Conservation Gap Analysis of Select Native

Asian Oaks


Queen Sirikit Botanic Garden

Species profile: ***Quercus kingiana***

Kittiyut Punchay, Joeri S. Strijk, Kate Good, Chai-Shian Kua

CRITICALLY ENDANGERED

Quercus baniensis
Quercus baolamensis
Quercus bidoupensis
Quercus blaoensis
Quercus cambodiensis
Quercus camusiae
Quercus dankiaensis
Quercus dilacerata
Quercus donnaiensis
Quercus honbaensis
Quercus mangdenensis
Quercus ngochoaensis
Quercus pseudoverticillata
Quercus sontraensis
Quercus trungkhanhensis
Quercus xuanlienensis

ENDANGERED

Quercus arbutifolia
Quercus asymmetrica
Quercus bambusifolia
Quercus chrysotricha
Quercus disciformis
Quercus edithiae
Quercus kinabaluensis
Quercus kingiana
Quercus lenticellata
Quercus lodicosa
Quercus nivea
Quercus percoriacea
Quercus petelotii
Quercus ramsbottomii
Quercus rupestris
Quercus steenisii
Quercus xanthotricha

VULNERABLE

Quercus austrocochinchinensis
Quercus braianensis
Quercus gaharuensis
Quercus hondae
Quercus kerangasensis
Quercus merrillii
Quercus quangtriensis
Quercus treubiana

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Global Conservation Consortium Oak

CSS TREES Center for Species Survival

DALAT UNIVERSITY

Alliance Conservation Tree Genomics

Quercus kingiana Craib

IUCN Red List Category and Criteria: Endangered B2ab(i,ii,iii,iv,v)b(iii)
Synonyms: None **Common Names:** Ko daeng (ก่อแดง), ko ngae (ก่อแงะ), ko ta mu (ก่อตาหมู), ko dam (ก่อดำ), ko aep (ก่อแอบ), ko maeng nun (ก่อแมงนูน)(Northern); ko daeng (ก่อแดง), ko khi mu (ก่อขี้หมู), ko yuak (ก่อหยวก)(Northeastern); Laos - Kau Tum Moo (from the species protologue; Kor neuoy (ก่ำเฒ่ย); kor aeb (ก่ำแอบ)
Classification: subgenus *Cerris*, section *Ilex*

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DISTRIBUTION AND BIOLOGY

Quercus kingiana occurs in Thailand, Myanmar, and China (Carrero & Strijk, 2020; Figure 1). This species was also recently confirmed for Laos, but these georeferenced occurrence points have not been included here in our analyses. It is found primarily in subtropical moist forest (Figure 2), on limestone or granite bedrock, at 500–2,100 m elevation (most commonly 700–1,000 m; e-Flora of Thailand, 2008) but can also be found scattered throughout drier, mixed Dipterocarp-Oak forest (Laos).

Quercus kingiana can reach heights of 30 m, with a girth of 60–20 cm. Leaves are oblong, elliptic, ovate or obovate, 8–20 by 3.5–8 cm, with serrate margins (e-Flora of Thailand, 2008). Acorns are elliptic, 2 cm long x 1.6 cm in diameter (Hélardot, 2018).

