Conservation Gap Analysis of Select Native

Asian Oaks


Min Deng

Species profile: ***Quercus arbutifolia***

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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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DALAT UNIVERSITY

Alliance Conservation Tree Genomics

Quercus arbutifolia Hickel & A.Camus

IUCN Red List Category and Criteria: Endangered B2ab(ii,iii)
Synonyms: *Quercus obovatifolia* C.C.Huang; *Quercus obovatifolia* (C.C.Huang) Q.F.Zheng
Common Names: Sồi vòng **Classification:** subgenus *Cerris*, section *Cyclobalanopsis*

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DISTRIBUTION AND BIOLOGY

Quercus arbutifolia is native to southern China (Yunnan, Guizhou, Hunan, Guangxi provinces) and Viet Nam (Figure 1). It occurs primarily in warm temperate moist, evergreen, montane cloud forests between elevations of 900–2300 m (Carrero & Strijk, 2020; Figure 2). It prefers acidic, well-drained soils.

This species is frequently found in ravines and on slopes, often in association with *Rhododendron*, *Lithocarpus*, and *Camellia* species (Deng et al., 2016). A small, shrubby tree, *Q. arbutifolia* reaches heights of 2.5–3 (-10) m (Hélardot, 2018). Leaves are obovate to elliptic in shape, leathery and stiff, with entire margins. Acorns are 14–19 x 10–16 mm and enclosed 1/3 by the cup (Deng et al., 2011).

