
Quercus nivea	EN	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus nixoniana	EN	MX	0	5.3.2,2.1.3,4.1	*Lobatae*
Quercus obconicus	EN	CN	0	2.2.2	*Cyclobalanopsis*
Quercus oblongata	NT	BD,IN,MM,NP,PK,TH,VN	16	5.3.1,5.3.2,2.1.4	*Cyclobalanopsis*
Quercus oblongifolia	LC	MX,US	23	2.3.2,8.2.2	*Quercus*
Quercus obtusata	LC	MX	27	5.3.5,2.3.4	*Quercus*
Quercus oglethorpensis	EN	US	47	8.1.2,8.1.2,8.1.2,2.1.4,2.2.2,1.2, 11.2,7.1.1,11.4,7.2.11	*Quercus*
Quercus oidocarpa	NT	ID,MM,MY,TH,VN	1	2.1.3,7.1.1	*Cyclobalanopsis*
Quercus oleoides	NT	BZ,CR,GT,HN,MX	12	1.1,5.3.1,2.3.2	*Virentes*
Quercus opaca	DD	MX	1	-	*Quercus*
Quercus oxyodon	LC	BD,BT,CN,IN,MM,NP,TH	15	-	*Cyclobalanopsis*
Quercus oxyphylla	NT	CN	0	1.1,2.1.3	*Ilex*
Quercus pachyloma	LC	CN,TW	6	-	*Cyclobalanopsis*
Quercus pacifica	EN	US	22	2.3.2,8.1.2,8.1.2,6.1,8.1.2,8.1.2,8.1.2, 1.3,9.5.4,5.3.1,3.2	*Quercus*
Quercus pagoda	LC	US	60	8.4.2,11.1	*Lobatae*
Quercus palmeri	NT	MX,US	29	1.1,11.1,11.2,8.2.1,1.3,7.1.3	*Protobalanus*
Quercus palustris	LC	CA,US	263	8.4.1,8.4.2,11.1	*Lobatae*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
*Quercus pannosa**	LC	CN	0	-	*Ilex*
Quercus parvula	NT	US	25	1.1,2.3.4,6.1,7.1.1,8.1.2,11.2	*Quercus*
Quercus pauciradiata	DD	ES	0	8.3,12.1,1.1	*Quercus*
Quercus paxtalensis	DD	MX	0	7.1.1,5.3.2,2.3.3	*Lobatae*
Quercus peduncularis	LC	BZ,GT,HN,MX,SV	8	11.1	*Quercus*
Quercus peninsularis	NT	MX	2	2.3.2	*Lobatae*
Quercus pentacycla	DD	CN	2	-	*Cyclobalanopsis*
Quercus percoriacea	EN	MY	0	2.1.3,7.1.1	*Cyclobalanopsis*
Quercus perpallida	DD	MX	0	-	*Quercus*
Quercus persica	NT	IQ,IR	0	5.3.1,5.3.2	*Cerris*
Quercus petelotii	EN	VN	0	5.3.4	*Cyclobalanopsis*
Quercus petraea	LC	AL,AM,AT,AZ,BA,BE,BG,BY,CH,CZ,DE, DK,ES,FR,GB,GE,HR,HU,IE,IR,IT,LT,ME, MK,NL,NO,PL,RO,RS,RU,SI,SK,SY,TR,UA	178	8.1.2,2.2.2,5.3.2,5.3.1,11.1,8.1.2	*Quercus*
Quercus phanera	EN	CN	1	1.1,2.1.3	*Cyclobalanopsis*
Quercus phellos	LC	US	180	8.4.1	*Lobatae*
Quercus phillyreoides	LC	CN,JP,KP,KR	105	-	*Ilex*
Quercus pinbianensis	CR	CN	0	2.2.2,2.1.3	*Cyclobalanopsis*
Quercus pinnativenulosa	NT	MX	6	1.1,2.1.2,5.3.4	*Lobatae*
Quercus planipocula	LC	MX	2	2.1.3,7.1.1	*Lobatae*
Quercus platycalyx	DD	CN,VN	0	2.2.2,1.1,5.3.4	*Cyclobalanopsis*
Quercus poilanei	LC	CN,TH,VN	0	-	*Cyclobalanopsis*
Quercus polymorpha	LC	GT,HN,MX,US	47	5.2.1,5.3.1,11.1	*Quercus*
Quercus pontica	EN	GE,TR	91	2.3.1,5.3.1,5.3.2	*Ponticae*
*Quercus porphyrogenita**	DD	MX	0	-	*Quercus*
Quercus potosina	LC	MX	4	5.3.2,2.1.3,8.4.1,2.3.3	*Quercus*
Quercus praeco	LC	MX	1	5.3.5,2.3.4	*Quercus*
Quercus pringlei	LC	MX	8	2.3.2,7.1.1,2.1.2	*Quercus*
Quercus prinoides	LC	CA,US	70	11.1	*Quercus*
*Quercus protoroburoides**	DD	BG	0	-	*Quercus*
Quercus pseudosetulosa	CR	CN	0	11.1	*Ilex*
*Quercus pseudoverticillata**	CR	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus pubescens	LC	AL,AT,BE,BG,CH,CZ,DE,ES,FR,GR,HR, IT,MD,ME,MK,RO,RS,RU,SI,SK,TR,UA	136	11.3,1.1,8.2,7.1.1	*Quercus*
Quercus pumila	LC	US	27	7.1.2	*Lobatae*
Quercus pungens	LC	MX,US	24	-	*Quercus*
Quercus purulhana	NT	BZ,GT,HN,MX,NI	0	7.1.1,5.3.2,1.1,2.3.3	*Quercus*
Quercus pyrenaica	LC	ES,FR,MA,PT	89	2.1.3,8.2.1,8.2,2.1.2,7.1.1,2.3.3,2.3.2, 2.2.2,11.5,11.2	*Quercus*
Quercus quangtriensis	VU	CN,LA,MM,TH,VN	0	2.2.2,1.1,5.3.4	*Cyclobalanopsis*
Quercus radiata	EN	MX	0	2.3.2,4.1,2.2.2	*Lobatae*
Quercus ramsbottomii	EN	MM,TH	0	2.1.4,2.2.3	*Cyclobalanopsis*
Quercus rehderiana	LC	CN,TH	6	-	*Ilex*
Quercus rekonis	DD	MX	0	-	*Quercus*
Quercus repanda	LC	MX	5	-	*Quercus*
Quercus resinosa	LC	MX	3	11.5	*Quercus*
Quercus rex	LC	CN,IN,LA,MM,TH,VN	2	-	*Cyclobalanopsis*
Quercus robur	LC	AL,AM,AT,AZ,BA,BE,BG,BY,CH,CZ,DE,D K,EE,ES,FI,FR,GB,GE,GR,HR,HU,IE,IR, IT,KZ,LT,LU,LV,MD,ME,MK,NL,NO,PL, PT,RO,RS,RU,SE,SI,SK,TR,UA	332	8.1.2,5.3.2,1.1,2.3.4,2.2.3,11.4,11.3, 11.2,11.1,2.1.4,8.3,8.1.2	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus robusta	DD	MX,US	2	7.1.3,6.1,11.4,11.2	*Lobatae*
Quercus rotundifolia	LC	DZ,ES,FR,MA,PT	47	2.1.2,2.3.2,11.2,11.3,7.1.1,8.1.2	*Ilex*
Quercus rubra	LC	CA,US	334	11.2,11.3,8.4.2	*Lobatae*
Quercus rubramenta	VU	MX	0	2.1.3,2.1.2,2.3.2	*Lobatae*
Quercus rugosa	LC	GT,HN,MX,US	70	11.1,5.2.1,7.1.1,5.3.1,1.1	*Quercus*
Quercus runcinatifolia	EN	MX	1	1.1,2.3.2,5.3.1	*Lobatae*
Quercus rupestris	EN	VN	0	5.3.4	*Cyclobalanopsis*
Quercus rysophylla	NT	MX	53	5.3.5,1.2	*Lobatae*
Quercus sadleriana	NT	US	25	1.1,6.1,4.1,7.1.2,5.3.2,2.3.2,3.2	*Ponticae*
Quercus sagrana	EN	CU	1	7.1.1,2.3.3,3.2	*Virentes*
Quercus salicifolia	LC	CR,GT,HN,MX,NI,PA,SV	4	5.3.2,2.3.2	*Lobatae*
Quercus salicina	LC	JP,KR	44	-	*Cyclobalanopsis*
Quercus saltillensis	NT	MX	7	2.3.2,2.1.1,1.1	*Lobatae*
Quercus sapotifolia	LC	BZ,CR,GT,HN,MX,PA,SV	2	-	*Lobatae*
*Quercus sarahmariae**	DD	CR	0	-	*Lobatae*
Quercus saravanensis	DD	CN,LA,TH	0	-	*Cyclobalanopsis*
Quercus sartorii	NT	MX	24	2.3.2,11.5	*Lobatae*
Quercus schottkyana	LC	CN	19	-	*Cyclobalanopsis*
Quercus scytophylla	LC	MX	8	5.3.1,2.3.3	*Lobatae*
Quercus sebifera	LC	MX	6	5.3.2,2.3.3	*Quercus*
Quercus segoviensis	LC	GT,HN,MX,NI,SV	0	2.3.2	*Quercus*
Quercus semecarpifolia	LC	AF,CN,IN,NP,PK	19	-	*Ilex*
Quercus semiserrata	LC	BD,BT,CN,ID,IN,MM,MY,TH,VN	0	-	*Cyclobalanopsis*
Quercus semiserratoides	CR	CN	2	2.2.2,5.3.1	*Cyclobalanopsis*
Quercus senescens	LC	CN	5	-	*Ilex*
Quercus serrata	LC	CN,JP,KP,KR,TW	127	2.1.1,1.1	*Quercus*
Quercus sessilifolia	LC	CN,JP,TH,TW	23	-	*Cyclobalanopsis*
Quercus setulosa	LC	CN,LA,TH,VN	0	-	*Ilex*

