

Conservation Gap Analysis of Select Native Asian Oaks



Species profile: *Quercus baolamensis*

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CRITICALLY ENDANGERED

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

ENDANGERED

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

VULNERABLE

<i>Quercus austrocochinchinensis</i>
<i>Quercus braianensis</i>
<i>Quercus gaharuensis</i>
<i>Quercus hondae</i>
<i>Quercus kerangasensis</i>
<i>Quercus merrillii</i>
<i>Quercus quangtriensis</i>
<i>Quercus treubiana</i>

Quercus baolamensis H.T.Binh & Ngoc

IUCN Red List Category and Criteria: Critically Endangered D

Synonyms: None Common Names: Sồi Bảo Lâm

Classification: Subgenus *Cerris*, Section *Cyclobalanopsis*

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DISTRIBUTION AND BIOLOGY

Quercus baolamensis is a newly described species in the *Quercus langbianensis* complex that is endemic to Viet Nam (Kon Tum and Lam Dong provinces; Figure 1). It is named after the type locality of Bao Lam District in the Central Highlands. It inhabits subtropical wet forest (Figure 2),

where it has been observed along roadsides and the edge of evergreen forests (Ngoc & Binh, 2023). It is a tree, 6–10 m tall. Leaves are elliptic to elliptic-lanceolate, and 9–15 × 1.7–4.5 cm (Ngoc & Binh, 2023). Leaf margins are undulate, becoming distinctly serrate in the upper half. Acorns are ovoid, with the cupule covering 1/3 of the nut (Binh et al., 2018). Cupules have 5–6 rings.