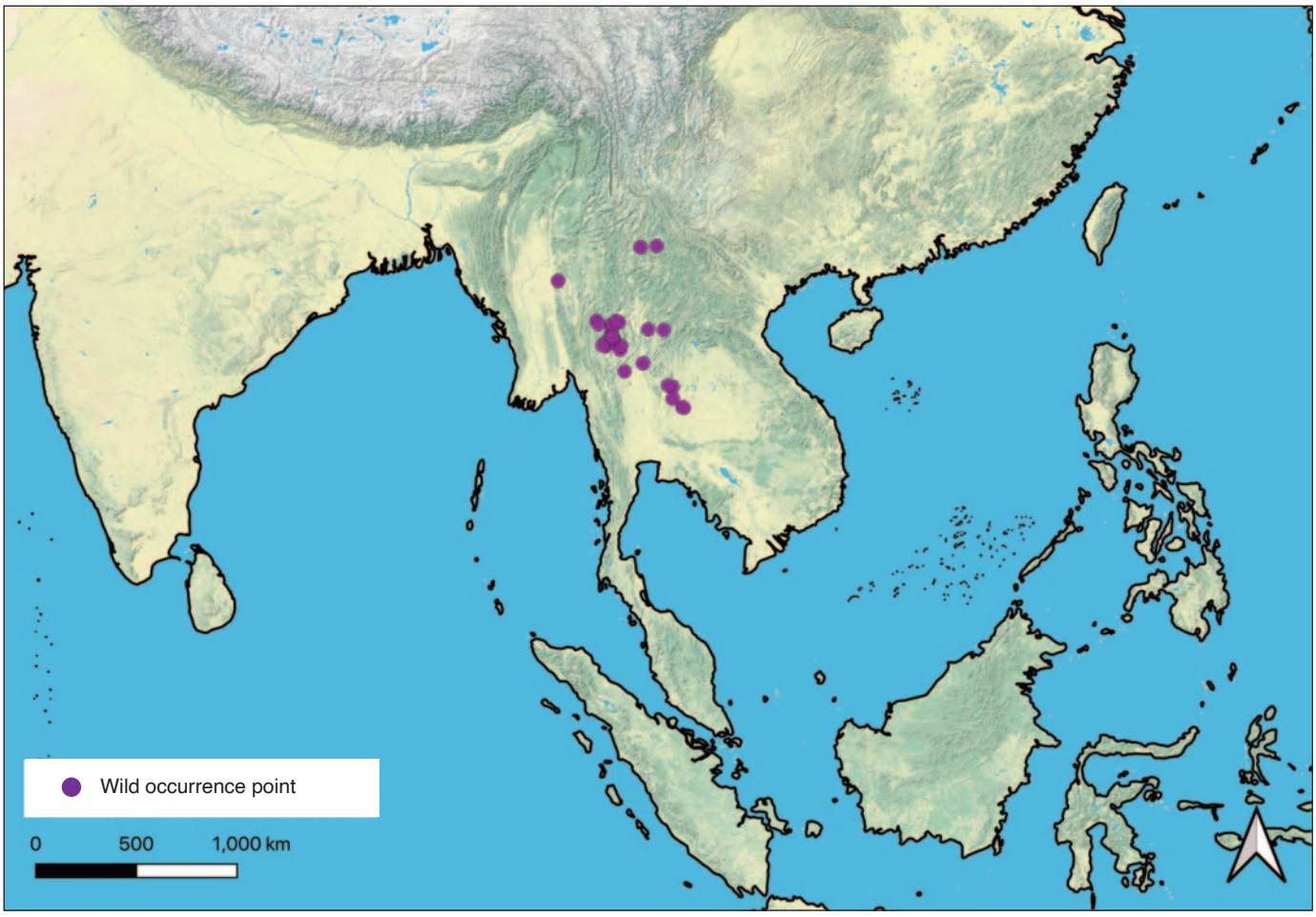

Figure 1. Wild (i.e., *in situ*) occurrence points for *Quercus kingiana*

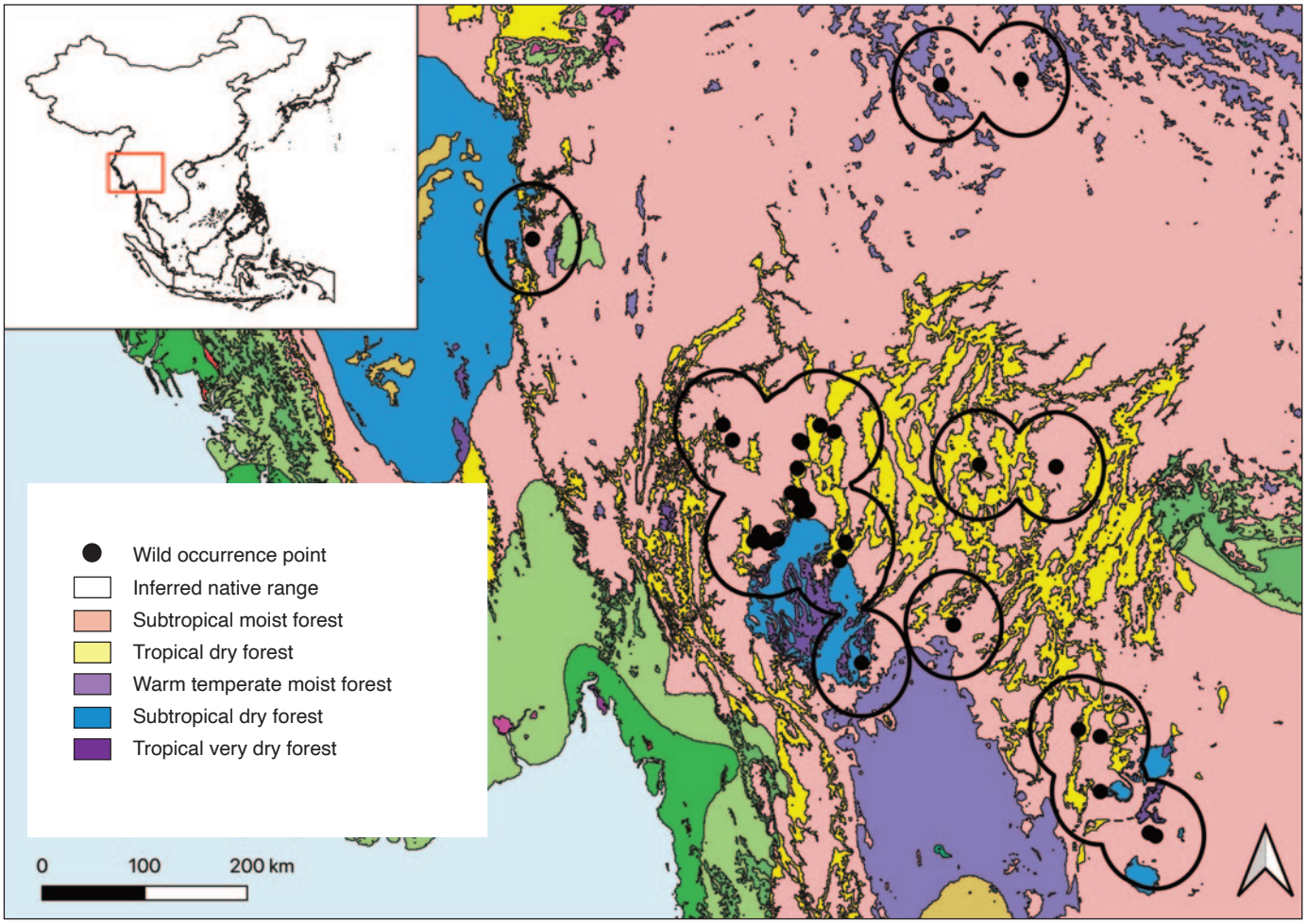

Figure 2. Holdridge Life zones within the inferred native range of *Quercus kingiana*. Map legend includes the HLZs with at least one occurrence point of *Q. kingiana*. For a full map of HLZs within the study region, see Appendix B in Good et al. (2026).

THREATS TO WILD POPULATIONS

Biodiversity loss in Southeast and East Asia is primarily driven by habitat loss from rapid urbanization, industrialization, and agricultural expansion, resulting in some of the highest deforestation rates globally (Austin et al., 2017; Botterill-James et al., 2024; World Resources Institute, 2025). For oaks in Southeast and East Asia, agricultural expansion (including wood and pulp plantations) is the leading threat, followed by logging and wood harvesting (Good et al., 2026). While species-specific data remain limited, a literature review and consultation with species experts indicates that these broader pressures are applicable to *Q. kingiana* and other terrestrial plant species.

Logging and wood harvesting: Local communities in Northern Thailand utilize the timber and branches of *Q. kingiana* as a primary source of fuelwood and for general household construction. Although harvesting is often for domestic use, the ongoing removal of biomass from the forest can degrade the habitat quality in areas where the species is already endangered. The wood is also reported as used for making barrels to ferment alcoholic beverages in Thailand.