Quercus magnoliifolia, *LC* (Béatrice Chassé)

Quercus insignis, *EN* (Diego Gomez Hoyos)

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus shangxiensis	DD	CN	0	-	*Ilex*
Quercus shennongii	DD	CN	0	-	*Quercus*
Quercus shingjenensis	DD	CN	0	-	*Quercus*
Quercus shumardii	LC	CA,US	173	8.4.2,11.1	*Lobatae*
Quercus sichourensis	CR	CN	1	2.1.4,5.3.1	*Cyclobalanopsis*
Quercus sideroxyla	LC	MX	8	5.3.2,2.3.2,11.1,2.2.2	*Lobatae*
Quercus similis	LC	US	3	11.1	*Quercus*
Quercus sinuata	LC	MX,US	40	-	*Quercus*
Quercus skinneri	NT	BZ,GT,HN,MX,SV	5	5.3.1,2.3.3	*Lobatae*
Quercus sororia	LC	MX	0	1.1,2.3.3	*Quercus*
Quercus spinosa	LC	CN,MM,TW	17	-	*Ilex*
Quercus steenisii	EN	ID	0	2.1.4,5.3.3	*Cyclobalanopsis*
Quercus stellata	LC	US	107	8.4.1,8.2.2	*Quercus*
Quercus stenophylloides	LC	TW	30	-	*Cyclobalanopsis*
Quercus stewardiana	LC	CN	5	-	*Cyclobalanopsis*
Quercus striatula	LC	MX	5	1.3,1.2	*Quercus*
Quercus suber	LC	DZ,ES,FR,IT,MA,PT,TN	197	2.1.4,8.2.1,8.2.7.3,7.1.1,11.2	*Cerris*
Quercus subsericea	NT	BN,ID,MY	3	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus subspathulata	LC	MX	7	5.3.3,5.3.1	*Quercus*
Quercus sumatrana	NT	ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus supranitida	DD	MX	0	-	*Quercus*
Quercus tarahumara	LC	MX	6	5.3.1,1.1	*Lobatae*
Quercus tardifolia	DD	MX,US	0	-	*Lobatae*
Quercus tarokoensis	DD	TW	6	-	*Ilex*
Quercus tatakaensis	DD	TW	5	-	*Ilex*
Quercus texana	LC	US	104	8.4.2,11.1	*Lobatae*
Quercus thomsoniana	CR	BD,BT,IN	0	1.1,5.3.4,2.1.3	*Cyclobalanopsis*
Quercus thorelii	DD	CN,LA,TH,VN	1	-	*Cyclobalanopsis*
Quercus tiaoloshanica	EN	CN	0	2.2.2	*Cyclobalanopsis*
Quercus tinkhamii	DD	MX	3	-	*Quercus*
Quercus tomentella	EN	MX,US	33	2.1.2,8.1.2,8.1.2,2.3.2,8.1.2,8.2.2,8.2.2, 8.2.2,8.1.2,8.1.2,8.1.2,8.1.2	*Quercus*
Quercus tomentosinervis	CR	CN	0	5.3.1,2.1.4,7.1.1,1.1	*Cyclobalanopsis*
Quercus toumeyi	DD	MX,US	8	8.2.2	*Quercus*
Quercus toxicodendrifolia	DD	MX	1	-	*Quercus*
Quercus treubiana	VU	ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus trinitatis	DD	MX,SV	0	5.3.2,2.1.3,5.3.4	*Lobatae*
Quercus trojana	LC	AL,BA,BG,GR,HR,IT,ME,MK,RS,TR	76	5.3.1	*Cerris*
*Quercus trungkhanhensis**	CR	VN	0	6.3	*Ilex*
Quercus tsinglingensis	DD	CN	0	-	*Quercus*
Quercus tuberculata	LC	MX	7	-	*Quercus*
Quercus tuitensis	VU	MX	0	2.1.2,5.3.2,5.3.4	*Lobatae*
Quercus tungmaiensis	EN	CN,IN	3	1.1,2.1.3	*Ilex*
Quercus turbinella	LC	MX,US	54	-	*Quercus*
Quercus undata	DD	MX	0	-	*Quercus*
Quercus ungeri	DD	IR	0	-	*Cerris*
Quercus urbani	LC	MX	1	-	*Lobatae*
Quercus utilis	EN	CN	2	1.1,4.1,5.3.1,5.3.4	*Ilex*
Quercus uxoris	LC	MX	7	5.3.1,2.1.2,4.1	*Lobatae*
Quercus vacciniifolia	LC	US	38	5.3.2,11.1,7.1.2	*Protobalanus*
Quercus valdinervosa	NT	BN,ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus variabilis	LC	CN,HK,JP,KP,KR,TW,VN	137	6.3	*Cerris*
Quercus vaseyana	LC	MX,US	32	-	*Quercus*
Quercus velutina	LC	CA,US	182	11.2,8.4.2,8.1.2	*Lobatae*
Quercus verde	DD	MX	0	-	*Quercus*
Quercus vestita	DD	IN	0	-	*Cyclobalanopsis*
Quercus vicentensis	VU	MX,SV	1	5.3.5,1.1	*Quercus*
Quercus viminea	LC	MX,US	3	5.2.1,2.3.2,5.2.2,11.1	*Lobatae*
Quercus virginiana	LC	US	132	7.1.1,11.3,8.4.2	*Virentes*
Quercus vulcanica	LC	SY,TR	15	1.3	*Quercus*
Quercus wislizeni	LC	MX,US	64	2.3.2,11.1,7.1.2	*Lobatae*
Quercus wutaishanica	LC	CN	33	-	*Quercus*
Quercus xalapensis	LC	GT,HN,MX,NI	15	-	*Lobatae*
Quercus xanthoclada	DD	LA,MM,VN	0	-	*Cyclobalanopsis*
*Quercus xanthotricha**	EN	CN,LA	0	2.1.3	*Cyclobalanopsis*
*Quercus xuanlienensis**	CR	VN	0	-	*Cyclobalanopsis*
Quercus xylina	NT	MX	0	2.3.2,2.1.2	*Quercus*
Quercus yonganensis	DD	CN	0	-	*Cyclobalanopsis*

*Assessments to be published in the first IUCN Red List update of 2021

Data sources for Appendices B and C

Country/Territory distribution

Country/territory codes follow the International Organization for Standardization ISO-3166-1. A list of all countries and territories used in IUCN's Red List of Threatened Species can be found online (iucnredlist.org/resources/country-codes).