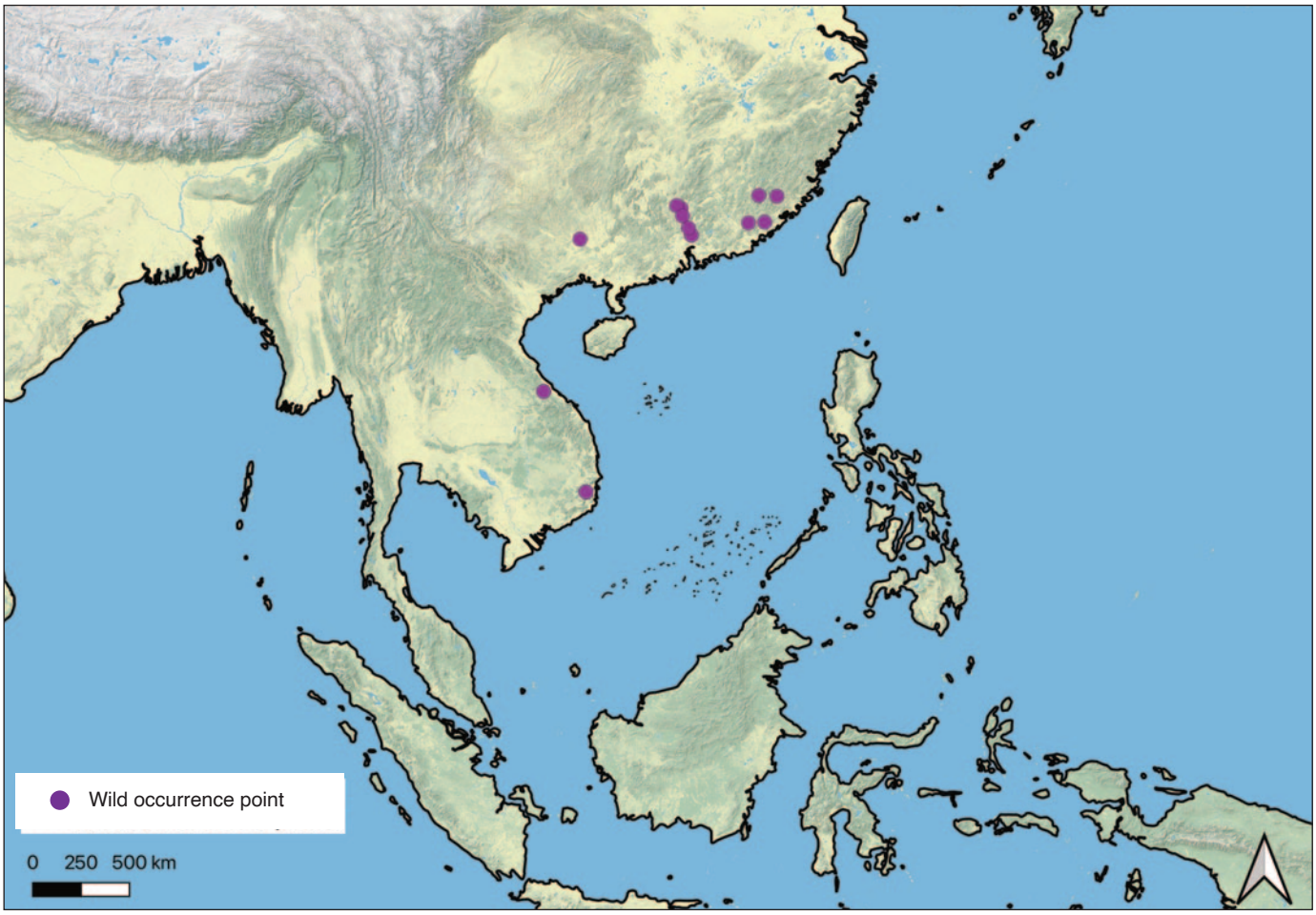

Figure 1. Wild (i.e., *in situ*) occurrence points for *Quercus arbutifolia*.

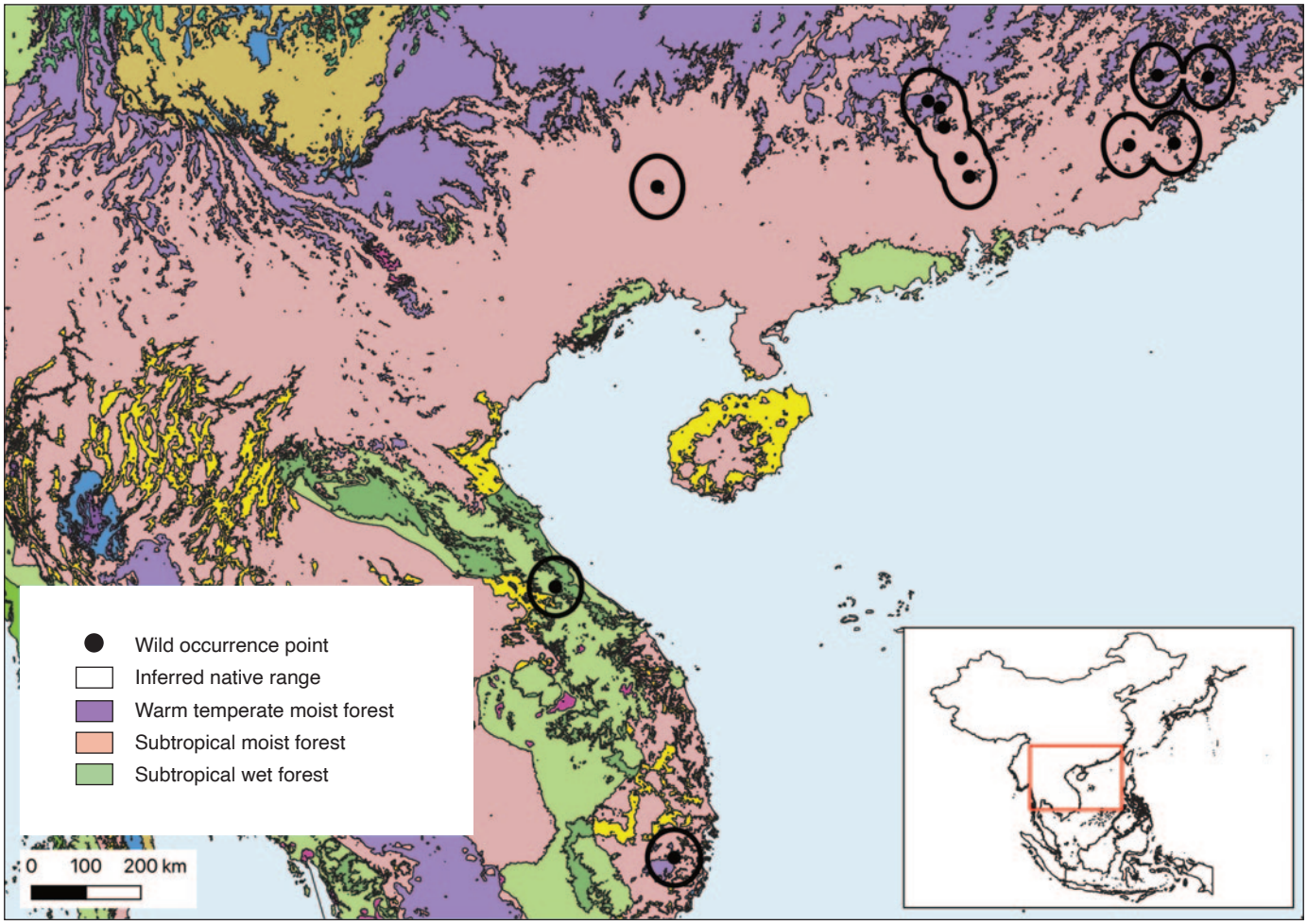

Figure 2. Holdridge life zones (HLZs) within the inferred native range of *Quercus arbutifolia*. Map legend includes the HLZs with at least one occurrence point of *Q. arbutifolia*. For a full map of HLZs within the study region, see Appendix B in Good et al. (2026).

