

Conservation Gap Analysis of Select Native Asian Oaks



Nguyen Van Ngoc

Species profile: *Quercus bidoupensis*

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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 bidoupensis H.T.Binh & Ngoc

IUCN Red List Category and Criteria: Critically Endangered D

Synonyms: None Common Names: Soi Bidoup

Classification: subgenus *Cerris* and section *Cyclobalanopsis*

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DISTRIBUTION AND BIOLOGY

Quercus bidoupensis is a newly described Vietnamese endemic species in the *Quercus langbianensis* complex (Lam Dong and Dac Lak provinces; Figure 1). Previously only known from the type locality in Bidoup-Nui Ba National Park, Lam Dong Province, a 2023 observation in Dac Lak extended the species' range north. This species has also been collected from Măng Đen (Kon Tum) at 1,200 m in

2024. However, this record is not part of the dataset in the present study. It is a tree up to 8 meters tall that inhabits the warm temperate moist forest (Lam Dong) and subtropical moist forest (Dac Lak; Figure 2).

Leaves are oblong-lanceolate, (7.5–)10–13 × 2.5–4 cm, with undulate margins that are distinctly serrate in the upper half (Binh et al., 2018). Acorns are blackish in color, ovoid and 2.2 cm high (2.6 cm high including the cupule).