Number of *ex situ* collections

Based on combined results from: 1) 2017 *ex situ* survey conducted by The Morton Arboretum (Beckman *et al*., 2019); 2) 2019 survey conducted for a project funded through the Institute of Museum and Library Services (award #MA-30-18-0273-18); 3) 2020 survey funded by the USDA Forest Service (cooperative agreement #16-CA-11132546-045) and Fondation Franklinia to support the conservation work of the Global Conservation Consortium for Oak; and 4) records held in BGCI's PlantSearch database of plants in cultivation (tools.bgci.org/plant_search.php; accessed May, 2020).

Threat codes

Threat codes follow IUCN's Threats Classification Scheme (Version 3.2) found online (iucnredlist.org/resources/threat-classification-scheme)

***Quercus* section**

Assessed species were matched to the most recent phylogenetic studies of oaks (Denk *et al*., 2017; Hipp *et al*., 2020). Thirty-five species assessed for this report were not included in either of these phylogenetic studies. For these species, a literature review was conducted to determine their section and/or regional oak experts were consulted to assign a section (A. Coombes and J. Strijk, pers. comm.).

Quercus ajoensis, *VU* *(Beth Fallon)*

Quercus havardii, *LC* *(Emily Beckman)*

Appendix C:

Full list of evaluated *Quercus* species by Red List category

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus albicaulis	CR	CN	0	2.2.3,5.3.1,5.3.4	*Cyclobalanopsis*
Quercus argyrotricha	CR	CN	4	6.3	*Cyclobalanopsis*
Quercus baniensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus baolamensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus bawanglingensis	CR	CN	0	2.2.3,5.3.3	*Ilex*
Quercus bidoupensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus blaoensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus boyntonii	CR	US	21	9.4,1.3,5.3.1,6.1	*Quercus*
Quercus cambodiensis	CR	KH	0	1.1,5.3.5	*Lobatae*
Quercus camusiae	CR	VN	0	-	*Cyclobalanopsis*
Quercus dankiaensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus dilacerata	CR	VN	0	-	*Cyclobalanopsis*
Quercus dinghuensis	CR	CN	1	1.1,5.3.1	*Cyclobalanopsis*
Quercus donnaiensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus fimbriata	CR	CN	0	1.1	*Ilex*
Quercus graciliformis	CR	MX,US	21	6.1,7.2.8,8.2.2,7.1.3	*Lobatae*
Quercus hinckleyi	CR	MX,US	12	8.2.2,8.2.2,11.1,2.3.4,4.1,1.3,8.2.1	*Quercus*
Quercus honbaensis	CR	VN	0	-	*Cyclobalanopsis*
Quercus lungmaiensis	CR	CN	1	2.1.4	*Cyclobalanopsis*
Quercus marlipoensis	CR	CN	1	1.1,5.3.1	*Ilex*
Quercus monnula	CR	CN	0	1.1,2.1.3	*Quercus*
Quercus motuoensis	CR	CN	0	1.1,2.1.3	*Cyclobalanopsis*
Quercus mulleri	CR	MX	0	5.3.4,4.1,2.2.3,2.1.4	*Lobatae*
Quercus pinbianensis	CR	CN	0	2.2.2,2.1.3	*Cyclobalanopsis*
*Quercus pseudosetulosa**	CR	CN	0	11.1	*Ilex*
Quercus pseudoverticillata	CR	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus semiserratoides	CR	CN	2	2.2.2,5.3.1	*Cyclobalanopsis*
Quercus sichourensis	CR	CN	1	2.1.4,5.3.1	*Cyclobalanopsis*
Quercus thomsoniana	CR	BD,BT,IN	0	1.1,5.3.4,2.1.3	*Cyclobalanopsis*
Quercus tomentosinervis	CR	CN	0	5.3.1,2.1.4,7.1.1,1.1	*Cyclobalanopsis*
*Quercus trungkhanhensis**	CR	VN	0	6.3	*Ilex*
*Quercus xuanlienensis**	CR	VN	0	-	*Cyclobalanopsis*
Quercus acerifolia	EN	US	44	3.2,2.3.2,7.1.2,5.3.4,1.3,8.4.1,6.1,1.2,9.4	*Lobatae*
Quercus arbutifolia	EN	CN,VN	0	11.1,1.1	*Cyclobalanopsis*
Quercus asymmetrica	EN	CN,VN	0	1.1,1.2,5.3.4,6.3	*Cyclobalanopsis*
Quercus bambusifolia	EN	CN,HK,VN	4	12.1,2.1.3	*Cyclobalanopsis*
Quercus brandegeei	EN	MX	9	2.3.2,1.3,11.2,5.3.1	*Virentes*
Quercus carmenensis	EN	MX,US	3	8.2.2,2.3.2	*Quercus*
Quercus chrysotricha	EN	MY	0	5.3.5	*Cyclobalanopsis*
Quercus cualensis	EN	MX	1	3.2,1.3,2.3.2,5.3.5	*Lobatae*
Quercus cupreata	EN	MX	4	1.1,2.3.2,5.3.1	*Lobatae*
Quercus daimingshanensis	EN	CN	0	1.1,2.1.4,4.1,5.3.1	*Cyclobalanopsis*
Quercus delgadoana	EN	MX	9	2.1.2,5.3.1,5.3.3	*Lobatae*
Quercus delicatula	EN	CN	0	1.1	*Cyclobalanopsis*
Quercus devia	EN	MX	0	2.3.2	*Lobatae*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus disciformis	EN	CN	2	1.1	*Cyclobalanopsis*
Quercus diversifolia	EN	MX	3	1.2,1.1	*Quercus*
Quercus dumosa	EN	MX,US	30	1.3,7.1.3,1.1,6.1,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus edithiae	EN	CN,HK,VN	0	1.1,5.3.1	*Cyclobalanopsis*
Quercus engelmannii	EN	MX,US	36	1.2,1.1,2.3.4,7.1.1,8.2.2,11.1,8.2.2	*Quercus*
Quercus flocculenta	EN	MX	3	1.1,5.3.3	*Lobatae*
Quercus galeanensis	EN	MX	8	2.1.2,5.3.2,1.1,2.3.2	*Lobatae*
Quercus georgiana	EN	US	55	11.1,11.2,6.1,8.2.2	*Lobatae*
Quercus havardii	EN	US	19	3.1,2.3.3,9.3.3	*Quercus*
Quercus hintonii	EN	MX	3	2.1.2,1.1,2.3.2,4.1,5.3.1,7.1.1	*Lobatae*
Quercus hirtifolia	EN	MX	7	5.3.3,1.2,4.1,2.3.2,11.2,11.1	*Lobatae*
Quercus insignis	EN	BZ,CR,GT,HN,MX,NI,PA	27	2.1.2,2.3.2,5.3.1	*Quercus*
Quercus kinabaluensis	EN	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus kingiana	EN	CN,LA,MM,TH	0	1.1,2.1.4,2.2.3,5.3.1,5.3.3	*Ilex*
Quercus kiukiangensis	EN	CN	4	5.3.5,7.1.3	*Cyclobalanopsis*
Quercus kotschyana	EN	LB	0	2.3.2,5.3.1,11.1	*Quercus*
Quercus kouangsiensis	EN	CN	0	2.1.3,4.1,5.3.4	*Cyclobalanopsis*
Quercus lenticellata	EN	TH	0	5.3.5,7.1.3	*Cyclobalanopsis*
Quercus liboensis	EN	CN	2	1.1,2.1.3	*Cyclobalanopsis*
Quercus lobbii	EN	BD,CN,IN	0	5.3.5	*Cyclobalanopsis*
Quercus lodicosa	EN	CN,IN,MM	0	5.3.5	*Ilex*
Quercus look	EN	LB,SY	16	2.3.2,11.1	*Cerris*
Quercus macdougallii	EN	MX	0	2.3.2,5.3.4,7.1.1	*Quercus*
Quercus miquihuanensis	EN	MX	12	5.3.1,2.3.2	*Lobatae*
Quercus nivea	EN	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus nixoniana	EN	MX	0	5.3.2,2.1.3,4.1	*Lobatae*
Quercus obconicus	EN	CN	0	2.2.2	*Cyclobalanopsis*
Quercus oglethorpensis	EN	US	47	8.1.2,8.1.2,8.1.2,2.1.4,2.2.2,1.2,11.2, 7.1.1,11.4,7.2.11	*Quercus*
Quercus pacifica	EN	US	22	2.3.2,8.1.2,8.1.2,6.1,8.1.2,8.1.2,8.1.2, 1.3,9.5.4,5.3.1,3.2	*Quercus*
Quercus percoriacea	EN	MY	0	2.1.3,7.1.1	*Cyclobalanopsis*
Quercus petelotii	EN	VN	0	5.3.4	*Cyclobalanopsis*
Quercus phanera	EN	CN	1	1.1,2.1.3	*Cyclobalanopsis*
Quercus pontica	EN	GE,TR	91	2.3.1,5.3.1,5.3.2	*Ponticae*
Quercus radiata	EN	MX	0	2.3.2,4.1,2.2.2	*Lobatae*
Quercus ramsbottomii	EN	MM,TH	0	2.1.4,2.2.3	*Cyclobalanopsis*
Quercus runcinatifolia	EN	MX	1	1.1,2.3.2,5.3.1	*Lobatae*
Quercus rupestris	EN	VN	0	5.3.4	*Cyclobalanopsis*
