

Biodiversity and Conservation Significance of the Gaoligong Mountains: A UNESCO Biosphere Reserve

Situated on China's southwestern border with Myanmar, the long and narrow Gaoligong Mountains (GLGMs; N24.137°–N29.183°, 218–6155 m above sea level(asl)) boast a unique geographical environment (Li et al., 2024) (Figure 1). Their diverse climate zones, ranging from tropical to cold temperate both latitudinally and vertically (Zhou et al., 2023), combined with their position at the convergence of the Himalayan, Southwest China, and Indo-Burma biodiversity hotspots (Myers et al., 2000), render the GLGMs exceptionally biodiverse.

Despite covering only 0.33% of China's land area (~32 000 km²), the GLGMs harbor a notable array of species including 216 mammal species (Li et al., 2024), 796 bird species (Wu et al., 2024), 110 reptile species (Wang et al., 2024), 90 amphibian species (Wang et al., 2024), 147 fish species (Chen & Zeng, 2025), and over 6 700 vascular plant species (Zhou et al., 2023) (new species described from 2010 to 2025 in the Supplementary Information), representing over 29% of mammals, 50% of birds, 20% of reptiles, 15% of amphibians, 9% of freshwater fishes, and 15% of vascular plants recorded in China. Of which, eight large carnivores (*Panthera pardus*, *Panthera uncia*, *Neofelis nebulosa*, *Lynx lynx*, *Helarctos malayanus*, *Ursus thibetanus*, *Canis lupus*, *Cuon alpinus*), eight feline species (accounting for 36.4% recorded in China), and ten primate species (accounting for 35.7% recorded in China; including the recently described *Hoolock tianxing* (Fan et al., 2017), and new records of *Rhinopithecus strykeri* (Chen et al., 2022; Long et al., 2012;) and *Macaca leucogenys* (Hu et al., 2024)) inhabit here. Particularly, carnivores in the GLGMs account for 16.2% of the mammal species (Li et al., 2024), a proportion that is 1.86 times that of China and 3.07 times the global level (Wilson & Reeder, 2005), reflecting the exceptionally high carnivore diversity in this region. The area also serves as a refuge for critically endangered IUCN-listed species like the Malayan Pangolin (*Manis javanica*), the Baer's Pochard (*Aythya baeri*), the Elongated Tortoise (*Indotestudo elongata*), the Dahoaping Stream Toad (*Bufo tuberospinus*), and the Indian Nard (*Nardostachys jatamansi*).

Global analyses of terrestrial vertebrate diversity indicate that the GLGMs possess the highest vertebrate diversity at the same latitude, along with a rich abundance of rare species and small-range species (Jenkins et al., 2013). Analysis of terrestrial vertebrates in China shows that the GLGMs are one

of China's highest regions in terms of species diversity, phylogenetic diversity, and genetic diversity (Hu et al., 2021). Concurrently, the terrestrial vertebrates of the GLGMs exhibit exceptionally high phylogenetic endemism and phylogenetic uniqueness on a global scale (Baselga et al., 2025). Zhang et al. (2024) further reveal that the GLGMs are among the regions with the highest functional diversity of terrestrial mammals in China. Additionally, global analyses also demonstrate that the plant of the GLGMs is characterized by rich species diversity, phylogenetic diversity, functional diversity, species endemism, and phylogenetic endemism (Luo et al., 2024; Tietje et al., 2023). The GLGMs' highly heterogeneous environment fosters genetic differentiation and speciation, solidifying their reputation as a “global gene bank of species”. Between 2010 and October 2025, an impressive 116 new species were discovered, comprising 12 mammals, 15 reptiles, 25 amphibians, six fishes, and 58 vascular plants (Figure 1; Supplementary Information). The remarkable biodiversity of the GLGMs endows it with high conservation and research value.

Despite rich biodiversity and ongoing discoveries, researches on biodiversity in the GLGMs are notably insufficient. Web of Science and Scopus searches for “Gaoligong” yield only 694 and 780 academic papers respectively, a surprisingly scant body of literature given the region's substantial ecological significance and the frequent discovery of new species there—particularly primates, which remain rarely found anywhere in the world. This highlights enormous potential for further exploration and necessitates increased scientific investment and systematic biodiversity surveys to thoroughly inventory existing species.