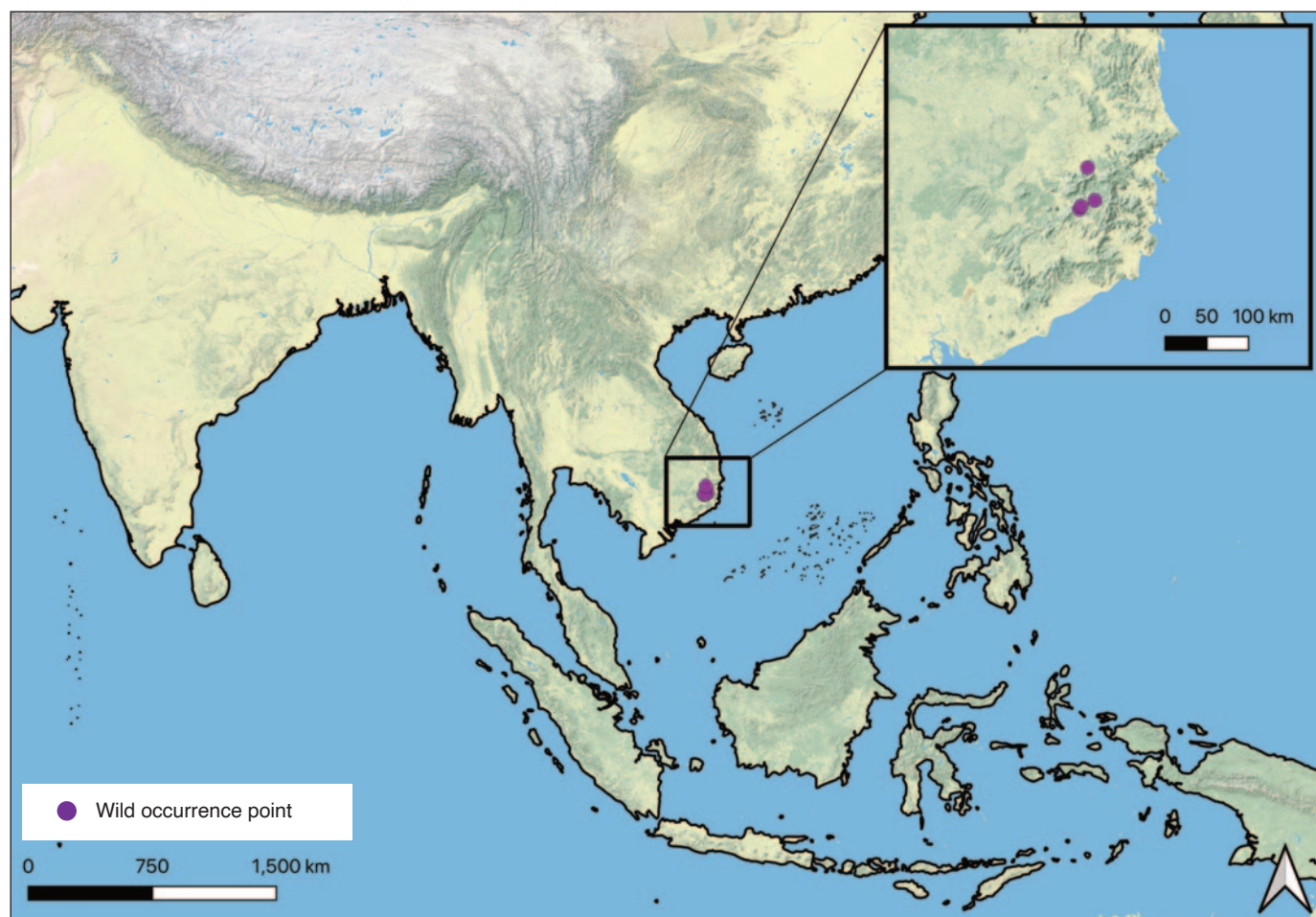


Figure 1. Wild (i.e., in situ) occurrence points for *Quercus bidoupensis*

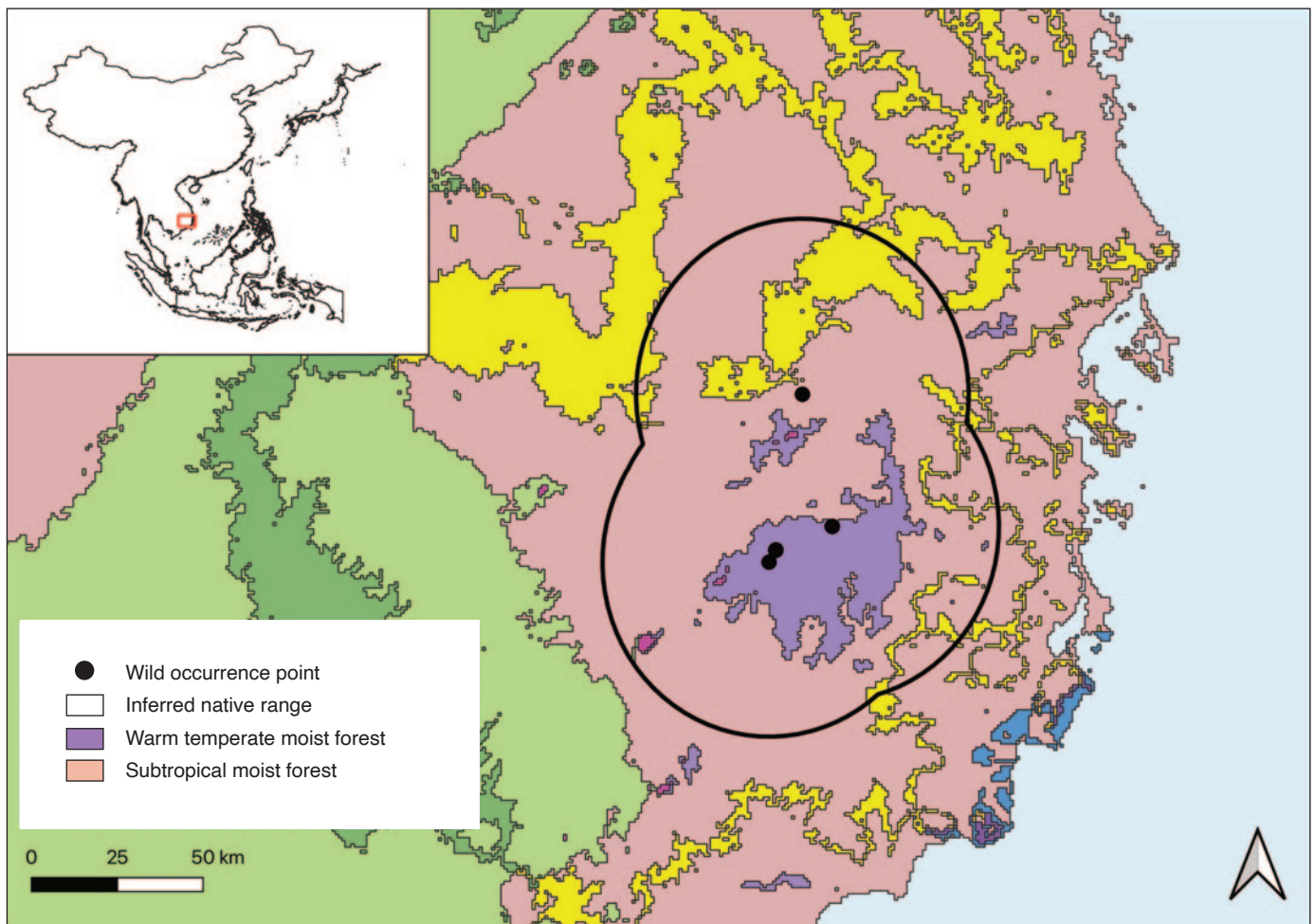


Figure 2. Holdridge life zones (HLZs) within the inferred native range of *Quercus bidoupensis*. Map legend includes the HLZs with at least one occurrence point of *Q. bidoupensis*. For a full map of HLZs within the study region, see Appendix B in Good et al. (2026).



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. bidoupensis* and other terrestrial plant species.

Logging and wood harvesting: Although *Q. bidoupensis* is located largely within Bidoup-Nui Ba National Park, illegal logging remains a concern within the park. Selective extraction of high-value timber and fuelwood collection by local communities occur within the park boundaries, potentially impacting regeneration of Fagaceae species, including *Q. bidoupensis* (Austin et al., 2017; GIZ, 2023).

Agriculture, wood and pulp plantations: Agricultural encroachment remains a major challenge for Bidoup-Nui Ba National Park (GIZ, 2023). Furthermore, the 2023 finding of *Q. bidoupensis* in Dak Lak Province highlights the precarious status of such species in unprotected zones, where significant forest decline has been driven by the expansion of coffee and pepper plantations (Austin et al., 2017; World Resources Institute, 2025).

Residential/commercial development, mining, roads: Infrastructure expansion in the highland forests of Lam Dong and Dak Lak provinces, including road construction for agricultural access, poses an indirect threat to *Q. bidoupensis* through habitat fragmentation and increased access for illegal resource extraction.

Tourism and recreation: Bidoup-Nui Ba National Park attracts eco-tourists, and associated visitor infrastructure and trail development may contribute to localized disturbance of *Q. bidoupensis* habitat.

Fire and fire suppression: Free-range livestock grazing within Bidoup-Nui Ba National Park can increase fire risk through accumulation of dry biomass. Uncontrolled fires represent a threat to the Fagaceae-dominated hill evergreen forests where *Q. bidoupensis* grows (GIZ, 2023).