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. arbutifolia* and other terrestrial plant species.

Logging and wood harvesting: Timber extraction is listed as a primary threat to *Q. arbutifolia* on the Vietnam Red List of Threatened Species (Vietnam Academy of Science and Technology, 2024). Illegal logging is a concern within Bidoup-Nui Ba National 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. arbutifolia* (Austin et al., 2017; GIZ, 2023).

Agriculture, wood and pulp plantations: Agriculture is listed as a primary threat to *Q. arbutifolia* on the Vietnam Red List of Threatened Species (Vietnam Academy of Science and Technology, 2024).

Residential/commercial development, mining, roads: Unknown at the time of publication.

Tourism and recreation: Tourism development is listed as a primary threat to *Q. arbutifolia* on the Vietnam Red List of Threatened Species (Vietnam Academy of Science and Technology, 2024).

Fire and fire suppression: It is unknown if forest fires directly impact *Q. arbutifolia* habitat. However, it should be noted that forest fires occur frequently in southwest China where *Q. arbutifolia* is found, with Yunnan Province in particular recording the highest number of forest forest nationwide (Zhang et al., 2025)

Invasive species competition/disturbance: Unknown at the time of publication.

Climate change and severe weather: Climate change poses an acute threat: modeled distributions suggest substantial range contractions by 2050, especially under high-emissions scenarios (Song et al., 2019). The current habitat of *Q. arbutifolia* in Guangdong, China, and Viet Nam is projected to disappear entirely (Song et al., 2019)

Genetic material loss: Genetic studies reveal high genetic differentiation among populations, indicating limited gene flow (Deng et al., 2016).

Pests/pathogens: Unknown at the time of publication.

Extremely small populations: Populations are small, fragmented, and declining, with an estimated 1,200–2,500 mature individuals across its entire range (Deng et al., 2016; Carrero & Strijk, 2020). Reproductive failure has been observed in some fragmented populations. Natural regeneration is rare and seedlings are uncommon in disturbed habitats.

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

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

Using methods adapted from Khoury et al. (2020), we estimated the degree of representation of *Q. arbutifolia* 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 (UNEP-WCMC & IUCN, 2025) and the Data Resources of Nature Reserves in China Repository (National Specimen Information Infrastructure, 2020; Figure 3). 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. arbutifolia* is 48/100 (Table 2). As a reference, the threatened or Data Deficient SE-E Asian oak 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.

