

Snakes of South Asia

Discovering Hidden Diversity; Conserving a Changing Legacy



Editors

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Front cover species:

Top row: *Ptyas nigromarginata*, *Aspidura trachyprocta*, *Cylindrophis maculatus*;

Middle row: *Trimerodytes percarinatus*, *Tropidolaemus laticinctus*, *Tropidolaemus subannulatus*;

Bottom row: *Herpetoreas pealii* & *Python molurus*.

Back cover species: *Ahaetulla nasuta* & *Dendrelaphis effrenis*.

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Snakes of Bhutan: Past, Present, and Future

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Abstract

The Kingdom of Bhutan, a major part of the Eastern Himalayan Biodiversity Hotspot, harbours a remarkable yet understudied snake fauna. This article synthesizes past and present knowledge of Bhutan's snakes, tracing herpetological research from early 20th-century expeditions to current studies and establishing a checklist of 88 recognized species. Bhutan's distinct geoclimatic position, spanning subtropical valleys to alpine meadows across elevations of 100–7,500 meters above sea level, supports diverse bioclimatic zones and a rich snake fauna across 10 families. The checklist includes 21 venomous species of the Elapidae and Viperidae, notably the King Cobra (*Ophiophagus hannah*) and Russell's Viper (*Daboia russelii*), alongside medically important non-venomous constrictors such as the Indian Rock Python (*Python molurus*) and Burmese Python (*P. bivittatus*). Despite constitutional protection under the Forest and Nature Conservation Act of 1995 and cultural reverence in Vajrayana Buddhism, snakes face increasing threats from habitat fragmentation, deliberate killing, road mortality, and potentially climate change. This report examines their ecological significance as meso-predators and bioindicators, evaluates conservation initiatives including transboundary protected areas, and identifies knowledge gaps in distribution, population dynamics, and climate vulnerability. It recommends strengthening species-specific protection, expanding systematic surveys, applying environmental DNA and camera trapping, integrating snake conservation into Bhutan's carbon-negative development framework, and establishing community-based rapid-response networks for human-snake conflict mitigation.

Keywords: Bhutan, Biodiversity, Conservation, Eastern Himalayas, Herpetofauna, Snakes

Introduction

The Kingdom of Bhutan sandwiched between the two Asian giants China and India (Figure 1), is often described as the last Shangri-La, and represents one of the most biologically significant yet scientifically enigmatic regions of the Eastern Himalayas and touches the two biogeographic realms – the Palearctic to the north and the Indo-Malayan in the south. The constitutional monarchy covering 38,394 km², harbours highly diverse but still incompletely documented biodiversity despite decades of scientific study. Its constitution mandates the maintenance of at least 60% forest cover in perpetuity. As a steep mountainous country, its elevation rises dramatically from 150 m above sea level (asl) in the south to over 7,500 m asl in the north across a north-south distance of only ~170 km.

Bhutan is geologically fragile (Gansser, 1983) and calls for sustained conservation management as there are significant differences between the northern and central regions and the southern fringes, which are younger and less stable. Folded and metamorphosed rocks of Precambrian and early Paleozoic age, largely quartzite and gneiss, cover most of the country (Bhargava, 1995). A 1:500,000 geological map prepared by the Survey of India captures most of these geological variations (Long *et al.*, 2011).

Bhutan, according to the 'Forests Facts and Figure Report 2018' issued by the Department of Forest and Park Services (Anon. 2018), is home to over 5,600 vascular plants, of which 145 are endemic and 411 ferns and fern allies. Bhutan also houses 282 bryophytes, 350 fungii, and 287 lichens and