Beyond timber, *Q. kingiana* is subject to non-timber forest product (NTFP) collection. The acorns are harvested for direct consumption and processed into flour for traditional desserts, while the bark is stripped for use in betel nut chewing, a common cultural practice among ethnic groups in Northern Thailand. Such harvesting activities, particularly the collection of seeds, may hinder natural regeneration and reduce the recruitment rate of new individuals in wild populations. As of now, there is not any information known yet on the use of materials (beyond timber) of *Q. kingiana* in Laos.

Agriculture, wood and pulp plantations: In Laos, the extant populations are located inside the Nakai Nam Theun National Park, in an area where local human populations practice small-scale cassava farming and extensive cattle grazing in selected areas. The effects of this mixed protection-human-use approach on populations of *Q. kingiana* (and other threatened trees) is not well-known. Unregulated grazing and firewood collecting in dry forest ecosystems can have unwanted effects (e.g., increases in fire occurrences, aridification, and opportunities for invasive species).

Residential/commercial development, mining, roads: While for now, no specific instances of *Q. kingiana* removal are documented in Central Laos, the area in which the populations occur has seen an increase in development activities in recent years, following the construction of the hydro-electric dam and the opening of numerous limestone mining facilities along the main access roads towards the National Park. The resulting increase in human populations (and their activities such as firewood collecting and agriculture) can be expected to have resulted in higher pressures on populations of *Q. kingiana*.

Tourism and recreation: None known for Laos and Thailand.

Fire and fire suppression: Forest fires are a critical threat to *Q. kingiana* populations, particularly in high-elevation areas like Doi Suthep-Pui (Northern Thailand). Long-term monitoring (2012–2025) reveals a severe recruitment failure, with zero new individuals recorded despite the species' dominance in the canopy. The population structure is currently unimodal, lacking the seedlings and saplings necessary for natural replacement. As high-intensity fires increasingly reach mountain summits, the lack of young stems signals a gradual decline towards localized extinction. Without proactive fire control and assisted regeneration, *Q. kingiana* will likely be replaced by more fire-tolerant deciduous taxa. The limited number of populations currently known from Central Laos (Khammouane Province) occur in tropical dry forest, dominated by Dipterocarps, oaks and other Fagaceae. Under progressive drying, as a result of projected climate changes, these populations can be expected to suffer further declines.

Invasive species competition/disturbance: While the impact of invasive species on *Q. kingiana* is unknown, unregulated grazing and firewood collecting can have unwanted effects, such as more opportunities for invasive species.

Climate change and severe weather: A study by Vyan et al. (2026) evaluated the ecological requirements of *Q. kingiana* using species distribution modeling (SDM) and projected its distribution range under SSP2-4.5 and SSP5-8.5 climate scenarios. They found that the species is projected to lose up to 64% of its range by the year 2080.

Genetic material loss: Unknown at the time of publication.

Pests/pathogens: None known for Laos and Thailand.

Extremely small populations: There are currently no estimates for the size of the population(s) recently found in Central Laos. It should be noted that these populations are located in a region that has seen the construction of a hydro-electric dam, which resulted in the flooding of vast areas bisecting the National Park. It is not known whether populations of *Q. kingiana* existed in the now-flooded area, but given the proximity of the extant individuals to the lake, this is very possible.

CONSERVATION ACTIVITIES

Once per year between 2021 and 2025, *Quercus* accessions data were requested from *ex situ* collections globally. A total of 45 institutions from 12 countries submitted data for Southeast and East Asian (SE-E Asian) oak species, including *Q. kingiana*. We also included *ex situ* collections data in our analysis from the 267 institutions that responded to surveys conducted in 2017–2022 for previous gap analysis of oaks led by The Morton Arboretum, as these often included all *Quercus* level accession data at an institution and could have included one or more of our target species. Past, present, and planned conservation activities for SE-E Asian oak species of concern were also examined through literature review and expert consultation.