The conservation status of the GLGMs' rich biodiversity is challenging. Widespread grazing encroaches upon wildlife habitats (Zhang et al., 2017) and damages native vegetation (Kimball & Schiffman, 2003). Our research indicates that current human disturbance levels, including overgrazing, negatively impact large and medium-sized mammals (Hu et al., 2025; Li et al., 2022). This underscores the need for improved protected area planning, management, and grazing/human activity regulation. Although the establishment of protected areas has contributed to increased forest coverage over the past 40 years, accelerated infrastructure development has led to a sharp increase in impervious surfaces and intensified habitat fragmentation (Li et al., 2026a). Meanwhile, shrublands and grasslands have declined

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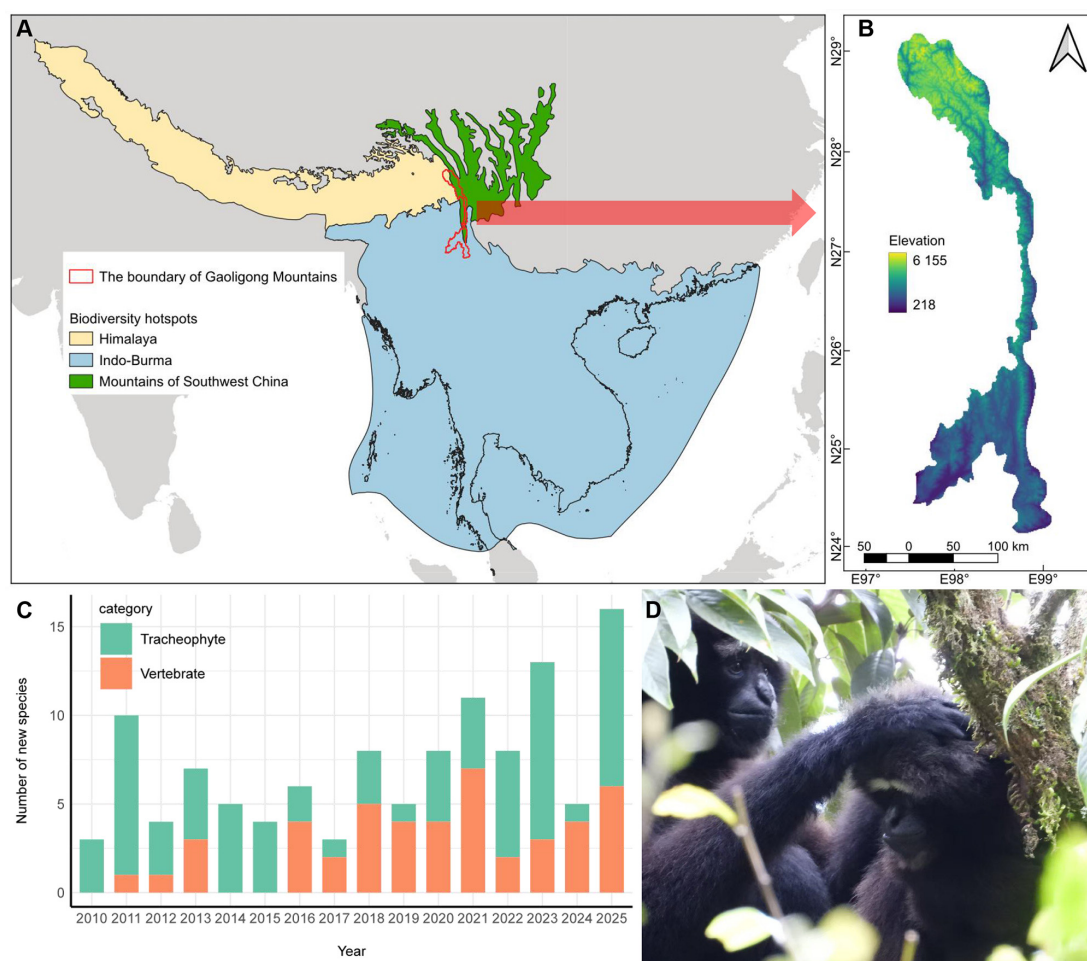


Figure 1 Geographical overview and new species discoveries of the GLGMs

A: The GLGMs are located at the intersection of three biodiversity hotspots; B: The significant latitudinal and elevational ranges of the GLGMs; C: New species of vertebrates and tracheophytes continuously discovered between 2010 and 2025. D: *Hoolock tianxing*, a new species of gibbons described in 2017.

markedly, threatening habitat-dependent species. Mitigating these issues requires ecological corridors and resettlement programs to preserve suitable habitats for key species.