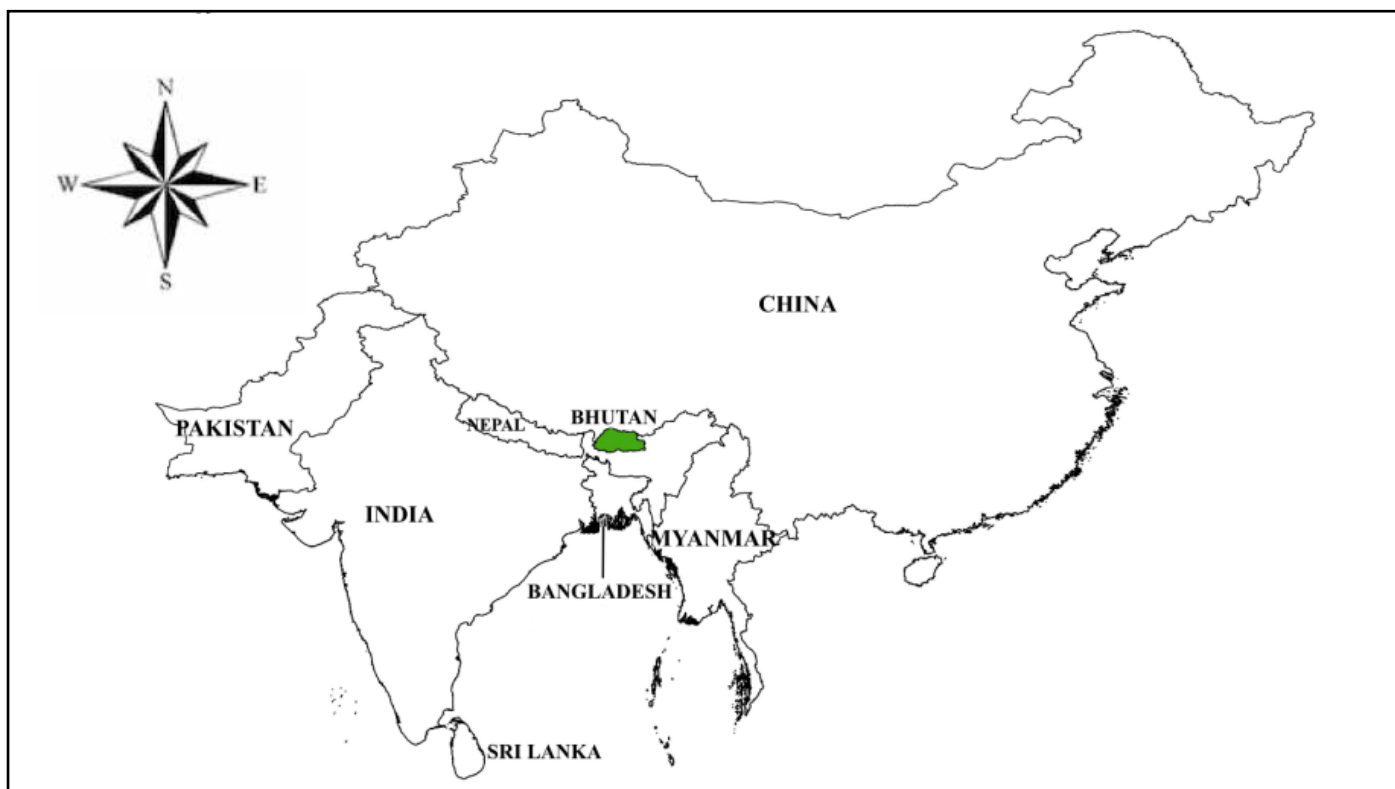


Figure 1. Location map of the Kingdom of Bhutan in southern Asia.

lichenicoles. There are 46 species of rhododendrons and 469 orchid species to be encountered within the nine forest types, these numbers, continue to grow with new discovery, that warrant further research on their biology and conservation requirements.

Although Bhutan is recognized as supporting a rich snake fauna, the group remains an understudied, with ecological and conservation information fragmentary (Wangyal *et al.*, 2026). The historical trajectory of snake documentation in Bhutan reflects broader patterns of Himalayan biological exploration (Wangyal & Das, 2021; Wangyal, 2014). Early naturalists, including those associated with British colonial surveys in the early 20th century, produced records that laid the groundwork for modern systematics (Phuntsho, 2013).

However, unlike neighbouring India and Nepal, where herpetological traditions extend to the colonial era (see Smith 1931, 1935, 1945, 1952), Bhutan's scientific documentation effectively began with the pioneering work of Biswas (1976), who included two species of snakes in his inventory (Wangyal *et al.*, 2026). This delayed scientific engagement, may have paradoxically preserved Bhutan's snake fauna from the intensive collection pressures that may have depleted populations elsewhere in south Asia (Wangyal & Das, 2021).