Invasive species competition/disturbance: Invasive species, including exotic grasses and the bracken fern *Pteridium aquilinum*, have been documented in disturbed highland forests of Viet Nam and may suppress native tree seedling regeneration in canopy gaps and disturbed areas within *Q. bidoupensis* habitat.

Climate change and severe weather: Climate projections for the Central Highlands indicate increased warming and altered rainfall patterns. Bidoup-Nui Ba National Park, with its warm temperate moist climate at elevations above 1,600 m, may experience significant changes in forest composition as temperature and precipitation regimes shift. As a narrow endemic, *Q. bidoupensis* is particularly vulnerable to climate-driven habitat contraction.

Genetic material loss: With the majority of the known population confined to Bidoup-Nui Ba National Park and very few confirmed localities, *Q. bidoupensis* likely experiences restricted gene flow between populations. The recent 2023 discovery in Dak Lak Province suggests the possibility of additional populations, but the risk of genetic erosion remains. No genetic diversity data are available for this species.

Pests/pathogens: Unknown. No pest or pathogen data has been recorded specifically for *Q. bidoupensis*.

Extremely small populations: *Quercus bidoupensis* was assessed as Critically Endangered D by the IUCN, reflecting an extremely small population size estimated at fewer than 250 mature individuals. Previously known only from Bidoup-Nui Ba National Park, a 2023 observation in Dak Lak Province extended its range. The total population size remains poorly known and systematic surveys are urgently needed.



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. bidoupensis*. 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. bidoupensis* (Table 1). As a result, geographic and ecological coverage of ex situ collections for *Q. bidoupensis* could not be calculated.