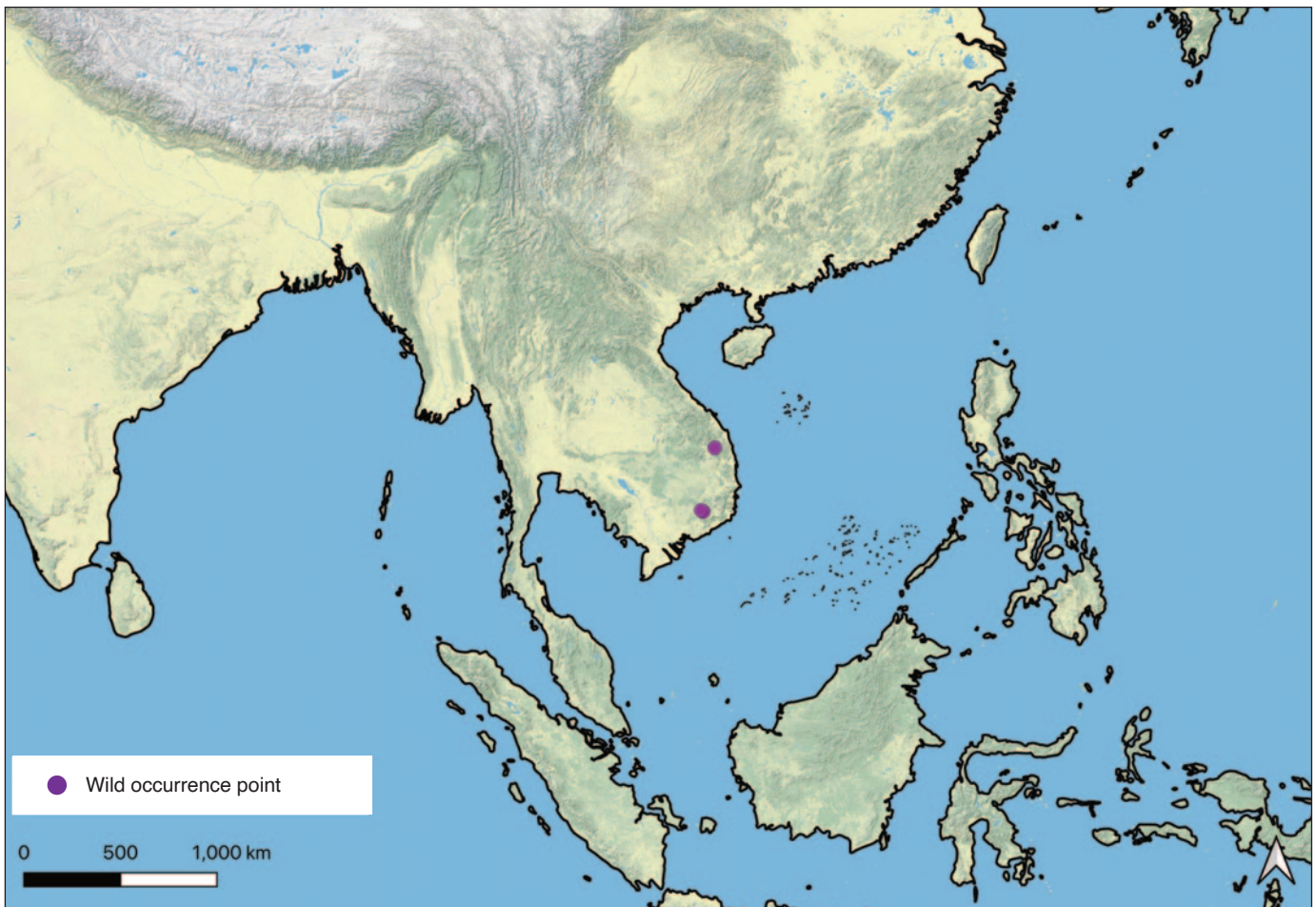


Figure 1. Wild (i.e., in situ) occurrence points for *Quercus baolamensis*.