Bhutan's approach to snake and other species conservation is uniquely shaped by the intersection of Vajrayana Buddhist philosophy and progressive environmental governance (Tshewang *et al.*, 2021; Walton, 2020; Long & Long, 2019). The 1995 Forest and Nature Conservation Act, subsequently strengthened by the 2023 Forest and Nature Conservation Act, provides comprehensive legal protection for all snake species, reflecting the constitutional mandate that 60% of the nation's territory remain under forest cover in perpetuity. This legal framework aligns with Buddhist principles of *ahimsa* (non-violence), creating a cultural context where animals (including snakes) are generally regarded with respect rather than fear (Windischgraetz, 2023).

However, this cultural protectionism coexists with practical challenges. Bhutan's rapid modernization, infrastructure development, and climate change present novel threats that legal protection alone cannot address (UNDRR & CDRI, 2024). The country's commitment to remaining carbon-negative (Dorji *et al.*, 2026), while globally significant, does not automatically translate to species-level protection for ectothermic vertebrates facing thermal shifts. Understanding this complex interplay of cultural reverence, legal protection, and emerging threats

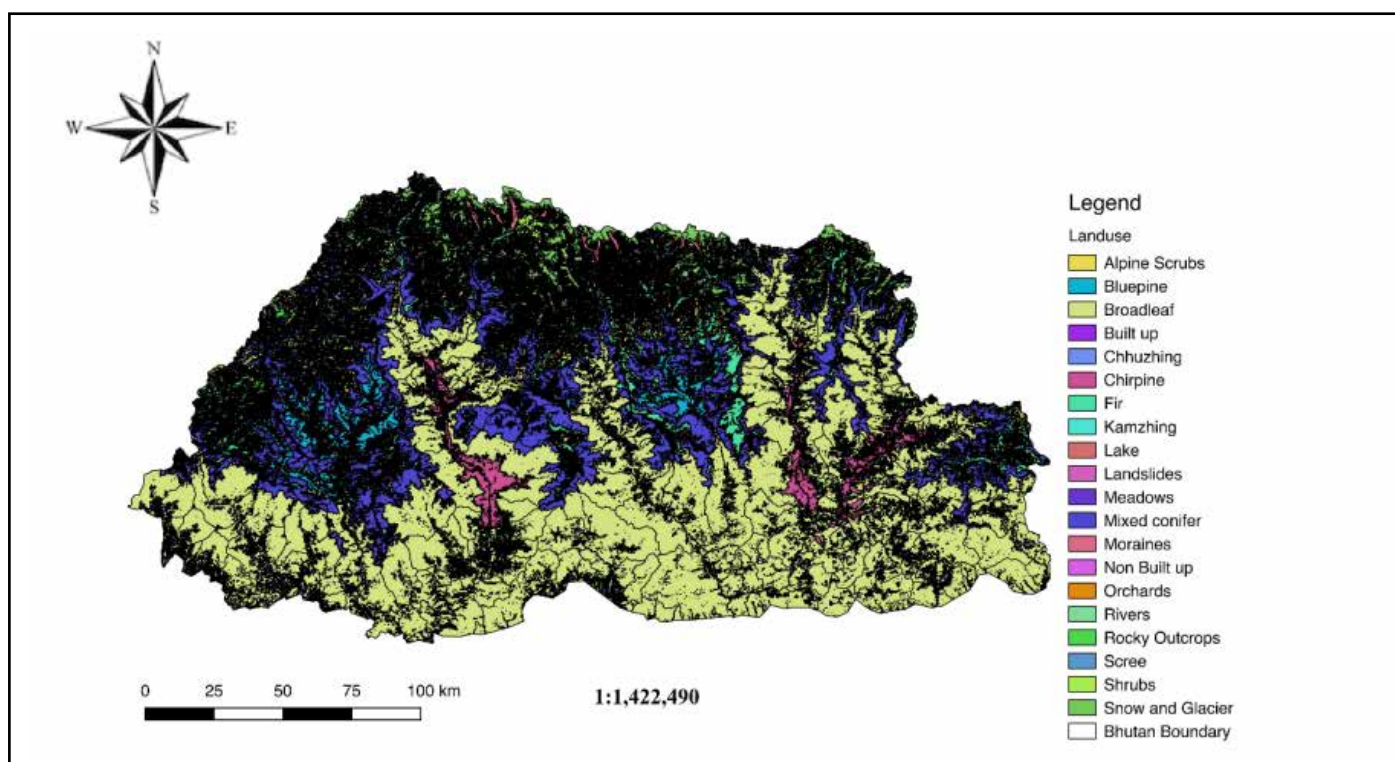


Figure 2. A physiographic and vegetation map of Bhutan.

forms the essential context for examining Bhutan's snake fauna.

