



Species Diversity and Elevational Patterns of Reptiles in the Leigongshan National Nature Reserve, Guizhou Province, China

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Dear Editor,

Understanding patterns of species diversity is a primary research focus in macroecology, with its distribution patterns having been described and theoretically validated on a global scale (Peters *et al.*, 2016; Sonne *et al.*, 2025). Numerous studies have found that species richness of different taxa tends to decrease with increasing elevation and is modulated by latitudinal gradients (Peters *et al.*, 2016; Dolson *et al.*, 2024). This principle provides a crucial scientific basis for regional conservation planning. However, it still exhibits significant variations across different mountain ranges and taxa. Therefore, exploring the elevational patterns of species richness remains an important area of ongoing research.

Reptiles are the most abundant species of terrestrial vertebrates and are widespread in Earth's terrestrial systems (Ran *et al.*, 2023; Dolson *et al.*, 2024). They display unique distribution patterns and life history traits due to their limited mobility and constraints imposed by topographic barriers (Rahbek *et al.*, 2019; Dolson *et al.*, 2024). However, it is currently facing the challenges of data scarcity and insufficient

conservation investment. Leigongshan National Nature Reserve (26°15'–26°32' N, 108°5'–108°24' E), a region with abundant reptile species, sits on the second step of China's Yunnan-Guizhou Plateau (Ran *et al.*, 2023, 2024). Over the past 50 years of surveys, the number of reptile species recorded within the reserve has increased from 34 to 62 (Hu *et al.*, 1973; Ran *et al.*, 2023). However, previous research has primarily focused on species composition and taxonomic revisions, lacking systematic studies on elevational distribution and conservation assessments. In addition, with ongoing taxonomic developments and revisions, a systematic review and update of the reptile checklist for the Leigongshan Reserve is warranted (Ran *et al.*, 2023; Wu *et al.*, 2025).

In this study, we conducted 51 transect surveys of reptile species in Leigongshan National Nature Reserve from March to October 2023 and April to October 2024 (Figure 1, Supplementary Table S1). Detailed sampling procedures, species identification methods, and endangered status classification approaches are referenced in the Supplementary information (Supplementary Text S1 and S2). A total of 63 reptile species were recorded, representing 52.5% of the 120 known reptile species in Guizhou Province (Supplementary Table S2) (Ran *et al.*, 2024). According to the China Red List of Biodiversity, three endangered species have been identified within the reserve, accounting for approximately 10.3% of all endangered species in the province (29 species). The threatened species are *P. sinensis*, *Dopasia harti*, and *Ptyas mucosa*. Additionally, we recorded a new species (*L. cathaya*) and corrected the classification of another species (*S. grahami*) based on historical records from previous surveys (Figure 1, Supplementary Text S3) (Hu *et al.*, 1973; Ran *et al.*, 2023; Wu *et al.*, 2025). These findings highlight

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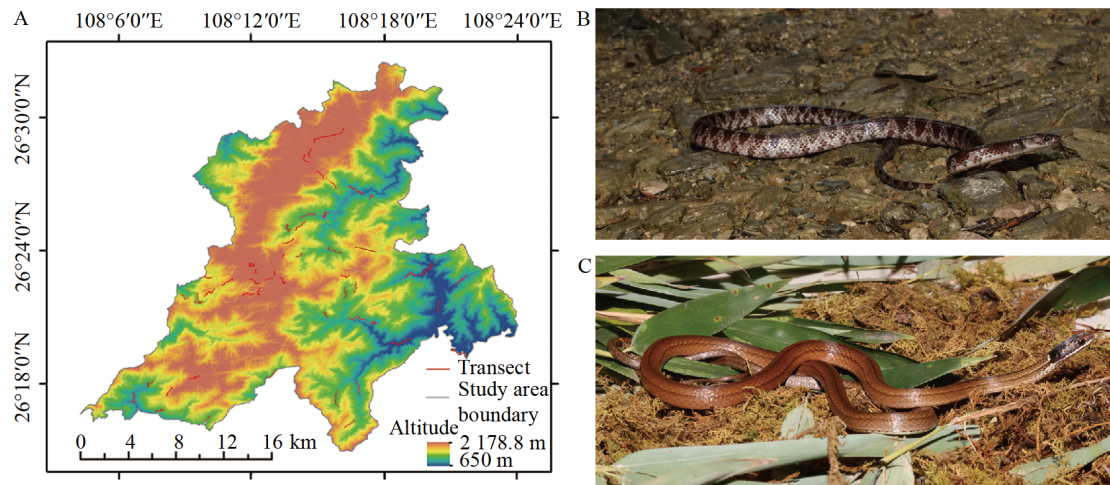


Figure 1 Schematic diagram of reptile surveys in Leigongshan National Nature Reserve, Guizhou Province, China. A shows the distribution of sampling transects (51 in total). B and C display raw photographs of two reptile species requiring correction within the reserve, identified as *Lycodon cathaya* and *Sibynophis grahami*, respectively.

the diversity and richness of reptile species in the reserve and indicate the potential for the discovery of additional species.