Poaching—a direct driver of biodiversity loss—has declined on the Chinese side of the GLGMs due to government efforts. However, in the adjacent Myanmar side, amid prolonged armed conflicts and lack of enforcement, hunting and wildlife trade remain frequent (Yang et al., 2019) and exacerbates biodiversity loss in the border region, which is a hotspot for threatened species (Huang et al., 2026). Enhanced cross-border conservation cooperation between China and Myanmar is essential to establish a biodiversity-friendly border (Huang et al., 2026). Long-term researches can also mitigate hunting pressure (Balduccio et al., 2025). The GLGMs, a globally significant yet underestimated biodiversity hotspot, urgently require greater attention from the international research community and strengthened scientific collaboration between China and Myanmar to ensure their conservation (Yang et al., 2019).

Invasive species pose another significant threat, with 23 invasive fish species (Chen & Zeng, 2025) and 225 alien plant species (Xiao et al., 2023) recorded, making the GLGMs a severely impacted area. Effective prevention and control demand robust monitoring and hierarchical management, including timely eradication for nascent invasions and long-term strategies for widespread species like the Crofton weed and the Siam weed (Xiao et al., 2023). Besides, with 64

rodents, 51 bats, and 242 birds domestic and cross-border living, the risk of epizootic spillover is concerning. The high-elevation in northern and middle sections serve as natural barriers, but the lower-elevation in southern section and valley areas, with their dense river network and moist, hot subtropical habitat, acts as corridors for species invasion and pathogen spread, exemplified by the fall armyworm moth's entry into China from Myanmar (Sun et al., 2021). Increased monitoring and management in the southern and low-altitude section are crucial, especially considering climate change.

China began establishing protected areas in the GLGMs since 1983, of which GLGMs National Nature Reserve was designated a UNESCO World Biosphere Reserve in 2000. However, the national nature reserve covers only 4 055 km², less than 13% of the mountain's total area, and is inadequately represented in the southern and low-altitude regions, which provide important wintering habitats for some rare and threatened species (Hu et al., 2025). Research indicates that protected areas effectively preserve functional diversity, whereas areas outside protected areas exhibit significantly lower and homogenized functional diversity (Li et al., 2026b). As China optimizes its protected area strategy and pursues the "30×30 Target" of the Kunming-Montreal Global Biodiversity Framework, addressing this conservation gap in the southern and low-altitude regions is imperative. This would facilitate a connected protected area system, creating a crucial north-south biological connectivity corridor.

In summary, the GLGMs serve as a global gene bank with a notable array of species, including numerous rare and newly discovered ones. Despite their immense ecological significance, the region faces severe conservation challenges, including habitat degradation from human activities and infrastructure development, the pervasive threat of invasive species and epizootic spillover, and insufficient protected area coverage, particularly in the southern and low-altitude regions. Addressing these threats necessitates urgent, increased scientific investment, systematic surveys, and enhanced transboundary conservation cooperation between China and Myanmar to ensure the long-term preservation of this globally significant yet underestimated biodiversity hotspot.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

XL and XJ were involved in conceptualization. MY and QL carried out the investigation. MY performed data curation, conducted the statistical analyses and wrote the first draft. XL reviewed and edited the manuscript. All authors read and approved the final version of the manuscript.

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REFERENCES

Balduccio N, Bessone M, Iannarilli F, et al. 2025. Long-term research presence mitigates hunting pressure and shapes mammal communities in the Congo Basin. *Biological Conservation*, **312**: 111502.

Baselga A, Martín-Devasa R, Gómez-Rodríguez C. 2025. Areas of high biodiversity value evidenced by the spatial scaling of phylogenetic uniqueness. *Ecology Letters*, **28**(7): e70179.

Chen XY, Zeng YY. 2025. Fishes of Gaoligong Mountain. Kunming: Yunnan Science and Technology Press. (in Chinese)

Chen YX, Yu Y, Li C, et al. 2022. Population and conservation status of a transboundary group of black snub-nosed monkeys (*Rhinopithecus strykeri*) between China and Myanmar. *Zoological Research*, **43**(4): 523–527.

Fan PF, He K, Chen X, et al. 2017. Description of a new species of *Hooleck gibbon* (Primates: Hylobatidae) based on integrative taxonomy. *American Journal of Primatology*, **79**(5): e22631.

Hu WQ, Li XY, Onditi KO, et al. 2025. Spatiotemporal distribution patterns of large and medium-sized mammals in a biodiversity hotspot: implications for conservation. *Biological Conservation*, **301**: 110863.