This report provides a synthesis of knowledge of the snake fauna of Bhutan, integrating historical records, contemporary survey data, examines geoclimatic determinants of diversity, evaluate the current conservation status of key taxa, analyze anthropogenic threats, and propose evidence-based strategies for herpetological research and conservation action in Bhutan.

Geoclimatic Profile of Bhutan

Bhutan is located in the Eastern Himalayas, bordered by Tibet Autonomous Region of the People's Republic of China in the north and Republic of India in the south, east, and west. The country exhibits extreme altitudinal variation, ranging from about 100 m in the south, at the northern banks of the Brahmaputra, to over 7,500 m at Gangkhar Puensum. This steep elevational gradient creates strikingly diverse physiographic zones that have influenced species distributions (Tshewang & Letro, 2018; Koirala *et al.*, 2016; see Figure 2).

The southern belt consists of the Duars Plain and foothills, characterized by subtropical broadleaf forests that form part of the Indo-Malayan biogeographic realm (Wangyal & Das, 2021;

Jamtsho & Sridith, 2015; Grierson & Long, 1983). High rainfall (often 3,000–7,000 mm annually) and warm temperatures create suitable conditions for tropical ecosystems. The central region comprises valleys and mid-hills with temperate broadleaf and mixed conifer forests between approximately 1,000–3,000 m. The northern region transitions into alpine meadows and cold deserts above 4,000 m, where environmental conditions become too extreme for most reptile species, though a few highly adapted taxa persist at mid-high elevations.

Bhutan's climate is strongly influenced by the south Asian monsoon system and its position between tropical and temperate circulation zones (NCHM, 2018). The southern region is hot and humid year-round (15–30°C), while central Bhutan experiences moderate summers and cold winters. Northern Bhutan remains cold for most of the year, with permanent snow and glaciers above 5,000 m. Three broad bioclimatic zones can be recognized:

1. Southern subtropical zone – high humidity, heavy rainfall, tropical forests; highest snake diversity including Pythons, Cobras, Kraits, and Colubrids.
2. Central temperate zone – mixed forests and valleys; transitional snake fauna including pit Vipers, Keelbacks, and False Cobras.

3. High alpine zone – cold, low productivity ecosystems; reduced snake diversity with only a few cold-adapted species in lower alpine margins.

Monsoonal rainfall is geographically variable (approximately 40 mm in the north to over 7,000 mm in the south), shaping habitat heterogeneity and ecological gradients (Power *et al.*, 2021).

Diversity, Ecological and Cultural Roles

A total of 88 species of snakes are currently recorded in Bhutan (Wangyal & Das, 2021), distributed across 9 families (Table 1; see Figure 3). The checklist shows an admixture of widespread south and south-east Asian taxa, Himalayan endemics, and recently described or taxonomically uncertain species. Several taxa remain unassessed or Data Deficient under the IUCN Red List framework.

Table 1. Checklist of Snakes of Bhutan (Abbreviation: DD – Data Deficient, NE – Not Evaluated, NT – Near Threatened, LC – Least Concern, VU - Vulnerable).