Quercus sagrana	EN	CU	1	7.1.1,2.3.3,3.2	*Virentes*
Quercus steenisii	EN	ID	0	2.1.4,5.3.3	*Cyclobalanopsis*
Quercus tiaoloshanica	EN	CN	0	2.2.2	*Cyclobalanopsis*
Quercus tomentella	EN	MX,US	33	2.1.2,8.1.2,8.1.2,2.3.2,8.1.2,8.2.2,8.2.2, 8.2.2,8.1.2,8.1.2,8.1.2,8.1.2	*Quercus*
Quercus tungmaiensis	EN	CN,IN	3	1.1,2.1.3	*Ilex*
Quercus utilis	EN	CN	2	1.1,4.1,5.3.1,5.3.4	*Ilex*
*Quercus xanthotricha**	EN	CN,LA	0	2.1.3	*Cyclobalanopsis*
Quercus acutifolia	VU	BZ,GT,HN,MX	34	2.3.4,11.2,11.1,2.1.4,5.3.4	*Lobatae*
Quercus afares	VU	DZ,TN	18	2.1.1,6.3,1.2,2.3.2,4.1	*Cerris*
Quercus ajoensis	VU	MX,US	5	11.2,8.2	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus arkansana	VU	US	48	2.1.3,1.3,5.3.4,7.3,7.1.1,8.1.2,9.3.3, 11.1,11.2	*Lobatae*
Quercus austrina	VU	US	25	2.1.2,2.1.3,3.1,5.3.1,8.2.1,11.2,6.1	*Quercus*
Quercus austrocochinchinensis	VU	CN,LA,TH,VN	0	8.2.2,1.1,5.3.3	*Cyclobalanopsis*
Quercus braianensis	VU	LA,VN	0	2.1.4	*Cyclobalanopsis*
Quercus cedrosensis	VU	MX,US	2	6.2,7.1.3,4.1,5.3.1	*Protobalanus*
Quercus costaricensis	VU	CR,HN,PA	2	5.3.1,4.1,11.1,7.1.1,10.3,5.3.1,4.1	*Lobatae*
Quercus furfuracea	VU	MX	5	5.3.4,5.3.1,2.3.3	*Lobatae*
Quercus gaharuensis	VU	ID,MY	0	2.2.3,5.3.5,1.1	*Cyclobalanopsis*
Quercus gulielmi-treleasei	VU	CR,PA	2	5.3.5	*Lobatae*
Quercus hintoniorum	VU	MX	6	7.1.1,1.1,2.1.2	*Lobatae*
Quercus hondae	VU	JP	2	2.1.4	*Cyclobalanopsis*
Quercus kerangasensis	VU	BN,ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus litseoides	VU	CN,HK	1	11.1,1.3	*Cyclobalanopsis*
Quercus meavei	VU	MX	1	5.3.3,1.2,4.1,2.3.2,11.1,11.2	*Lobatae*
Quercus merrillii	VU	ID,MY,PH	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus quangtriensis	VU	CN,LA,MM,TH,VN	0	2.2.2,1.1,5.3.4	*Cyclobalanopsis*
Quercus rubramenta	VU	MX	0	2.1.3,2.1.2,2.3.2	*Lobatae*
Quercus treubiana	VU	ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus tuitensis	VU	MX	0	2.1.2,5.3.2,5.3.4	*Lobatae*
Quercus vicentensis	VU	MX,SV	1	5.3.5,1.1	*Quercus*
*Quercus ariifolia**	NT	MX	1	11.2,11.3	*Quercus*
Quercus bella	NT	CN,VN	1	2.2.2	*Cyclobalanopsis*
Quercus benthamii	NT	CR,GT,HN,MX,NI,PA,SV	15	5.3.1,2.1.3,2.3.3	*Lobatae*
Quercus castaneifolia	NT	AZ,IR	105	2.1.4,2.3.4	*Cerris*
Quercus chenii	NT	CN	38	2.1.4,1.1,5.3.5	*Cerris*
Quercus cortesii	NT	BZ,CR,GT,HN,MX,NI,PA,SV	0	1.2,2.1.3	*Lobatae*
Quercus crispifolia	NT	GT,MX	0	3.3,2.1.3	*Lobatae*
Quercus crispipilis	NT	GT,MX	7	5.3.2,11.1,2.3.3	*Lobatae*
Quercus durifolia	NT	MX	10	2.1.4,2.3.4,5.3.1	*Lobatae*
Quercus elmeri	NT	BN,ID,MY	1	2.1.4,7.1.3	*Cyclobalanopsis*
Quercus hypargyrea	NT	CN	21	1.1,5.3.5	*Cyclobalanopsis*
Quercus hypophaea	NT	TW	1	1.1,4.1	*Cyclobalanopsis*
Quercus iltisii	NT	MX	0	5.3.4,4.1,1.1,2.3.4,2.1.4	*Lobatae*
Quercus jenseniana	NT	CN	3	5.3.5,2.1.4	*Cyclobalanopsis*
Quercus lamellosa	NT	BT,CN,IN,MM,NP,TH	11	2.1.4,5.3.3,5.3.4,7.1.3	*Cyclobalanopsis*
Quercus langbianensis	NT	VN	0	-	*Cyclobalanopsis*
Quercus lobata	NT	US	82	1.1,2.1.1,7.1.2,2.3.2,11.1	*Quercus*
Quercus lowii	NT	MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus mcvaughii	NT	MX	1	1.1,2.3.4,2.1.4	*Lobatae*
Quercus oblongata	NT	BD,IN,MM,NP,PK,TH,VN	16	5.3.1,5.3.2,2.1.4	*Cyclobalanopsis*
Quercus oidocarpa	NT	ID,MM,MY,TH,VN	1	2.1.3,7.1.1	*Cyclobalanopsis*
Quercus oleoides	NT	BZ,CR,GT,HN,MX	12	1.1,5.3.1,2.3.2	*Virentes*
Quercus oxyphylla	NT	CN	0	1.1,2.1.3	*Ilex*
Quercus palmeri	NT	MX,US	29	1.1,11.1,11.2,8.2.1,1.3,7.1.3	*Protobalanus*
Quercus parvula	NT	US	25	1.1,2.3.4,6.1,7.1.1,8.1.2,11.2	*Quercus*
Quercus peninsularis	NT	MX	2	2.3.2	*Lobatae*
Quercus persica	NT	IQ,IR	0	5.3.1,5.3.2	*Cerris*
Quercus pinnativenulosa	NT	MX	6	1.1,2.1.2,5.3.4	*Lobatae*
Quercus purulhana	NT	BZ,GT,HN,MX,NI	0	7.1.1,5.3.2,1.1,2.3.3	*Quercus*
Quercus rysophylla	NT	MX	53	5.3.5,1.2	*Lobatae*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus sadleriana	NT	US	25	1.1,6.1,4.1,7.1.2,5.3.2,2.3.2,3.2	*Ponticae*
Quercus saltillensis	NT	MX	7	2.3.2,2.1.1,1.1	*Lobatae*
Quercus sartorii	NT	MX	24	2.3.2,11.5	*Lobatae*
Quercus skinneri	NT	BZ,GT,HN,MX,SV	5	5.3.1,2.3.3	*Lobatae*
Quercus subsericea	NT	BN,ID,MY	3	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus sumatrana	NT	ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus valdinervosa	NT	BN,ID,MY	0	2.2.2,7.1.1	*Cyclobalanopsis*
Quercus xylina	NT	MX	0	2.3.2,2.1.2	*Quercus*
Quercus acherdophylla	DD	MX	13	-	*Lobatae*
Quercus aerea	DD	MX	0	-	*Lobatae*
Quercus alpescens	DD	MX	1	-	*Quercus*
Quercus barrancana	DD	MX	0	-	*Quercus*
*Quercus breedloveana**	DD	MX	0	-	*Lobatae*
Quercus brevicalyx	DD	CN,LA,TH	0	2.1.1	*Cyclobalanopsis*
Quercus canariensis	DD	DZ,ES,MA,PT,TN	83	7.1.1,5.3.2,2.2.2,11.2	*Quercus*
Quercus carduchorum	DD	IR	0	8.1.1,11.3,11.2	*Cerris*
*Quercus centenaria**	DD	MX	0	-	*Quercus*
Quercus chapensis	DD	CN,VN	3	-	*Cyclobalanopsis*
Quercus chevalieri	DD	CN,VN	0	-	*Cyclobalanopsis*
Quercus chrysocalyx	DD	CN,KH,LA,TH,VN	1	5.3.1	*Cyclobalanopsis*
Quercus coahuilensis	DD	MX	0	-	*Lobatae*
Quercus coffeicolor	DD	MX	0	-	*Lobatae*
Quercus conduplicans	DD	CN	0	-	*Cyclobalanopsis*
Quercus dalechampii	DD	IT	21	-	*Quercus*
Quercus deliquescens	DD	MX	3	2.3.2,1.1,1.2,4.2	*Quercus*
Quercus dongfangensis	DD	CN	0	2.2.2	*Cyclobalanopsis*
Quercus edwardsiae	DD	MX	3	-	*Quercus*
Quercus elevaticostata	DD	CN	0	-	*Cyclobalanopsis*
Quercus eumorpha	DD	MM,TH	0	-	*Cyclobalanopsis*
Quercus fuliginosa	DD	CN	0	2.1.4	*Cyclobalanopsis*
Quercus ghiesbreghtii	DD	MX	0	-	*Lobatae*
Quercus gomeziana	DD	BD,CN,MM,VN	0	-	*Cyclobalanopsis*
Quercus gracilenta	DD	CN	0	-	*Cyclobalanopsis*
*Quercus gracilior**	DD	HN	0	-	*Lobatae*
Quercus grahamii	DD	MX	3	-	*Lobatae*
Quercus hartwissiana	DD	BG,GE,RU,TR	53	7.1.3,5.3.1,1.2	*Quercus*
Quercus ignaciensis	DD	MX	0	-	*Lobatae*
Quercus jinpinensis	DD	CN	0	-	*Cyclobalanopsis*
Quercus liaoi	DD	TW	1	-	*Cyclobalanopsis*
*Quercus melissae**	DD	GT,MX	0	-	*Quercus*
Quercus mespilifolia	DD	BD,IN,LA,MM,TH,VN	1	-	*Cyclobalanopsis*
*Quercus mexiae**	DD	MX	0	-	*Lobatae*
Quercus ningangensis	DD	CN	3	-	*Cyclobalanopsis*
Quercus ningqiangensis	DD	CN	0	-	*Quercus*
Quercus opaca	DD	MX	1	-	*Quercus*
Quercus pauciradiata	DD	ES	0	8.3,12.1,1.1	*Quercus*
Quercus paxtalensis	DD	MX	0	7.1.1,5.3.2,2.3.3	*Lobatae*
Quercus pentacycla	DD	CN	2	-	*Cyclobalanopsis*
Quercus perpallida	DD	MX	0	-	*Quercus*
Quercus platycalyx	DD	CN,VN	0	2.2.2,1.1,5.3.4	*Cyclobalanopsis*
*Quercus porphyrogenita**	DD	MX	0	-	*Quercus*