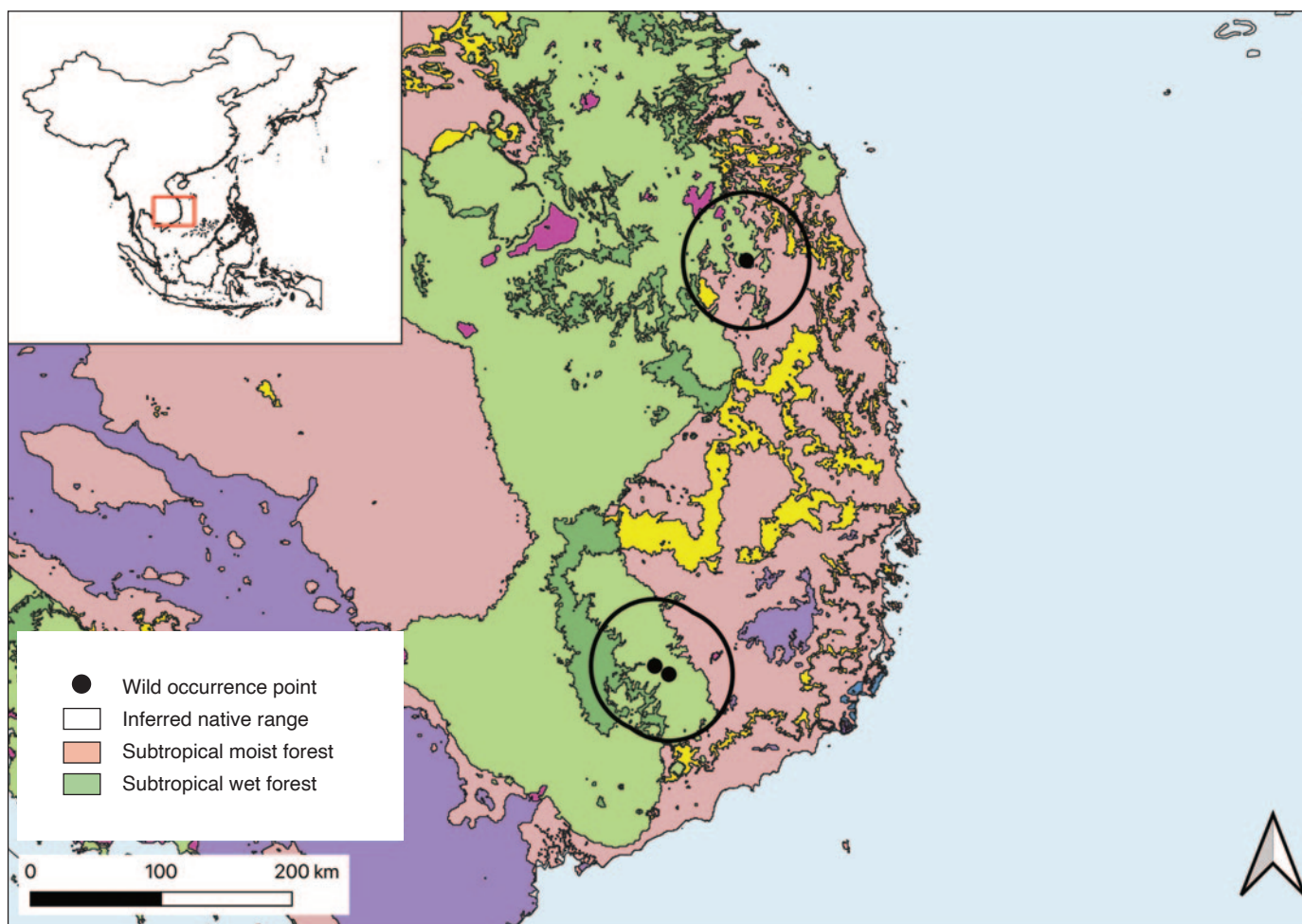


Figure 2. Holdridge life zones (HLZs) within the inferred native range of *Quercus baolamensis*. Map legend includes the HLZs with at least one occurrence point of *Q. baolamensis*. For a full map of HLZs within the study region, see Appendix B in Good et al. (2026).



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. baolamensis* and other terrestrial plant species.

Logging and wood harvesting: Although there are no published reports of commercial logging specifically targeting *Q. baolamensis*, the species' habitat in evergreen forests along roadsides and forest edges in Lam Dong and Kon Tum provinces is subject to selective logging and fuelwood collection. The Central Highlands of Vietnam have experienced significant forest degradation due to timber extraction (Austin et al., 2017; World Resources Institute, 2025).

Agriculture, wood and pulp plantations: Agricultural expansion is the primary driver of forest loss in Vietnam's Central Highlands. Conversion of forest to coffee, pepper, and acacia plantations has been extensive in Lam Dong and Kon Tum provinces, where *Q. baolamensis* occurs (Austin et al., 2017). Edge-of-forest habitats, which the species preferentially inhabits, are particularly vulnerable to agricultural encroachment.

Residential/commercial development, mining, roads: The species has been observed along roadsides, indicating its vulnerability to road construction and infrastructure development. Urbanization in Bao Lam District, Lam Dong Province (the type locality), and Kon Plong District, Kon Tum Province, poses a threat to remaining habitat patches.

Tourism and recreation: Eco-tourism development in the Central Highlands, while generally less intensive than agriculture and logging, may contribute to habitat disturbance at forest edges and roadsides where *Q. baolamensis* is found.

Fire and fire suppression: Seasonal fires set for agricultural land clearing in areas adjacent to forest edges are a threat to the marginal forest-edge habitat where *Q. baolamensis* occurs. Fire suppression is generally not practiced in these areas.

Invasive species competition/disturbance: Invasive grasses and pioneer shrubs commonly colonize disturbed forest edges and roadsides, and may compete with *Q. baolamensis* seedlings for light and resources in the edge habitats this species occupies.

Climate change and severe weather: Climate projections for the Central Highlands of Vietnam indicate warming temperatures and shifts in monsoon rainfall patterns. The subtropical wet forest habitat of *Q. baolamensis*, found at approximately 800–1,200 m elevation, may be affected by upslope habitat shifts. As a restricted-range endemic, *Q. baolamensis* is particularly vulnerable to climate-driven changes in forest composition and structure.

Genetic material loss: With a known distribution limited to two provinces and very few confirmed localities, *Q. baolamensis* likely exists in small, isolated populations with limited gene flow. This increases the risk of inbreeding depression and loss of adaptive genetic diversity. No genetic diversity data are currently available for this species.

Pests/pathogens: Unknown. No pest or pathogen data have been reported for *Q. baolamensis*.

Extremely small populations: *Quercus baolamensis* was assessed as Critically Endangered D by the IUCN (Carrero & Strijk, 2020), reflecting its extremely small known population size. The total number of mature individuals is estimated to be fewer than 250. Given that the species was described in 2018 and has been observed at only a few localities, the true population size remains poorly known and further surveys are needed (Binh et al., 2018; Ngoc & Binh, 2023).

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. baolamensis*. 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.

There were no institutions that reported *ex situ* collections of *Q. baolamensis* (Table 1). As a result, geographic and ecological coverage of *ex situ* collections for *Q. baolamensis* could not be calculated.