No.	Family	Scientific name	Common name	Range	IUCN Status
1	Colubridae	<i>Ahaetulla flavescens</i>	Yellow Whip Snake	Native	NE
2	Colubridae	<i>Ahaetulla prasina</i>	Asian Vine Snake	Native	LC
3	Colubridae	<i>Anguiculus rappi</i>	Rapp's Anguiculus	Native	LC
4	Colubridae	<i>Boiga cyanea</i>	Green Cat Snake	Native	LC
5	Colubridae	<i>Boiga gokool</i>	Arrowback Tree Snake	Native	LC
6	Colubridae	<i>Boiga multifasciata</i>	Many-banded Tree Snake	Native	LC
7	Colubridae	<i>Boiga ochracea ochracea</i>	Ochraceous Cat Snake	Native	LC
8	Colubridae	<i>Boiga quincunciata</i>	Quincunx Cat Snake	Native	LC
9	Colubridae	<i>Boiga siamensis</i>	Siamese Cat Snake	Native	LC
10	Colubridae	<i>Boiga stoliczkae</i>	Stoliczka's Cat Snake	Native	NE
11	Colubridae	<i>Calamaria pavimentata</i>	Pavement Reed Snake	Native	LC
12	Colubridae	<i>Chrysopelea ornata</i>	Golden Tree Snake	Native	LC
13	Colubridae	<i>Coelognathus helena</i>	Common Trinket Snake	Native	LC
14	Colubridae	<i>Coelognathus radiatus</i>	Radiated Rat Snake	Native	LC
15	Colubridae	<i>Dendrelaphis cyanochloris</i>	Blue-green Bronzeback	Native	LC
16	Colubridae	<i>Dendrelaphis proarchos</i>	Himalayan Bronzeback	Native	LC
17	Colubridae	<i>Dendrelaphis tristis</i>	Bronzeback Tree Snake	Native	LC
18	Colubridae	<i>Elaphe cantoris</i>	Cantor's Rat Snake	Native	LC
19	Colubridae	<i>Elaphe hodgsoni</i>	Hodgson's Rat Snake	Native	LC
20	Colubridae	<i>Elaphe taeniurus</i>	Taiwan Beauty Snake	Native	LC
21	Colubridae	<i>Gonyosoma frenatum</i>	Yunnan Tree Snake	Native	LC
22	Colubridae	<i>Gonyosoma prasinum</i>	Green Tree Snake	Native	LC
23	Colubridae	<i>Lycodon aulicus</i>	Indian Wolf Snake	Native	LC
24	Colubridae	<i>Lycodon cf. davisonii</i>	Davison's Wolf Snake	Native	LC
25	Colubridae	<i>Lycodon fasciatus</i>	Banded Wolf Snake	Native	LC
26	Colubridae	<i>Lycodon gammiei</i>	Gammie's Wolf Snake	Native	LC
27	Colubridae	<i>Lycodon jara</i>	Jara Wolf Snake	Native	LC
28	Colubridae	<i>Lycodon septentrionalis</i>	Northern Wolf Snake	Native	LC
29	Colubridae	<i>Lycodon zawi</i>	Zaw's Wolf Snake	Native	LC
30	Colubridae	<i>Oligodon albocinctus</i>	White-banded Kukri Snake	Native	LC
31	Colubridae	<i>Oligodon cf. chinensis</i>	Chinese Kukri Snake	Native	LC
32	Colubridae	<i>Oligodon cinereus</i>	Ashy Kukri Snake	Native	LC
33	Colubridae	<i>Oligodon cyclurus</i>	Cantor's Kukri Snake	Native	LC