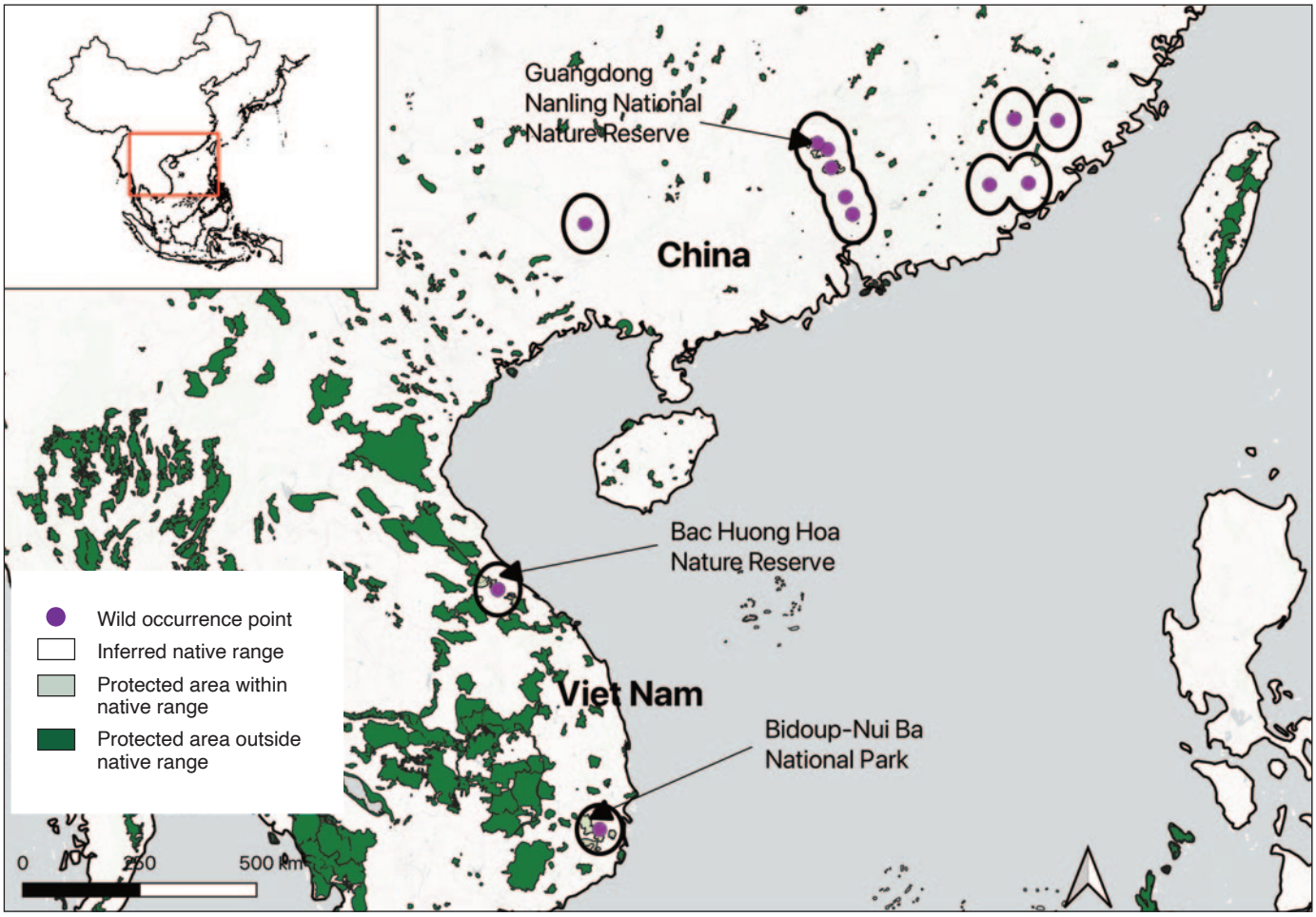

Figure 3. Wild occurrence points and inferred native range of *Quercus arbutifolia* in relation to protected areas. Protected areas are from the World Database on Protected Areas (UNEP-WCMC & IUCN, 2025) and the Data Resources of Nature Reserves in China Repository (National Specimen Information Infrastructure,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

Table 2. *In situ* conservation scores for *Quercus arbutifolia* 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*	7
Ecological coverage *in situ*	100
Species representation in *in situ* collections	38
Final *in situ* conservation score	48

Land protection: Only 7% of the species' inferred native range is within protected areas (Table 2). Populations occur within protected areas such as Bidoup-Nui Ba National Park and Bac Huong Hoa Nature Reserve in Viet Nam and the Guangdong Nanling National Nature Reserve in China.

Sustainable management of land: It is not known if there is sustainable management of land within the species' native range in China. In Viet Nam, 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.

Population monitoring and/or occurrence surveys: Recently, field surveys for *Quercus arbutifolia* identified 10 known populations across China and Viet Nam, of which eight populations were confirmed in the field. Extensive surveys conducted between 2011 and 2016 examined an additional 31 sites with similar habitat, but no new populations were discovered. The confirmed populations in southern China were studied in detail, including mapping population boundaries, recording elevation and slope, and estimating population size and structure. Survey methods varied by population size, with complete counts in small populations and transect-based extrapolation in larger ones. (Song et al., 2019)

Wild collecting and/or *ex situ* curation: According to the results of our *ex situ* surveys, there are no living collections of *Q. arbutifolia* in botanic gardens or arboreta worldwide. However, seed collections are at the Germplasm Bank of Wild Species (Kunming Institute of Botany, Chinese Academy of Sciences).

Propagation and/or breeding programs: Micropropagation protocols have been successfully developed to support nursery production (Li, 2017).

Reintroduction, reinforcement, and/or translocation: This is not a conservation activity at the time of publication.

Research: Research on *Quercus arbutifolia* transitioned from taxonomic clarification, where Deng et al. (2011) resolved its nomenclature and synonymy, to intensive genetic and spatial analysis. Xu et al. (2016) identified high genetic diversity across five Chinese populations, noting significant differentiation caused by geographic isolation. Furthering this, Song et al. (2019) utilized distribution modeling to reveal how Quaternary climate shifts shaped the species' current fragmented genetic patterns. Collectively, this work highlights a resilient genetic foundation that is increasingly threatened by a rapidly shrinking montane habitat.

Education, outreach, and/or training: This is not a conservation activity at the time of publication.

Species protection policies: This is not a conservation activity at the time of publication.

PRIORITY CONSERVATION ACTIONS

Quercus arbutifolia is a highly threatened oak species of Southeast Asia's montane cloud forests. It is emblematic of a broader conservation challenge in the region — safeguarding relict species with limited distributions, fragmented populations, and narrow ecological niches in the face of rapid environmental change. Targeted habitat protection, genetic management, and propagation-based recovery efforts are urgently needed to prevent extinction.

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