Using methods adapted from Khoury et al. (2020), we estimated the degree of representation of *Q. bidoupensis* 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 and 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 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. bidoupensis* is 50/100 (Table 2). As a reference, the threatened or Data Deficient SE-E Asian oak 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: An estimated 20% of the species' inferred native range is within protected areas. *Quercus bidoupensis* is named for Bidoup-Nui Ba National Park where it was originally described.

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

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

Table 2. *In situ* conservation scores for *Quercus bidoupensis* 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>	20
Ecological coverage <i>in situ</i>	100
Species representation in <i>in situ</i> collections	29
Final <i>in situ</i> conservation score	50

Sustainable management of land: Bidoup-Nui Ba National Park is under the management of Lam Dong Provincial People's Committee. The primary objective of the national park is “the protection of the integrity of the forest ecosystems, and conservation of the rare plant and animal genetic resources” (GIZ, 2023). There are three management zones within the National Park with different levels of protection: strictly protected zones (52%), regeneration zones (35%), and administrative and service zones (13%). Encroachment of agricultural land into the protected area is a major issue in the park. Additional destructive activities include free-range livestock grazing, unregulated use of non-timber forest products (NTFPs), as well as hunting and fishing. Engaging the communities that live in the park in forest protection is key. Villagers who commit to protect the forest receive financial support through Payment for Forest Environmental Services (PFES) contracts. In 2020, these contracts covered 66,579 ha of forest within the NP.