34	Colubridae	<i>Oligodon dorsalis</i>	Blotched Kukri Snake	Native	LC
35	Colubridae	<i>Oligodon juglandifer</i>	Walnut Kukri Snake	Native	VU
36	Colubridae	<i>Oreocryptophis porphyraceus</i>	Mountain Bamboo Snake	Native	LC
37	Colubridae	<i>Ptyas korros</i>	Indo-Chinese Rat Snake	Native	NT
38	Colubridae	<i>Ptyas mucosa</i>	Indian Rat Snake	Native	LC
39	Colubridae	<i>Ptyas nigromarginata</i>	Black-margined Rat Snake	Native	LC
40	Colubridae	<i>Sibynophis collaris</i>	Collared Many-toothed Snake	Native	LC
41	Colubridae	<i>Sibynophis sagittarius</i>	Arrow-headed Snake	Native	LC
42	Elapidae	<i>Bungarus bungaroides</i>	Northeastern Hill Krait	Native	LC
43	Elapidae	<i>Bungarus fasciatus</i>	Banded Krait	Native	LC
44	Elapidae	<i>Bungarus lividus</i>	Lesser Black Krait	Native	LC
45	Elapidae	<i>Bungarus niger</i>	Black Krait	Native	LC
46	Elapidae	<i>Bungarus walli</i>	Wall's Krait	Native	LC
47	Elapidae	<i>Naja kaouthia</i>	Monocled Cobra	Native	LC
48	Elapidae	<i>Naja naja</i>	Spectacled Cobra	Native	LC
49	Elapidae	<i>Ophiophagus hannah</i>	King Cobra	Native	VU
50	Elapidae	<i>Sinomicrurus maccllellandi</i>	MacClelland's Coral Snake	Native	LC
51	Natricidae	<i>Amphiesma stolatum</i>	Buff-striped Keelback	Native	LC
52	Natricidae	<i>Enhydris enhydris</i>	Common Smooth Water Snake	Native	LC
53	Natricidae	<i>Fowlea piscator</i>	Checkered Keelback	Native	LC
54	Natricidae	<i>Fowlea sanctijohannis</i>	John's Keelback	Native	LC
55	Natricidae	<i>Hebius clerki</i>	Clerk's Keelback	Native	LC
56	Natricidae	<i>Herpetoreas platyceps</i>	Himalayan Keelback	Native	LC
57	Natricidae	<i>Hebius parallelus</i>	Parallel Keelback	Native	LC
58	Natricidae	<i>Herpetoreas sieboldii</i>	Siebold's Keelback	Native	LC
59	Natricidae	<i>Rhabdophis himalayanus</i>	Himalayan Keelback	Native	LC
60	Natricidae	<i>Rhabdophis subminiatus</i>	Red-necked Keelback	Native	LC
61	Natricidae	<i>Smithophis bicolor</i>	Bicolored Snake	Native	LC
62	Natricidae	<i>Trachischium fuscum</i>	Brown Worm Snake	Native	LC
63	Natricidae	<i>Trachischium guentheri</i>	Günther's Worm Snake	Native	LC
64	Natricidae	<i>Trachischium laeve</i>	Smooth Worm Snake	Native	LC
65	Natricidae	<i>Trachischium monticola</i>	Mountain Worm Snake	Native	LC
66	Natricidae	<i>Trachischium reticulata</i>	Reticulated Worm Snake	Native	DD
67	Natricidae	<i>Trachischium tenuiceps</i>	Narrow-headed Worm Snake	Native	LC
68	Pareidae	<i>Pareas monticola</i>	Mountain Slug Snake	Native	LC
69	Psammodynastidae	<i>Psammodynastes pulverulentus</i>	Common Mock Viper	Native	LC
70	Pseudoxenodontidae	<i>Pseudoxenodon karlschmidti</i>	Karl Schmidt's False Cobra	Native	LC
71	Pseudoxenodontidae	<i>Pseudoxenodon macrops</i>	Large-eyed False Cobra	Native	LC
72	Pythonidae	<i>Python molurus</i>	Indian Rock Python	Native	NT
73	Pythonidae	<i>Python bivittatus</i>	Burmese Python	Native	VU
74	Typhlopidae	<i>Argyrophis diardii</i>	Diard's Blind Snake	Native	LC
75	Typhlopidae	<i>Indotyphlops braminus</i>	Brahminy Blind Snake	Native	LC
76	Typhlopidae	<i>Indotyphlops jerdoni</i>	Jerdon's Blind Snake	Native	LC
77	Viperidae	<i>Daboia russelii</i>	Russell's Viper	Native	LC
78	Viperidae	<i>Protobothrops himalayanus</i>	Himalayan Pit Viper	Native	LC
79	Viperidae	<i>Protobothrops jerdonii</i>	Jerdon's Pit Viper	Native	LC
80	Viperidae	<i>Protobothrops kaulbacki</i>	Kaulback's Pit Viper	Native	DD

81	Viperidae	<i>Ovophis monticola</i>	Mountain Pit Viper	Native	LC
82	Viperidae	<i>Trimeresurus albolabris</i>	White-lipped Pit Viper	Native	LC
83	Viperidae	<i>Trimeresurus erythrurus</i>	Red-tailed Pit Viper	Native	LC
84	Viperidae	<i>Trimeresurus popeiorum</i>	Pope's Pit Viper	Native	LC
85	Viperidae	<i>Trimeresurus salazar</i>	Salazar's Pit Viper	Native	NE
86	Viperidae	<i>Trimeresurus septentrionalis</i>	Northern White-lipped Pit Viper	Native	LC
87	Viperidae	<i>Trimeresurus cf. tibetanus</i>	Tibetan Pit Viper	Native	LC
88	Viperidae	<i>Trimeresurus cf. yunnanensis</i>	Yunnan Pit Viper	Native	LC