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*Quercus protoroburoides**	DD	BG	0	-	*Quercus*
Quercus rekonis	DD	MX	0	-	*Quercus*
Quercus robusta	DD	MX,US	2	7.1.3,6.1,11.4,11.2	*Lobatae*
*Quercus sarahmariae**	DD	CR	0	-	*Lobatae*
Quercus saravanensis	DD	CN,LA,TH	0	-	*Cyclobalanopsis*
Quercus shangxiensis	DD	CN	0	-	*Ilex*
Quercus shennongii	DD	CN	0	-	*Quercus*
Quercus shingjenensis	DD	CN	0	-	*Quercus*
Quercus supranitida	DD	MX	0	-	*Quercus*
Quercus tardifolia	DD	MX,US	0	-	*Lobatae*
Quercus tarokoensis	DD	TW	6	-	*Ilex*
Quercus tatakaensis	DD	TW	5	-	*Ilex*
Quercus thorelii	DD	CN,LA,TH,VN	1	-	*Cyclobalanopsis*
Quercus tinkhamii	DD	MX	3	-	*Quercus*
Quercus toumeyi	DD	MX,US	8	8.2.2	*Quercus*
Quercus toxicodendrifolia	DD	MX	1	-	*Quercus*
Quercus trinitatis	DD	MX,SV	0	5.3.2,2.1.3,5.3.4	*Lobatae*
Quercus tsinglingensis	DD	CN	0	-	*Quercus*
Quercus undata	DD	MX	0	-	*Quercus*
Quercus ungeri	DD	IR	0	-	*Cerris*
Quercus verde	DD	MX	0	-	*Quercus*
Quercus vestita	DD	IN	0	-	*Cyclobalanopsis*
Quercus xanthoclada	DD	LA,MM,VN	0	-	*Cyclobalanopsis*
Quercus yonganensis	DD	CN	0	-	*Cyclobalanopsis*
Quercus acatenangensis	LC	GT,MX,SV	0	-	*Lobatae*
Quercus acrodonta	LC	CN	3	-	*Ilex*
Quercus acuta	LC	CN,JP,KR,TW	46	-	*Cyclobalanopsis*
Quercus acutissima	LC	BT,CN,IN,JP,KP,KR,LA,MM,NP,TH,VN	201	5.3.2	*Cerris*
Quercus affinis	LC	MX	23	2.1.2,5.3.3	*Lobatae*
Quercus agrifolia	LC	MX,US	94	2.3.3,1.1,7.1.3,5.3.2,2.1.3,8.4.2	*Lobatae*
Quercus alba	LC	CA,US	234	7.1.2,8.2.2,1.1	*Quercus*
Quercus albocincta	LC	MX	3	-	*Lobatae*
Quercus aliena	LC	CN,JP,KP,KR,LA,MM,TH,TW	101	7.1.3,2.2.1	*Quercus*
Quercus alnifolia	LC	CY	48	11.1,7.1.1	*Ilex*
Quercus annulata	LC	CN,IN,MM,NP,VN	0	-	*Cyclobalanopsis*
Quercus aquifolioides	LC	BT,CN,MM	6	-	*Ilex*
Quercus argentata	LC	ID,MY,SG	3	-	*Cyclobalanopsis*
Quercus aristata	LC	MX	0	5.3.4,5.3.1,1.1,2.3.4,2.1.4	*Lobatae*
Quercus arizonica	LC	MX,US	31	-	*Quercus*
Quercus aucheri	LC	GR,TR	13	6.1,5.3.5,11.1,1.3,1.1	*Ilex*
Quercus augustini	LC	CN,MM,TH,VN	4	-	*Cyclobalanopsis*
Quercus auricoma	LC	CN,TH,VN	0	-	*Cyclobalanopsis*
Quercus baloot	LC	AF,PK	7	-	*Ilex*
Quercus baronii	LC	CN	16	-	*Ilex*
Quercus berberidifolia	LC	MX,US	43	8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus bicolor	LC	CA,US	220	7.1.1,5.3.5,8.2.2,8.2.2,11.1	*Quercus*
Quercus blakei	LC	CN,HK,LA,VN	1	5.3.5	*Cyclobalanopsis*
Quercus brandisiana	LC	LA,MM,TH	0	2.1.1,5.3.1	*Cyclobalanopsis*
Quercus brantii	LC	IQ,IR,SY,TR	23	5.3.3,8.4.1	*Cerris*
Quercus buckleyi	LC	US	51	8.2.2,8.4.2	*Lobatae*
Quercus bumelioides	LC	CR,GT,HN,MX,NI,PA	1	2.3.4,2.1.4,5.3.5	*Lobatae*