Hu WQ, Wang HJ, Li XY, et al. 2024. New records of the white-cheeked macaque provide range extension for the endangered primate in Gaoligong Mountains. *Primates*, **65**(1): 15–19.

Hu YB, Fan HZ, Chen YH, et al. 2021. Spatial patterns and conservation of genetic and phylogenetic diversity of wildlife in China. *Science Advances*, **7**(4): eabd5725.

Huang ZD, Wang QY, Wang J, et al. 2026. Integrating biodiversity hotspots, ecological gradients, and ecosystem services for transboundary conservation in the Gaoligong Mountains. *Conservation Biology*, **40**(1): e70133.

Jenkins CN, Pimm SL, Joppa LN. 2013. Global patterns of terrestrial vertebrate diversity and conservation. *Proceedings of the National Academy of Sciences of the United States of America*, **110**(28): E2602–E2610.

Kimball S, Schiffman PM. 2003. Differing effects of cattle grazing on native and alien plants. *Conservation Biology*, **17**(6): 1681–1693.

Li Q, Li XY, Hu WQ, et al. 2024. Mammals of Gaoligong mountain in China: diversity, distribution, and conservation. *Zoological Research: Diversity and Conservation*, **1**(1): 3–19.

Li XY, Hu WQ, Bleisch WV, et al. 2022. Functional diversity loss and change in nocturnal behavior of mammals under anthropogenic disturbance. *Conservation Biology*, **36**(3): e13839.

Li XY, Hu WQ, Onditi KO, et al. 2026a. Beyond species richness: habitat fragmentation reduces community occupancy and functional richness of mountain forest mammals. *Biological Conservation*, **318**: 111828.

Li XY, Hu WQ, Onditi KO, et al. 2026b. Functional homogenization of terrestrial mammals outside protected areas in the Hengduan mountains, China. *Conservation Biology*, **40**(3): e70214.

Long YC, Momberg F, Ma J, et al. 2012. *Rhinopithecus strykeri* found in China!. *American Journal of Primatology*, **74**(10): 871–873.

Luo A, Li YQ, Shrestha N, et al. 2024. Global multifaceted biodiversity patterns, centers, and conservation needs in angiosperms. *Science China Life Sciences*, **67**(4): 817–828.

Myers N, Mittermeier RA, Mittermeier CG, et al. 2000. Biodiversity hotspots for conservation priorities. *Nature*, **403**(6772): 853–858.

Sun XX, Hu CX, Jia HR, et al. 2021. Case study on the first immigration of fall armyworm, *Spodoptera frugiperda* invading into China. *Journal of Integrative Agriculture*, **20**(3): 664–672.

Tietje M, Antonelli A, Forest F, et al. 2023. Global hotspots of plant phylogenetic diversity. *New Phytologist*, **240**(4): 1636–1646.

Wang K, Yu ZB, Wu YH, et al. 2024. Herpetofauna diversity of the Gaoligong mountain in China: checklist, zoogeography, and conservation. *Zoological Research: Diversity and Conservation*, **1**(3): 169–179.

Wilson DE, Reeder MD. 2005. Mammal Species of the World: A Taxonomic and Geographic Reference. 3rd ed. Baltimore: Johns Hopkins University Press.

Wu F, Gao JY, Yan D, et al. 2024. Bird species composition and conservation challenges in the Gaoligong Mountains, one of the most diverse bird areas in the world. *Zoological Research: Diversity and Conservation*, **1**(1): 20–50.

Xiao Y, Li YR, Duan HX, et al. 2023. Invasion status and control measures for alien plants within the Gaoligong mountains. *Biodiversity Science*, **31**(5): 23011. (in Chinese)

Yang Y, Ren GP, Li WJ, et al. 2019. Identifying transboundary conservation priorities in a biodiversity hotspot of China and Myanmar: implications for data poor mountainous regions. *Global Ecology and Conservation*, **20**: e00732.

Zhang C, Li YM, Wang W, et al. 2024. Combined effects of climate and land-use changes on the alpha and beta functional diversities of terrestrial mammals in China. *Science China Life Sciences*, **67**(10): 2224–2233.

Zhang JD, Hull V, Ouyang ZY, et al. 2017. Divergent responses of sympatric species to livestock encroachment at fine spatiotemporal scales. *Biological Conservation*, **209**: 119–129.

Zhou J, Li R, Jiang XL, et al. 2023. Comprehensive Scientific Research in Gaoligong Mountains, Yunnan. Beijing: Science Press. (in Chinese)