Snakes occupy critical trophic positions as mesopredators and apex predators in Bhutan's ecosystems. Large species such as the king cobra (*Ophiophagus hannah*) and the Indian and Burmese pythons (*Python molurus* and *P. bivittatus*) presumably help regulate populations of rodents, birds, amphibians, and other reptiles (Whitaker & Captain, 2004). This contributes to natural pest control, particularly in agricultural landscapes, providing indirect ecosystem services of high economic value (Valencia-Aguilar *et al.*, 2013). Venomous snakes, including vipers, elapids, and certain large-bodied colubrids, also contribute to ecosystem stability through intraguild predation and maintaining prey balance. As ectotherms, snakes are highly sensitive to environmental change, making them useful bioindicators of ecosystem health and climate change impacts (Fu *et al.*, 2007).

Snakes hold cultural and spiritual importance in the Bhutanese society, where they are often associated with both reverence and fear (Dujardin, 2003). Species such as the king cobra feature in folklore and religious symbolism (Lange, 2019). Traditional medicinal systems also recognize the potential value of snake-derived compounds, for the treatment of snakebites and for other medical use or health benefits (Sapkota *et al.*, 2020).

Emerging ecotourism provides potential livelihood opportunities, particularly in rural regions where biodiversity-based tourism is growing (Gyeltshen, 2020).

Conservation Status

Of Bhutan's snake species assessed by the IUCN Red List are Vulnerable (three), Near Threatened (two), Least Concern (78) and Data Deficient (two), three being in the Not Evaluated category (Figure 4). This highlights a significant global knowledge gap in the conservation assessment of the Himalayan herpetofauna.

Threats to snake populations are multidimensional. There are direct as well as indirect threats to snake populations.

1. **Direct Anthropogenic Threats.** Direct killing is an immediate threat to the snakes (Sapkota *et al.*, 2020; Pandey *et al.*, 2016) in Bhutan. Fear-driven human–snake encounters often result in indiscriminate killing of both venomous and non-venomous species (IUCN SSC Human-Wildlife Conflict & Coexistence Specialist Group, n.d.). Snake-bite incidents reported in the dozens annually frequently lead to retaliatory killing (World Health Organization [WHO], n.d.; Carter *et al.*, 2024). Road mortality is an emerging threat, particularly along major highways and monsoon migration routes (Baxter-Gilbert *et al.*, 2015), where habitat fragmentation increases encounter rates between snakes and vehicles (Tiwari, 2023).

2. **Habitat Loss and Fragmentation.** Conversion of forests into agricultural land, settlements, and infrastructure is a major driver of habitat degradation (Carter *et al.*, 2024; Nordberg *et al.*, 2021). Snakes depend on microhabitats for thermoregulation, foraging, and shelter; fragmentation reduces habitat quality and isolates populations (He & Li, 2025; Glass & Eichholz, 2022). Linear infrastructure such as roads further restrict movement and increase mortality risk (Szabolcs *et al.*, 2024). Species with narrow ecological niches are particularly vulnerable.

3. **Climate Change.** Climate warming is altering thermal environments, forcing altitudinal range shifts (Urban, 2024; Dagnino *et al.*, 2020). Lowland species may expand upward, while high-elevation specialists face habitat compression (elevational trap, see Dirnböck *et al.*, 2011). Mountain-top extinction risk is particularly high for endemic or specialized species.

4. **Trade and Exploitation.** Although currently limited in Bhutan, international wildlife trade poses risks to

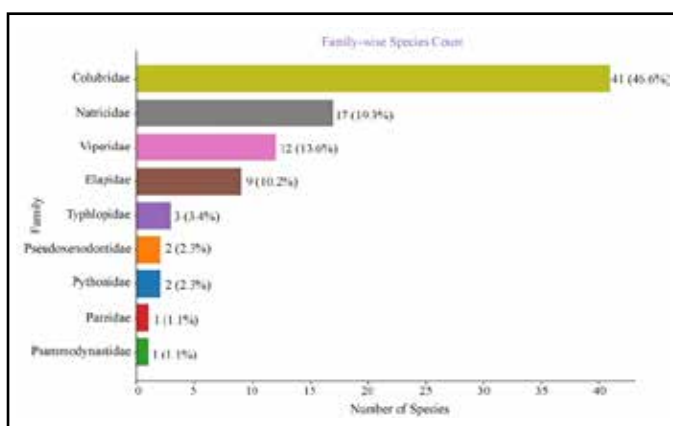


Figure 3. Family-wise snake species count for Bhutan.