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Quercus calophylla	LC	GT,MX	16	2.1.2,1.1	*Lobatae*
Quercus canbyi	LC	MX	39	2.1.2,7.1.1,2.3.2	*Lobatae*
Quercus castanea	LC	GT,MX,SV	25	1.1,2.3.4,2.1.4	*Lobatae*
Quercus cerris	LC	AL,AT,BA,BG,CH,CZ,ES,FR,GR,HR,HU, IT,LB,ME,MK,PT,RO,RS,SI,SK,SY,TR	211	2.1.1	*Cerris*
Quercus championii	LC	CN,TW	6	-	*Cyclobalanopsis*
Quercus chapmanii	LC	US	16	7.1.2,6.1,1.1	*Quercus*
Quercus chihuahuensis	LC	MX,US	5	2.3.2,6.1,7.1.3	*Quercus*
Quercus chrysolepis	LC	MX,US	82	1.1,7.1.2	*Protobalanus*
Quercus chungii	LC	CN	1	-	*Cyclobalanopsis*
Quercus ciliaris	LC	CN	10	-	*Cyclobalanopsis*
Quercus coccifera	LC	AL,BA,BG,CY,DZ,ES,FR,GR,HR,IL,IT,JO, LB,LY,MA,ME,MK,PS,PT,RS,SI,SY,TN,TR	131	2.3.4,2.2.3,7.1.1	*Ilex*
Quercus cocciferoides	LC	CN	2	-	*Ilex*
Quercus coccinea	LC	US	216	8.4.2	*Lobatae*
Quercus confertifolia	LC	MX	0	2.1.2,2.3.2,4.2	*Lobatae*
Quercus congesta	LC	IT	0	7.1.1,2.3.4,2.1.4,1.1	*Quercus*
Quercus convallata	LC	MX	0	-	*Quercus*
Quercus conzattii	LC	MX	1	-	*Lobatae*
Quercus cornelius-mulleri	LC	MX,US	15	6.1	*Quercus*
Quercus corrugata	LC	BZ,CR,GT,HN,MX,SV	14	-	*Quercus*
Quercus crassifolia	LC	GT,MX	36	1.1,2.3.4,11.1	*Lobatae*
Quercus crassipes	LC	MX	32	5.3.1,2.3.3	*Lobatae*
Quercus delavayi	LC	CN	2	-	*Cyclobalanopsis*
Quercus dentata	LC	CN,JP,KR,MN,RU,TW	168	-	*Quercus*
Quercus depressa	LC	MX	2	1.2,2.3.2,4.1,11.1,11.2,5.3.3	*Lobatae*
Quercus depressipes	LC	MX,US	1	5.3.5	*Quercus*
Quercus deserticola	LC	MX	9	-	*Quercus*
Quercus dolicholepis	LC	CN	14	-	*Ilex*
Quercus douglasii	LC	US	63	2.3.2,11.2,8.1.1,1.1,7.1.2,8.2.2,8.2.2	*Quercus*
Quercus durata	LC	US	37	-	*Quercus*
Quercus eduardi	LC	MX	7	5.3.1,2.3.4,11.1,2.1.4	*Lobatae*
Quercus ellipsoidalis	LC	CA,US	115	8.4.2,11.1	*Lobatae*
Quercus elliptica	LC	BZ,GT,HN,MX,NI,SV	5	8.4.2	*Lobatae*
Quercus emoryi	LC	MX,US	30	5.3.1,8.2.2,2.3.2,6.1,5.2.1,8.2.2,7.1.2,11.1	*Lobatae*
Quercus engleriana	LC	CN	15	-	*Ilex*
Quercus fabrei	LC	CN,HK	31	-	*Quercus*
Quercus faginea	LC	ES,MA,PT	88	2.1.4,11.2,8.2,11.3,1.3	*Quercus*
Quercus falcata	LC	US	111	8.4.2	*Lobatae*
Quercus floribunda	LC	AF,IN,NP,PK	3	-	*Ilex*
Quercus frainetto	LC	AL,BA,BG,CZ,GR,HR,IT,MK,RO, RS,SK,TR	132	2.1.4,8.3,5.3.1	*Quercus*
Quercus franchetii	LC	CN,TH	17	-	*Ilex*
Quercus frutex	LC	MX	8	8.4.1,11.5	*Quercus*
Quercus fulva	LC	MX	2	-	*Lobatae*
Quercus fusiformis	LC	MX,US	39	5.3.3,2.3.4,8.2,8.4.2	*Virentes*
Quercus gambelii	LC	MX,US	76	-	*Quercus*
Quercus gambleana	LC	BD,CN,IN	0	-	*Cyclobalanopsis*
Quercus garryana	LC	CA,US	79	2.3.2,8.2.2,8.2.2,8.2.2,8.1.2	*Quercus*
Quercus gemelliflora	LC	BN,ID,MY	5	2.2.2	*Cyclobalanopsis*
Quercus geminata	LC	US	28	-	*Virentes*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus germana	LC	MX	27	2.3.3,2.3.2,5.3.1	*Quercus*
Quercus gilliana	LC	CN	0	-	*Ilex*
Quercus gilva	LC	CN,JP,KR,TW	35	-	*Cyclobalanopsis*
Quercus glabrescens	LC	MX	16	5.3.2,2.3.3	*Quercus*
Quercus glauca	LC	AF,BT,CN,HK,IN,JP,KP,KR,LA,MM,NP,TW	111	2.1.1	*Cyclobalanopsis*
Quercus glaucescens	LC	MX	0	7.1.3,5.3.5,2.1.4	*Quercus*
Quercus glaucoides	LC	MX	20	2.1.1,1.1,8.1.2	*Quercus*
Quercus gravesii	LC	MX,US	36	7.2.2,2.3.2,11.2	*Lobatae*
Quercus greggii	LC	MX	27	-	*Quercus*
Quercus griffithii	LC	BT,CN,IN,LA,MM,NP,TH,VN	26	2.1.1	*Quercus*
Quercus grisea	LC	MX,US	39	2.3.2,2.1.2,5.3.1,11.1	*Quercus*
Quercus guyavifolia	LC	CN	10	-	*Ilex*
Quercus helferiana	LC	CN,IN,LA,MM,TH,VN	0	5.3.1	*Cyclobalanopsis*
Quercus hemisphaerica	LC	US	48	8.2.2	*Lobatae*