One institution in Asia reported an *ex situ* collection of *Q. kingiana*. Thirty-seven individuals of wild origin were reported (Table 1). A spatial analysis was conducted to estimate the geographic and ecological coverage of *ex situ* collections using methods adapted from Khoury et al. (2020). Fifty-kilometer buffers were placed around each wild occurrence point as well as the source locality of each plant living in *ex situ* collections. Collectively, the buffer area around the wild occurrence points represents the inferred native range of the species. The buffer area around *ex situ* points serves as the native range represented in *ex situ* collections. Geographic coverage of *ex situ* collections was estimated by dividing the *ex situ* buffer area by the area of the inferred native range. Ecological coverage of *ex situ* collections was estimated by dividing the number of Holdridge life zones present under the *ex situ* buffer by the number of Holdridge life zones under the inferred native range. The species representativeness *ex situ* was calculated by counting the number of *ex situ* institutions that currently have one or more living individuals of wild provenance in their collections, up to a maximum of ten. In order to maintain a consistent scale across all scores, this number was multiplied by ten. All three scores range from 0–100. A final *ex situ* conservation score was calculated by taking an average of the three scores above. Final scores range from 0–100, with scores near 100 indicating comprehensive *ex situ* conservation, and scores near 0 indicating poor *ex situ* conservation.

Table 1. Results of 2017–2022 *ex situ* surveys.

Number of *ex situ* collections reporting this species	1
Number of plants in *ex situ* collections	37
Average number of plants per institution	37
Percent of *ex situ* plants of wild origin	100%
Percent of wild origin plants with known locality	100%

Table 2. *Ex situ* conservation scores for *Quercus kingiana* with all scores ranging from 0–100. A final score of 100 indicates comprehensive *ex situ* conservation, and a score of 0 represents poor ex situ conservation..

Geographic coverage *ex situ*	7
Ecological coverage *ex situ*	71
Species representation in *ex situ* collections	10
Final *ex situ* conservation score	30

The final conservation score *ex situ* for *Q. kingiana* is 30/100 (Table 2). As a reference, the threatened or Data Deficient SE-E Asian oaks with the highest *ex situ* conservation scores are *Q. tarokoensis* with a score of 63/100, and *Q. tatakaensis* with a score of 54/100.

Using methods adapted from Khoury et al. (2020), we estimated the degree of representation of *Q. kingiana* in protected areas in order to identify *in situ* conservation gaps. Wild occurrence points were mapped and overlaid with protected areas from the World Database on Protected Areas (Figure 3; UNEP-WCMC & IUCN, 2025) and the Data Resources of Nature Reserves in China Repository (National Specimen Information Infrastructure, 2020). A fifty-kilometer buffer was placed around each occurrence point to represent the species inferred native range. Geographic coverage *in situ* was estimated by calculating the proportion of a species inferred native range that is covered by protected areas. Ecological coverage *in situ* was estimated by identifying the Holdridge life zones in the inferred native range as well as the Holdridge life zones in protected areas within the inferred native range and calculating the percentage of life zones that are conserved in protected areas. Species representativeness *in situ* was estimated by calculating the percentage of known occurrence points within the species inferred native range that fall inside protected areas. All three scores range from 0–100. A final conservation score *in situ* was calculated by taking an average of the three scores above. Final scores range from 0–100, with scores near 100 indicating comprehensive *in situ* conservation, and scores near 0 indicating poor *in situ* conservation.

The final conservation score in situ for *Q. kingiana* is 52/100 (Table 3). As a reference, the threatened or Data Deficient SE-E Asian oaks with the highest *in situ* conservation scores are *Q. blaoensis* with a score of 77/100, and *Q. xuanlienensis* with a score of 79/100.