To investigate the distribution pattern of species richness along the elevation gradient, the protected area was divided into eight elevation zones based on the elevation range (650–2 178.8 m), with each zone spaced at 200 m intervals (Supplementary Text S2). The results revealed that species richness of reptiles in the reserve exhibited a monotonically decreasing trend, with species richness being highest at lower elevations (Figure 2). This result is consistent with studies on richness-elevation patterns in other reptiles (Peters *et al.*, 2016; Dolson *et al.*, 2024). Although elevational gradients encompass a wide range of terrain and climate changes, a key characteristic is the presence of strong thermal gradients. Previous studies have shown that temperature influences the distribution and functioning of organisms (Zhao *et al.*, 2023). As ectothermic animals, reptiles depend on environmental temperatures to regulate their body temperature and maintain normal biological functions. At low elevations, relatively high temperatures provide a more favorable environment for reptile survival. However, changes in thermal gradients caused by vertical decreases in temperature may lead to physiological stress in reptiles, including slowed metabolism, reduced mobility, and reduced reproductive success (Rahbek *et al.*, 2019b; Zhao *et al.*, 2023). In addition, high-elevation areas often involve complex topographic and climatic conditions, such as frequent precipitation, strong winds, and seasonal temperature fluctuations, which may further restrict reptile habitat range and survival.

The threatened species richness also shows a monotonically decreasing vertical distribution pattern along the elevational

gradient (Figure 2). Most threatened species are found below 1 399 m, and their richness declines sharply at higher elevations. The distribution range of a species reflects its environmental tolerance (Peters *et al.*, 2016; Zhao *et al.*, 2023). Two threatened species, *E. taeniura* and *D. harti*, occur across all elevation zones, indicating a wide distribution range and strong adaptability. Turtle populations are currently facing a serious decline (Ennen *et al.*, 2020). *P. sinensis* was recorded only once in our study and was confined to an extremely limited area (Figure 2, Supplementary Text S4 and Table S2). Therefore, for threatened species with narrow distribution ranges, increased conservation efforts are essential. Although *P. styani* is currently classified as “Least Concern”, its elevational range in the Leigongshan Reserve is very restricted (IUCN, 2024). We strongly recommend that management authorities take proactive conservation measures for this species. Our findings offer valuable insights into future ecological and evolutionary research and provide a scientific foundation for the management and protection of threatened species.

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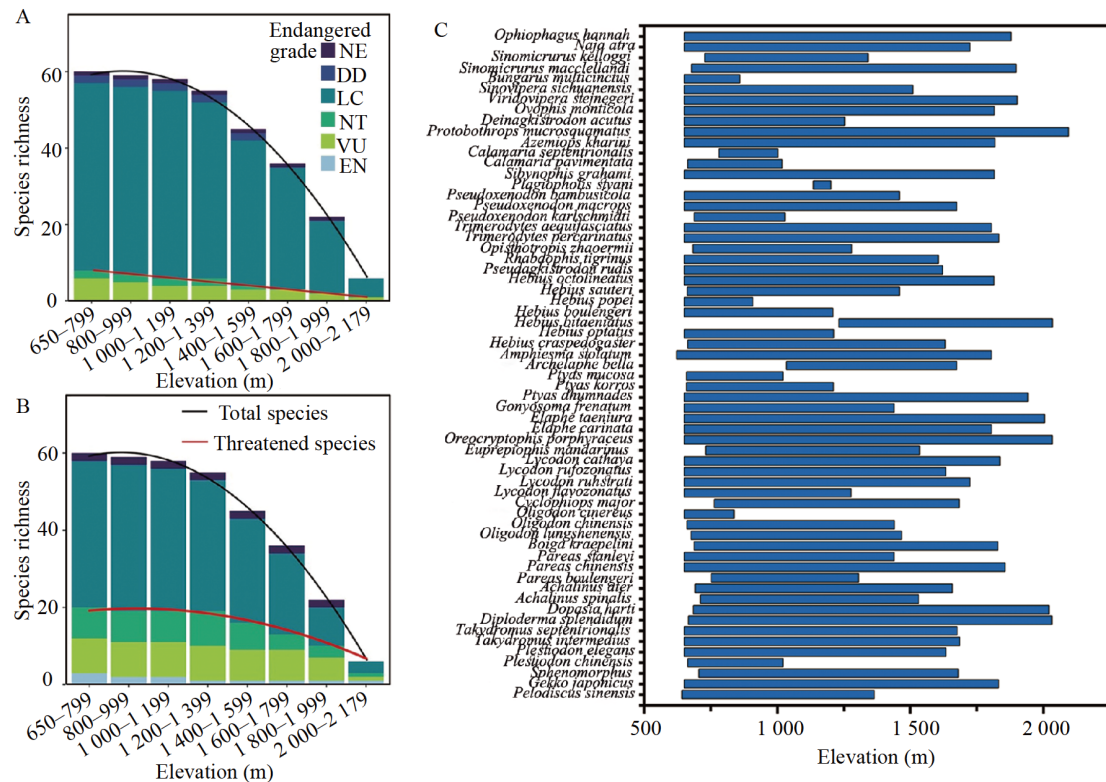


Figure 2 Elevational distribution patterns of reptile species richness and threat status in Leigongshan National Nature Reserve, Guizhou Province, China. A and B correspond to the IUCN Red List and the Red List of Chinese Biodiversity, respectively. All distribution patterns were derived using polynomial regression models. C shows the elevational distribution ranges of all reptile species within the reserve.

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