Quercus humboldtii	LC	CO,PA	7	1.1,4.1,5.3.1	*Lobatae*
Quercus hypoleucoides	LC	MX,US	27	-	*Lobatae*
Quercus hypoxantha	LC	MX	5	-	*Lobatae*
Quercus ichnusae	LC	IT	0	2.3.4,7.1.1	*Quercus*
Quercus ilex	LC	AL,BA,CH,DZ,ES,FR,GR,HR,IT,LY,MA,ME,MT,RS,SI,TN,TR	212	1.2,1.1,9.5.4,7.1.3,5.3.1,11.2,2.3.3,2.1.3,8.2	*Ilex*
Quercus ilicifolia	LC	CA,US	101	7.1.2,11.1	*Lobatae*
Quercus imbricaria	LC	US	190	8.4.2,11.1	*Lobatae*
Quercus incana	LC	US	43	7.1.2,11.1	*Lobatae*
Quercus infectoria	LC	AZ,CY,GR,IL,IQ,IR,LB,PS,SY,TR	51	5.3.5,2.1.4,2.3.4	*Quercus*
Quercus inopina	LC	US	7	7.1.2,1.2,1.1,2.1.4	*Lobatae*
Quercus intricata	LC	MX,US	5	2.3.2,1.2,5.2.2,7.1.2,11.2	*Quercus*
Quercus invaginata	LC	MX	9	-	*Quercus*
Quercus ithaburensis	LC	AL,GR,IL,IT,LB,SY,TR	84	5.3.1,2.3.4,1.3,1.1	*Cerris*
Quercus john-tuckeri	LC	US	22	1.1,7.1.2,2.3.2	*Quercus*
Quercus jonesii	LC	MX	2	-	*Lobatae*
Quercus kelloggii	LC	MX,US	68	5.3.2,7.1.2,7.1.1,8.2.2,8.2.2	*Lobatae*
Quercus kerrii	LC	CN,KH,LA,MM,TH,VN	1	-	*Cyclobalanopsis*
Quercus laceyi	LC	MX,US	33	11.1	*Quercus*
Quercus laeta	LC	MX	25	11.1	*Quercus*
Quercus laevis	LC	US	29	2.2.2,8.4.2,11.1	*Lobatae*
Quercus lanata	LC	BT,CN,IN,MM,NP,TH,VN	7	-	*Ilex*
Quercus lancifolia	LC	BZ,CR,GT,HN,MX,NI,PA,SV	10	1.2,2.3.3	*Quercus*
Quercus laurifolia	LC	US	70	8.4.1,8.4.2	*Lobatae*
Quercus laurina	LC	GT,MX,SV	30	7.1.1,5.3.5,2.3.1	*Lobatae*
Quercus libani	LC	IQ,IR,SY,TR	88	8.4.1	*Cerris*
Quercus liebmannii	LC	MX	8	2.3.2	*Quercus*
Quercus lineata	LC	BD,CN,ID,IN,LA,MY,TH,VN	1	2.2.2	*Cyclobalanopsis*
Quercus longinux	LC	TW	12	-	*Cyclobalanopsis*
Quercus longispica	LC	CN	5	-	*Ilex*
Quercus lusitanica	LC	ES,MA,PT	33	-	*Quercus*
Quercus lyrata	LC	US	111	11.1	*Quercus*
Quercus macranthera	LC	AM,AZ,GE,IQ,IR,LB,RU,SY,TR	100	11.2,2.3.1,8.1.1,8.2	*Quercus*
Quercus macrocalyx	LC	CN,LA,VN	6	-	*Cyclobalanopsis*
Quercus macrocarpa	LC	CA,US	261	7.1.2,2.3.4	*Quercus*
Quercus magnoliifolia	LC	MX	5	11.1,7.1.1,5.3.2	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus margarettae	LC	US	28	11.1	*Quercus*
Quercus marilandica	LC	US	101	8.4.1	*Lobatae*
Quercus martinezii	LC	MX	1	-	*Quercus*
Quercus mexicana	LC	MX	43	1.1,2.3.4,11.1,2.1.4	*Lobatae*
Quercus michauxii	LC	US	115	8.2.2,8.2.2,8.2.2,8.2.2,8.2.2,8.2.2	*Quercus*
Quercus microphylla	LC	MX	11	7.1.2	*Quercus*
Quercus minima	LC	US	12	7.1.2,1.1,2.3.3,2.2.2	*Virentes*
Quercus miyagii	LC	JP	0	-	*Cyclobalanopsis*
Quercus mohriana	LC	MX,US	18	-	*Quercus*
Quercus mongolica	LC	CN,JP,KP,KR,MN,RU	150	5.3.2	*Quercus*
Quercus monimotricha	LC	CN,MM	10	-	*Ilex*
Quercus montana	LC	US	165	8.1.2,8.2.2,8.2.2,8.2.2,8.2.2,11.1	*Quercus*
Quercus morii	LC	TW	18	-	*Cyclobalanopsis*
Quercus muehlenbergii	LC	CA,MX,US	184	8.2.2,7.1.1,8.1.2,8.2.2,8.2.2,11.1	*Quercus*
Quercus myrsinifolia	LC	CN,HK,JP,KR,LA,TH,TW,VN	108	8.2.2	*Cyclobalanopsis*
Quercus myrtifolia	LC	US	24	7.1.2,1.2,1.1	*Lobatae*
Quercus nigra	LC	US	128	8.4.1	*Lobatae*
Quercus oblongifolia	LC	MX,US	23	2.3.2,8.2.2	*Quercus*
Quercus obtusata	LC	MX	27	5.3.5,2.3.4	*Quercus*
Quercus oxyodon	LC	BD,BT,CN,IN,MM,NP,TH	15	-	*Cyclobalanopsis*
Quercus pachyloma	LC	CN,TW	6	-	*Cyclobalanopsis*
Quercus pagoda	LC	US	60	8.4.2,11.1	*Lobatae*
Quercus palustris	LC	CA,US	263	8.4.1,8.4.2,11.1	*Lobatae*
*Quercus pannosa**	LC	CN	0	-	*Ilex*
Quercus peduncularis	LC	BZ,GT,HN,MX,SV	8	11.1	*Quercus*
Quercus petraea	LC	AL,AM,AT,AZ,BA,BE,BG,BY,CH,CZ,DE,DK,ES,FR,GB,GE,HR,HU,IE,IR,IT,LT,ME,MK,NL,NO,PL,RO,RS,RU,SI,SK,SY,TR,UA	178	8.1.2,2.2.2,5.3.2,5.3.1,11.1,8.1.2	*Quercus*