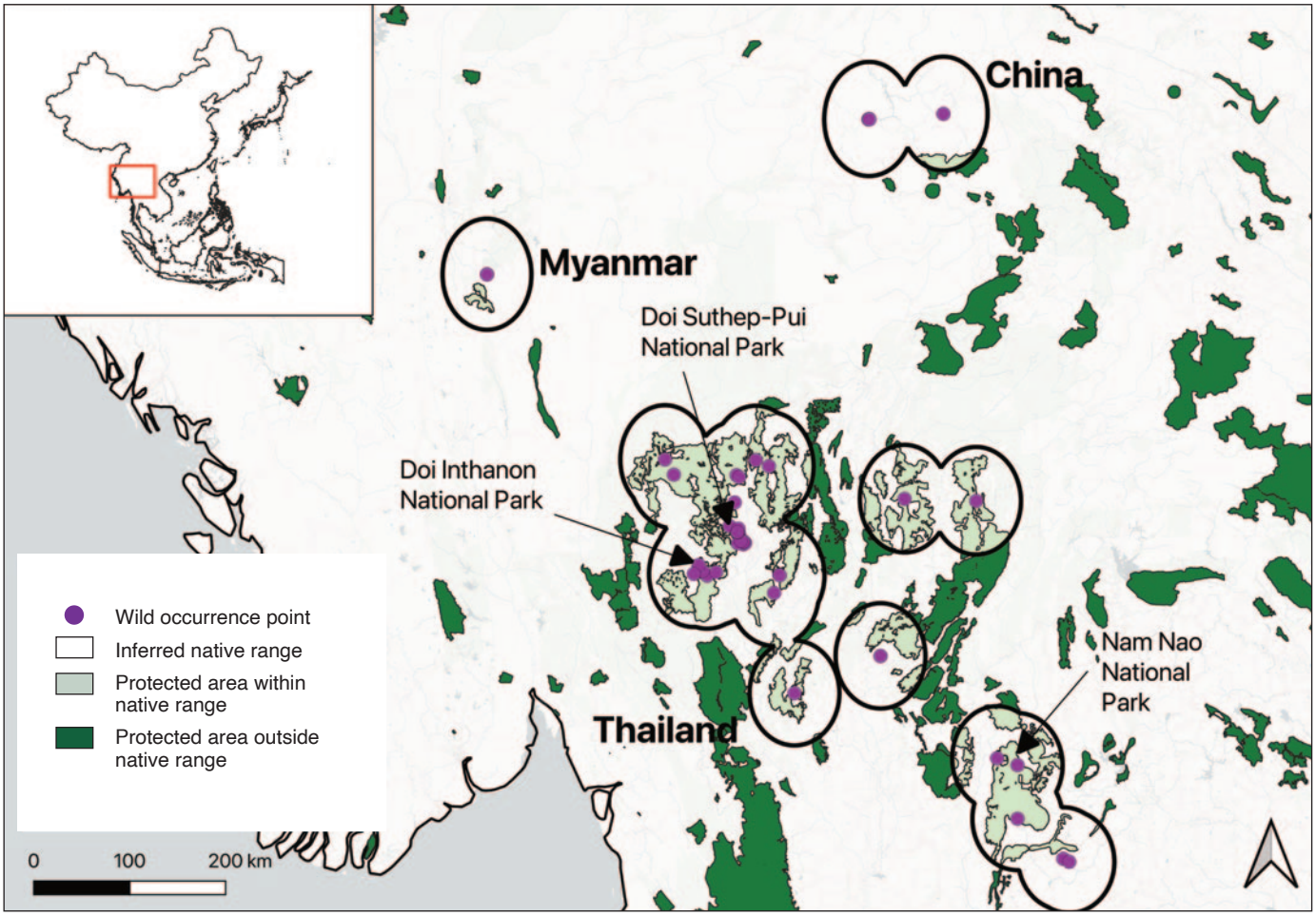

Figure 3. Wild occurrence points and inferred native range of *Quercus kingiana* in relation to protected areas. Protected areas are from the World Database on Protected Areas (UNEP-WCMC and IUCN, 2025) and the Data Resources of Nature Reserves in China Repository (National Specimen Information Infrastructure, 2020).

Table 3. *In situ* conservation scores for *Quercus kingiana* with all scores ranging from 0–100. A final score of 100 indicates comprehensive *in situ* conservation, and a score of 0 represents poor *in situ* conservation.

Geographic coverage *in situ*	28
Ecological coverage *in situ*	71
Species representation in *in situ* collections	58
Final *in situ* conservation score	52

Land protection: In the species' inferred native range, 28% is within protected areas (Table 2). Protected areas include Ob Luang National Park and Mae Sa-Kog Ma Reserve in Thailand. In Laos, it is found in the western part of Nakai Nam Theung National Park with scattered individuals, where it faces a diffuse array of threats.