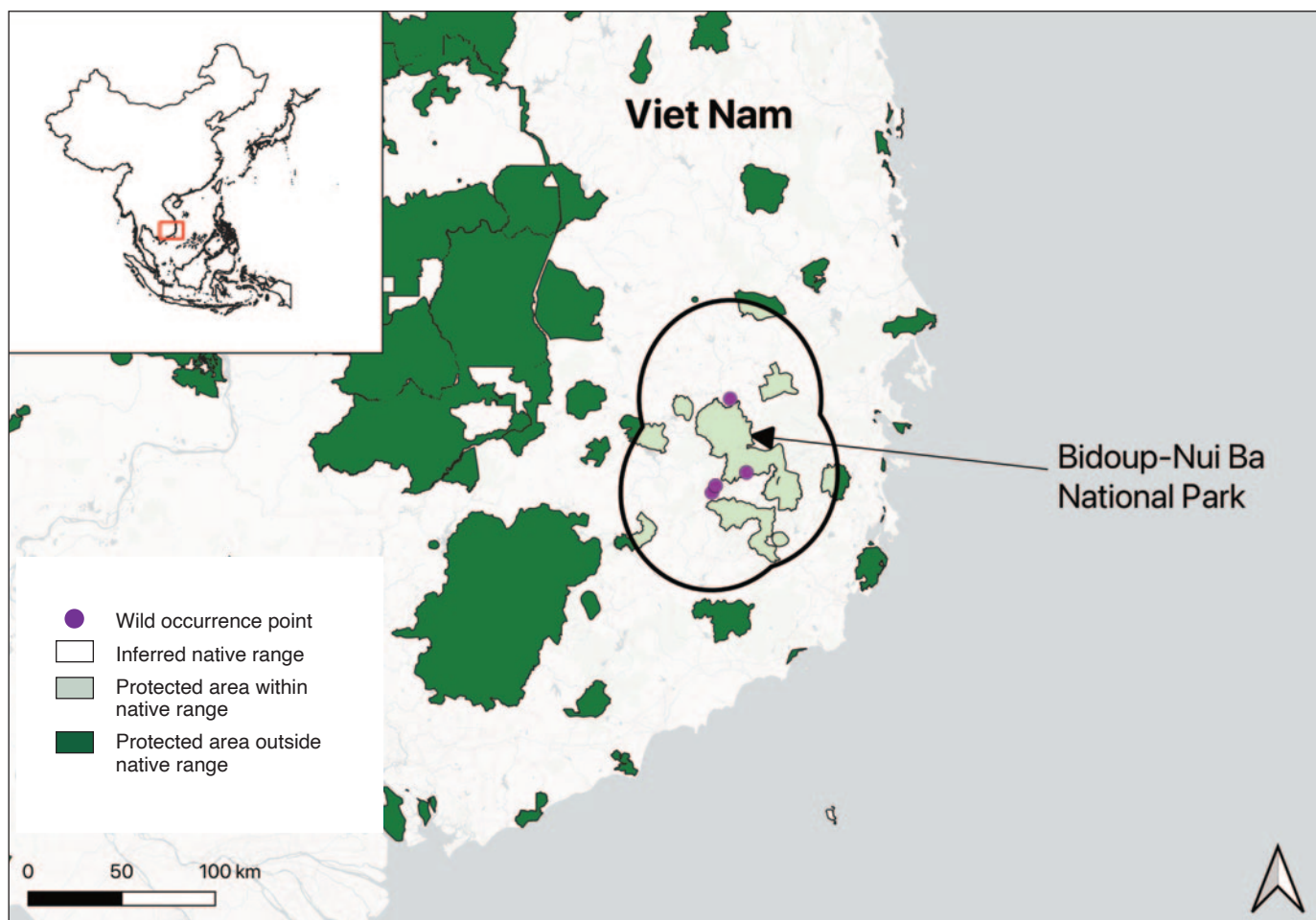


Figure 3. Wild occurrence points and inferred native range of *Quercus bidoupensis* in relation to protected areas. Protected areas are from the World Database on Protected Areas (UNEP-WCMC & IUCN, 2025).

Population monitoring and/or occurrence surveys:

Researchers from Dalat University have identified *Q. bidoupensis* at several locations within Bidoup-Nui Ba National Park, specifically at its type locality (1,553–1,807 m elevation) and in the Lan Tranh and Cong Troi sectors (Binh et al., 2018; Ngoc & Binh, 2023). Notably, a 2023 sighting in Dak Lak Province marked the first time the species was confirmed outside of Lam Dong. To accurately map its entire range, thorough systematic surveys throughout the Central Highland forests are now essential.

Wild collecting and/or ex situ curation: There were no institutions that reported ex situ collections of *Q. bidoupensis*. Herbarium voucher specimens are deposited in the herbaria of Dalat University (DLU) and Kyushu University, Japan (FU) (Binh et al., 2018; Ngoc & Binh, 2023). Seed collection for ex situ conservation is an urgent and as-yet-unmet conservation priority.

Propagation and/or breeding programs:

No propagation programs exist for *Q. bidoupensis*. Development of propagation protocols at Dalat University's Faculty of Biology, in collaboration with Bidoup-Nui Ba National Park management and international partners such as the Global Conservation Consortium for Oak (GCCO), would be a high-priority conservation action.

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 propagation protocols have been established.

Research: First described in PhytoKeys 95 (Binh et al., 2018), *Q. bidoupensis* was distinguished from the *Quercus langbianensis* complex through its unique morphology and genetic profile. MIG-seq phylogenetic analysis highlights its distinctiveness, placing the species in its own isolated clade (M1), while broader analysis of 50 Vietnamese oaks confirms its position within section *Cyclobalanopsis* (Binh et al., 2018, 2024). Detailed descriptions and photography are available in *Fagaceae of Vietnam, Volume I* (Ngoc & Binh, 2023), and DNA barcoding has identified ITS as the most effective marker for species identification (Ngoc et al., 2022).

Education, outreach, and/or training: No specific education or outreach programs for *Q. bidoupensis* are currently known. Dalat University, through its Faculty of Biology, has conducted biodiversity training activities in the Central Highlands. The *Fagaceae of Vietnam, Volume I* monograph (Ngoc & Binh, 2023) serves as an accessible educational and scientific reference for this species.

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

PRIORITY CONSERVATION ACTIONS

In order to conserve *Q. bidoupensis*, the conservation activities that should be given the highest priority are *ex situ* conservation and survey and collection of wild seeds or living plant material from multiple sites, including both the Lam Dong and Dak Lak populations. The exceptional phylogenetic uniqueness of *Q. bidoupensis*, forming a clade entirely isolated from all related species, makes *ex situ* backup especially critical for preserving irreplaceable evolutionary heritage. Systematic field surveys across the Central Highlands are needed to determine the distribution range of *Q. bidoupensis*. Identification of additional populations, and quantification of population size will help refine the IUCN Critically Endangered D assessment and guide future conservation planning. Initiating the process to list *Q. bidoupensis* in Vietnam's Red Data Book and under Decree 84/2021/ND-CP would provide legal status complementing the existing protection of Bidoup-Nui Ba National Park. Engagement of park management and local communities in species-specific monitoring and habitat protection is essential for long-term survival.

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