Quercus planipocula, *LC* *(Béatrice Chassé)*

Quercus microphylla, *LC* *(Béatrice Chassé)*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus phellos	LC	US	180	8.4.1	*Lobatae*
Quercus phillyreoides	LC	CN,JP,KP,KR	105	-	*Ilex*
Quercus planipocula	LC	MX	2	2.1.3,7.1.1	*Lobatae*
Quercus poilanei	LC	CN,TH,VN	0	-	*Cyclobalanopsis*
Quercus polymorpha	LC	GT,HN,MX,US	47	5.2.1,5.3.1,11.1	*Quercus*
Quercus potosina	LC	MX	4	5.3.2,2.1.3,8.4.1,2.3.3	*Quercus*
Quercus praeco	LC	MX	1	5.3.5,2.3.4	*Quercus*
Quercus pringlei	LC	MX	8	2.3.2,7.1.1,2.1.2	*Quercus*
Quercus prinoides	LC	CA,US	70	11.1	*Quercus*
Quercus pubescens	LC	AL,AT,BE,BG,CH,CZ,DE,ES,FR,GR,HR, IT,MD,ME,MK,RO,RS,RU,SI,SK,TR,UA	136	11.3,1.1,8.2,7.1.1	*Quercus*
Quercus pumila	LC	US	27	7.1.2	*Lobatae*
Quercus pungens	LC	MX,US	24	-	*Quercus*
Quercus pyrenaica	LC	ES,FR,MA,PT	89	2.1.3,8.2.1,8.2.2,1.2,7.1.1,2.3.3,2.3.2, 2.2.2,11.5,11.2	*Quercus*
Quercus rehderiana	LC	CN,TH	6	-	*Ilex*
Quercus repanda	LC	MX	5	-	*Quercus*
Quercus resinosa	LC	MX	3	11.5	*Quercus*
Quercus rex	LC	CN,IN,LA,MM,TH,VN	2	-	*Cyclobalanopsis*
Quercus robur	LC	AL,AM,AT,AZ,BA,BE,BG,BY,CH,CZ,DE, DK,EE,ES,FI,FR,GB,GE,GR,HR,HU,IE,IR, IT,KZ,LT,LU,LV,MD,ME,MK,NL,NO,PL, PT,RO,RS,RU,SE,SI,SK,TR,UA	332	8.1.2,5.3.2,1.1,2.3.4,2.2.3,11.4,11.3, 11.2,11.1,2.1.4,8.3,8.1.2	*Quercus*
Quercus rotundifolia	LC	DZ,ES,FR,MA,PT	47	2.1.2,2.3.2,11.2,11.3,7.1.1,8.1.2	*Ilex*
Quercus rubra	LC	CA,US	334	11.2,11.3,8.4.2	*Lobatae*
Quercus rugosa	LC	GT,HN,MX,US	70	11.1,5.2.1,7.1.1,5.3.1,1.1	*Quercus*
Quercus salicifolia	LC	CR,GT,HN,MX,NI,PA,SV	4	5.3.2,2.3.2	*Lobatae*
Quercus salicina	LC	JP,KR	44	-	*Cyclobalanopsis*
Quercus sapotifolia	LC	BZ,CR,GT,HN,MX,PA,SV	2	-	*Lobatae*
Quercus schottkyana	LC	CN	19	-	*Cyclobalanopsis*
Quercus scytophylla	LC	MX	8	5.3.1,2.3.3	*Lobatae*
Quercus sebifera	LC	MX	6	5.3.2,2.3.3	*Quercus*
Quercus segoviensis	LC	GT,HN,MX,NI,SV	0	2.3.2	*Quercus*
Quercus semecarpifolia	LC	AF,CN,IN,NP,PK	19	-	*Ilex*
Quercus semiserrata	LC	BD,BT,CN,ID,IN,MM,MY,TH,VN	0	-	*Cyclobalanopsis*
Quercus senescens	LC	CN	5	-	*Ilex*
Quercus serrata	LC	CN,JP,KP,KR,TW	127	2.1.1,1.1	*Quercus*
Quercus sessilifolia	LC	CN,JP,TH,TW	23	-	*Cyclobalanopsis*
Quercus setulosa	LC	CN,LA,TH,VN	0	-	*Ilex*
Quercus shumardii	LC	CA,US	173	8.4.2,11.1	*Lobatae*
Quercus sideroxyla	LC	MX	8	5.3.2,2.3.2,11.1,2.2.2	*Lobatae*
Quercus similis	LC	US	3	11.1	*Quercus*
Quercus sinuata	LC	MX,US	40	-	*Quercus*
Quercus sororia	LC	MX	0	1.1,2.3.3	*Quercus*
Quercus spinosa	LC	CN,MM,TW	17	-	*Ilex*
Quercus stellata	LC	US	107	8.4.1,8.2.2	*Quercus*
Quercus stenophylloides	LC	TW	30	-	*Cyclobalanopsis*
Quercus stewardiana	LC	CN	5	-	*Cyclobalanopsis*
Quercus striatula	LC	MX	5	1.3,1.2	*Quercus*
Quercus suber	LC	DZ,ES,FR,IT,MA,PT,TN	197	2.1.4,8.2.1,8.2,7.3,7.1.1,11.2	*Cerris*
Quercus subspathulata	LC	MX	7	5.3.3,5.3.1	*Quercus*

Scientific Name	IUCN Red List Category	Country distribution	Number of *ex situ* collections	Threat codes	*Quercus* section
Quercus tarahumara	LC	MX	6	5.3.1,1.1	*Lobatae*
Quercus texana	LC	US	104	8.4.2,11.1	*Lobatae*
Quercus trojana	LC	AL,BA,BG,GR,HR,IT,ME,MK,RS,TR	76	5.3.1	*Cerris*
Quercus tuberculata	LC	MX	7	-	*Quercus*
Quercus turbinella	LC	MX,US	54	-	*Quercus*
Quercus urbani	LC	MX	1	-	*Lobatae*
Quercus uxoris	LC	MX	7	5.3.1,2.1.2,4.1	*Lobatae*
Quercus vacciniifolia	LC	US	38	5.3.2,11.1,7.1.2	*Protobalanus*
Quercus variabilis	LC	CN,HK,JP,KP,KR,TW,VN	137	6.3	*Cerris*
Quercus vaseyana	LC	MX,US	32	-	*Quercus*
Quercus velutina	LC	CA,US	182	11.2,8.4.2,8.1.2	*Lobatae*
Quercus viminea	LC	MX,US	3	5.2.1,2.3.2,5.2.2,11.1	*Lobatae*
Quercus virginiana	LC	US	132	7.1.1,11.3,8.4.2	*Virentes*
Quercus vulcanica	LC	SY,TR	15	1.3	*Quercus*
Quercus wislizeni	LC	MX,US	64	2.3.2,11.1,7.1.2	*Lobatae*
Quercus wutaishanica	LC	CN	33	-	*Quercus*
Quercus xalapensis	LC	GT,HN,MX,NI	15	-	*Lobatae*

*Assessments to be published in the first IUCN Red List update of 2021

Data sources for Appendices B and C

Country/Territory distribution

Country/territory codes follow the International Organization for Standardization ISO-3166-1. A list of all countries and territories used in IUCN's Red List of Threatened Species can be found online (iucnredlist.org/resources/country-codes).

Number of *ex situ* collections

Based on combined results from: 1) 2017 *ex situ* survey conducted by The Morton Arboretum (Beckman *et al*., 2019); 2) 2019 survey conducted for a project funded through the Institute of Museum and Library Services (award #MA-30-18-0273-18); 3) 2020 survey funded by the USDA Forest Service (cooperative agreement #16-CA-11132546-045) and Fondation Franklinia to support the conservation work of the Global Conservation Consortium for Oak; and 4) records held in BGCI's PlantSearch database of plants in cultivation (tools.bgci.org/plant_search.php; accessed May, 2020).

Threat codes

Threat codes follow IUCN's Threats Classification Scheme (Version 3.2) found online (iucnredlist.org/resources/threat-classification-scheme)

***Quercus* section**

Assessed species were matched to the most recent phylogenetic studies of oaks (Denk *et al*., 2017; Hipp *et al*., 2020). Thirty-five species assessed for this report were not included in either of these phylogenetic studies. For these species, a literature review was conducted to determine their section and/or regional oak experts were consulted to assign a section (A. Coombes and J. Strijk, pers. comm.).

Quercus arkansana, *VU* *(Jared Chauncey)*

Quercus havardii, *EN* *(Emily Beckman)*

Appendix D:

IUCN Red List Categories & Criteria

EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time-frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)
A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time-frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)
A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)
A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)
A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

The criteria for Critically Endangered, Endangered and Vulnerable

CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥ 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a. direct observation
   b. an index of abundance appropriate to the taxon
   c. a decline in area of occupancy, extent of occurrence and/or quality of habitat
   d. actual or potential levels of exploitation
   e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥ 80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥ 80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥ 80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km^2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at only a single location.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

2. Area of occupancy estimated to be less than 10 km^2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at only a single location.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
   a. Population structure in the form of one of the following:
      i. no subpopulation estimated to contain more than 50 mature individuals, OR
      ii. at least 90% of mature individuals in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥ 70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a. direct observation
   b. an index of abundance appropriate to the taxon
   c. a decline in area of occupancy, extent of occurrence and/or quality of habitat
   d. actual or potential levels of exploitation
   e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥ 50% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥ 50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥ 50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5000 km2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at no more than five locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

2. Area of occupancy estimated to be less than 500 km2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at no more than five locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

C. Population size estimated to number fewer than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
   a. Population structure in the form of one of the following:
      i. no subpopulation estimated to contain more than 250 mature individuals, OR
      ii. at least 95% of mature individuals in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥ 50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a. direct observation
   b. an index of abundance appropriate to the taxon
   c. a decline in area of occupancy, extent of occurrence and/or quality of habitat
   d. actual or potential levels of exploitation
   e. the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥ 30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥ 30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥ 30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km^2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at no more than 10 locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

2. Area of occupancy estimated to be less than 2000 km2, and estimates indicating at least two of a-c:
   a. Severely fragmented or known to exist at no more than 10 locations.
   b. Continuing decline, observed, inferred or projected, in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. area, extent and/or quality of habitat
      iv. number of locations or subpopulations
      v. number of mature individuals.
   c. Extreme fluctuations in any of the following:
      i. extent of occurrence
      ii. area of occupancy
      iii. number of locations or subpopulations
      iv. number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):
   a. Population structure in the form of one of the following:
      i. no subpopulation estimated to contain more than 1000 mature individuals, OR
      ii. all mature individuals are in one subpopulation.
   b. Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km^2) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

The Red List of
Oaks 2020

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