Sustainable management of land: Tropical dry forests are a fragile habitat which is frequently used as rangeland for extensive cattle grazing, or for clearing for firewood and cultivation of specific dry-adapted crops. Even in protected areas, these activities can have a severely degrading effect on the habitat and further decrease populations of threatened species such as *Q. kingiana*. The recently found populations are inside the low-use zone of the protected area, where all of the aforementioned activities are taking place. At the time of writing, there is no information available on whether these activities are actively being managed or monitored by the park authorities.

Population monitoring and/or occurrence surveys: From 2025-2027, conservation and restoration work is being carried out within the scope of a 2-year research project (see "Propagation and/or breeding programs" below) including several species of *Quercus* in Laos and Vietnam.

Wild collecting and/or *ex situ* curation: According to the results of our *ex situ* surveys, there are 37 individuals of *Q. kingiana* currently held in one *ex situ* collection worldwide. A further 400+ individuals are part of a 2-year propagation program (see "Propagation and/or breeding programs" below).

Propagation and/or breeding programs: A 2-year research and conservation program funded by Fondation Franklinia, and led by the Alliance for Conservation Tree Genomics (www.actg.science) and The Morton Arboretum, is being conducted in Laos and Vietnam (2025-2027), focusing on the propagation and restoration of ten threatened species of Fagaceae. Part of this project has seen the construction of a Native Plant Conservation Nursery in Nakai Nam Theun National Park, where at the end of 2025 (end of project year 1), nearly 1,500 seedlings of threatened Fagaceae were being propagated for various species. This includes over 400 seedlings of *Q. kingiana*, which will be used in future restoration efforts in the region, and the establishment of metapopulation collections elsewhere in the country. With mother trees located in the first year, further collections of seeds for propagation of *Q. kingiana* are scheduled for year 2 (J.S.Strijk pers.comm 2026).

Reintroduction, reinforcement, and/or translocation: *Q. kingiana* seedlings are currently being propagated in a nursery in Laos, and planned for future restoration efforts within the region.

Research: A recent study sequenced, assembled, and annotated the chloroplast genome of *Q. kingiana* and compared results with those of other *Quercus* species (Zhou et al., 2024). Their results showed that the *Quercus* chloroplast genomes were similar in quadripartite structure, GC content, codon usage features and gene order. Vyan et al. (2026) created species distribution models for *Q. kingiana* and projected changes in distribution under different climate change scenarios. Long-term demographic monitoring was established through a 1-hectare permanent plot at Queen Sirikit Botanic Garden, Northern Thailand, to track the 13-year dynamics (2012–2025) of plant species in pine-dipterocap forest including *Q. kingiana* (Kantasrila et al., 2026). A total of 36 trees are distributed in QSBG permanent plot in dry dipterocarp-pine forest.

Education, outreach, and/or training: To enhance the capacity building of Lao botanists, two workshops on identification and taxonomy of Fagaceae (especially in genus *Quercus*) for students and young researchers of the National University of Laos and other research institutions were held (Souladeth, 2022). *Quercus kingiana* was one of the focal species of the workshop. In addition, to increase awareness, skills and network capacity for conserving threatened Fagaceae in Laos, three regional workshops with over 70 participants were held in 2026 (https://www.actg.science/projects/workshops-and-field-courses/). Participants represented local communities, regional forestry offices and national university departments and, using classroom-, nursery- and field-based sessions, were introduced to species identification, collection, propagation and reforestation techniques, and the formulation of conservation and management planning for threatened species.

Species protection policies: None specifically known for Laos and Thailand.

PRIORITY CONSERVATION ACTIONS

The primary threats in Laos and Thailand involve population decreases as a result of climate change, forest conversion and removal, and unsustainable use of (parts of) plants by local communities. The scattered distribution of small populations and the lack of data on numbers of individuals within these populations presents a major obstacle to assessing the extent of threats, and this can only be addressed by increased survey work throughout the region, coupled with protective measures for newly found populations. The creation of a standardized propagation protocol (one of the major milestones of the 2025-2027 project in Laos and Vietnam) will enable local stakeholders to propagate *Q. kingiana* for local community planting, restoration activities, and inclusion in metapopulation collections. Inclusion of *Q. kingiana* in monitoring and conservation planning both within (by National Park authorities) and outside of protected areas through broader national legislation is urgently needed to prevent further decreases in population size and numbers of extant individuals.

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