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

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

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

Table 2. *In situ* conservation scores for *Quercus baolamensis* 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 <i>in situ</i>	27
Ecological coverage <i>in situ</i>	83
Species representation in <i>in situ</i> collections	67
Final <i>in situ</i> conservation score	59

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. baolamensis* is 59/100 (Table 2). As a reference, the threatened or Data Deficient SE-E Asian oaks with the highest *in situ* conservation scores are *Q. blaensis* with a score of 77/100, and *Q. xuanlienensis* with a score of 79/100.

Land protection: Twenty-seven percent of the species’ inferred native range is within protected areas. This species has been observed in Cat Tien, a UNESCO-MAB Biosphere Reserve in Lam Dong province, Viet Nam.

Sustainable management of land: No specific sustainable land management programs targeting *Q. baolamensis* habitats are currently known. The forests of Bao Lam District fall under provincial management, but the edge-of-forest habitats where the species occurs lack dedicated management plans.

Population monitoring and/or occurrence surveys: Surveys for *Q. baolamensis* have been conducted by researchers at Dalat University (Binh et al., 2018; Ngoc & Binh, 2023). The species was initially collected in June 2015 from Bao Lam District, Lam Dong Province (type specimen: Ngoc et al. V3191), and subsequently recorded in July 2020 from Kon Plong District, Kon Tum Province (Binh & Ngoc, QC210), extending its known range. Further systematic surveys across the Central Highlands are needed to determine the full extent of the species’ distribution.

Wild collecting and/or *ex situ* curation: There were no institutions that reported *ex situ* collections of *Q. baolamensis*. Herbarium voucher specimens are deposited in the herbaria of Dalat University (DLU) and Kyushu University, Japan (FU). Collection of living plant material or seed for *ex situ* conservation is an urgent priority.

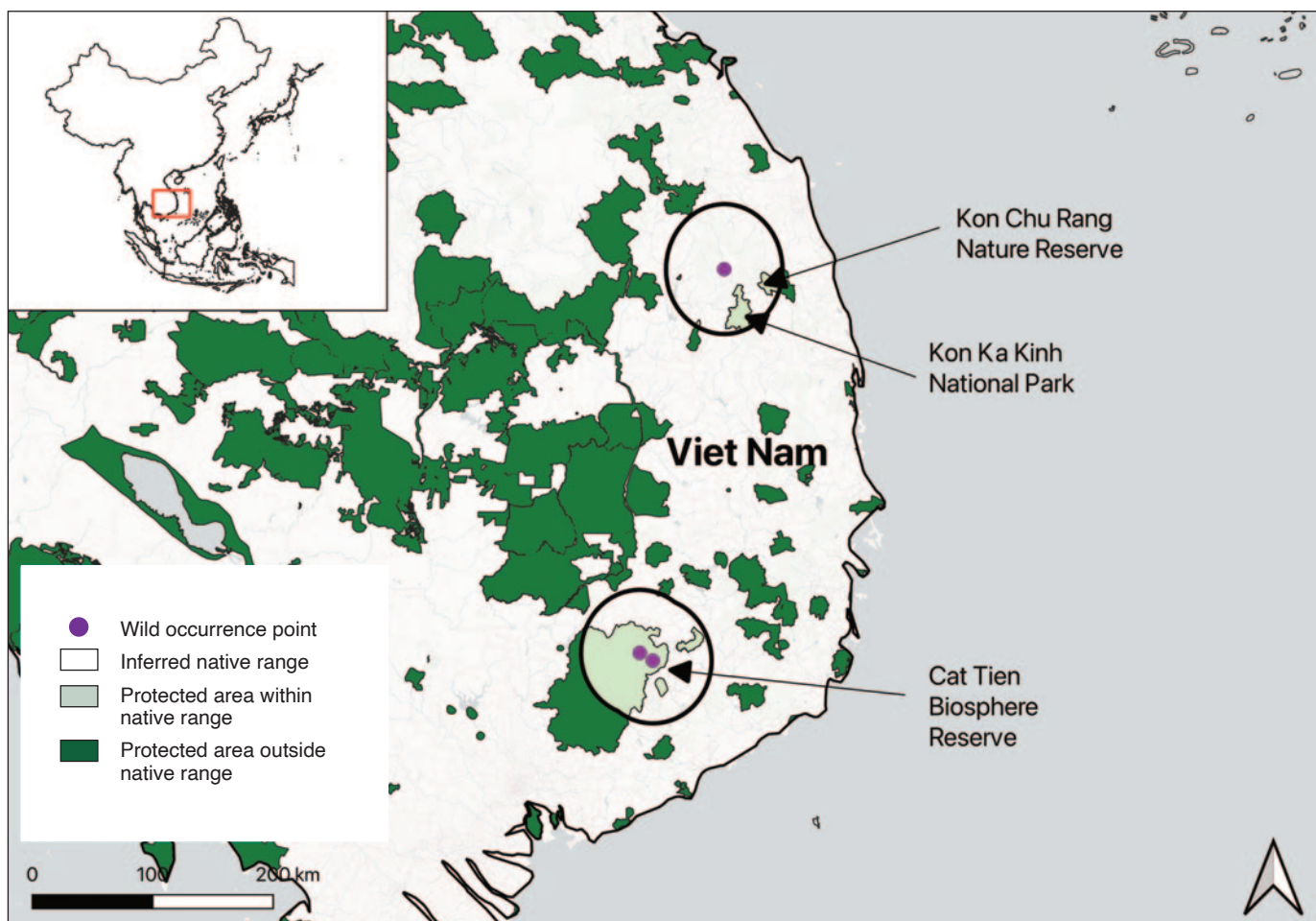


Figure 3. Wild occurrence points and inferred native range of *Quercus baolamensis* in relation to protected areas. Protected areas are from the World Database on Protected Areas (UNEP-WCMC & IUCN, 2025).

Propagation and/or breeding programs: No propagation programs currently exist for *Q. baolamensis*. Dalat University's Faculty of Biology has the botanical expertise and field access to develop propagation protocols for this species, in collaboration with the Franklinia Foundation and international partners.

Reintroduction, reinforcement, and/or translocation: This is not currently a conservation activity for this species. Reintroduction or population reinforcement activities are not feasible until ex situ material is available and site selection protocols are established.

Research: The original description of *Q. baolamensis* was published by Binh et al. (2018) in *PhytoKeys* 95: 37-70, establishing its identity as a distinct species within the *Quercus langbianensis* complex through morphological comparison and molecular analyses (rbcL, matK, ITS, and MIG-seq). MIG-seq phylogenetic analysis placed *Q. baolamensis* in a clade with *Q. honbaensis*, with strong bootstrap support. DNA barcoding studies by Ngoc et al. (2022) confirmed the utility of ITS for discriminating *Q. baolamensis* from related species in Lam Dong Province. The species is comprehensively described with photographs in *Fagaceae of Vietnam, Volume I* (Ngoc & Binh, 2023). Phylogenetic analysis using MIG-seq data from 50 Vietnamese *Quercus* species confirmed the placement of *Q. baolamensis* within section *Cyclobalanopsis* (Binh et al., 2024).

Education, outreach, and/or training: No specific education or outreach programs for *Q. baolamensis* are currently known. Dalat University has conducted biodiversity awareness activities in Lam Dong Province that include oaks as focal organisms, and the publication of *Fagaceae of Vietnam, Volume I* (Ngoc & Binh, 2023) serves as an educational resource for this species.

Species protection policies: No species-specific protection policies exist for *Q. baolamensis* under Vietnamese law. It is not currently listed in Vietnam's Red Data Book (Nguyen et al., 2007). Given its IUCN Red List Critically Endangered D status and its endemism to Vietnam's Central Highlands, nomination for inclusion in future editions of Vietnam's Red Data Book and official protection listings under Decree 84/2021/ND-CP is strongly recommended.

PRIORITY CONSERVATION ACTIONS

To conserve *Q. baolamensis*, priority should be given to population surveys and occurrence mapping. Comprehensive field surveys are urgently needed across the Central Highlands to establish the species's full distribution, population size, and structure. Data on *Q. baolamensis* is currently limited to a few locations across Lam Dong and Kon Tum provinces. Systematic surveys in adjacent suitable habitats is crucial to better understand its distribution. As the species is not currently represented in any global *ex situ* collection, establishing one is a priority. Living plants or seeds should be collected from various wild populations in both Lam Dong and Kon Tum for cultivation in botanical gardens or arboreta. Given the species' Critically Endangered (CR) status and extremely limited range, it is scientifically necessary to initiate the process of listing *Q. baolamensis* in Vietnam's Red Data Book and official protected species lists under Decree 84/2021/ND-CP. This will provide essential legal protection for the species and its habitat.



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