charismatic species (Sapkota & Gurung, 2019) such as king cobras and pythons. Illegal collection for the pet trade and venom extraction has been documented as a global threat, and has the potential to expand regionally (La Laina *et al.*, 2021; Hierink *et al.*, 2020; United Nations Office on Drugs and Crime [UNODC], 2013). Thus, unregulated bioprospecting and venom harvest may contribute to localized population declines, if not managed (University of Turku, 2021).

5. Conservation–Commercial Conflicts. Potential future conflicts may arise between conservation priorities and expanding development sectors such as hydropower, forestry, and infrastructure expansion (Rai *et al.*, 2024; Gyeltshen, 2022). While currently limited, Bhutan may face increasing pressure as economic development accelerates (Yangka *et al.*, 2023; World Bank Group, 2016; Asian Development Bank, 2004).

Current Conservation Initiatives

A number of initiatives, primarily championed by the government, have targeted the protection of the Kingdom's biodiversity. Those relevant to the conservation of herpetofaunas are briefly enumerated below.

1. Protected Areas. Bhutan has one of the most extensive protected area systems in the region, covering ~51–52% of its land area. This includes national parks, wildlife sanctuaries, a strict nature reserve, and biological corridors that ensure landscape connectivity (Figure 5). These protected landscapes indirectly conserve snake habitats, although reptile-specific monitoring remains limited.

2. Legal and Policy Framework. The Forest and Nature Conservation Act (2023) provides general

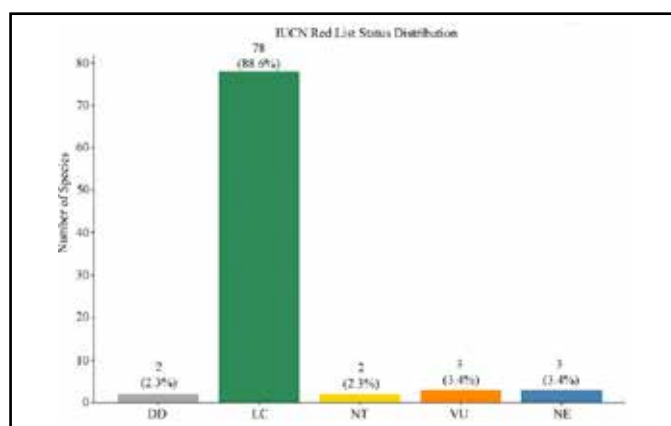


Figure 4. IUCN Red List status of snakes in Bhutan.

protection to wildlife, including snakes, through anti-poaching and habitat protection measures. The National Biodiversity Strategies and Action Plan aligns with global conservation frameworks but does not specifically prioritize snakes as a flagship taxon.

3. Community-based Conservation. Community engagement in biodiversity conservation is increasing through citizen science platforms (McKinley *et al.*, 2017), biodiversity reporting systems (Wangyal *et al.*, 2022), and wildlife rescue awareness programs (Salim *et al.*, 2024). However, formal snake-specific rescue or handling systems are still developing.

4. Research and Monitoring. Bhutan has initiated modern biodiversity tools such as environmental DNA (eDNA) for aquatic systems and camera trapping for mammals. However, snake-focused eDNA and systematic herpetological monitoring remain limited. Venom research and proteomics are emerging fields with potential biomedical relevance, although still in early stages.

5. National Conservation Philosophy. Bhutan's conservation success is strongly influenced by Gross National Happiness (GNH), which integrates environmental protection as a core development pillar. Strong constitutional mandates require maintaining at least 60% forest cover, supported by substantial government investment in environmental protection.

Conclusions

Bhutan's snake fauna is a significant component of the Himalayan biodiversity, although the total number of species is not consistently reported across authoritative sources. Most published herpetological records indicate a lower richness (approximately 60–80 species), reflecting dated data sources,

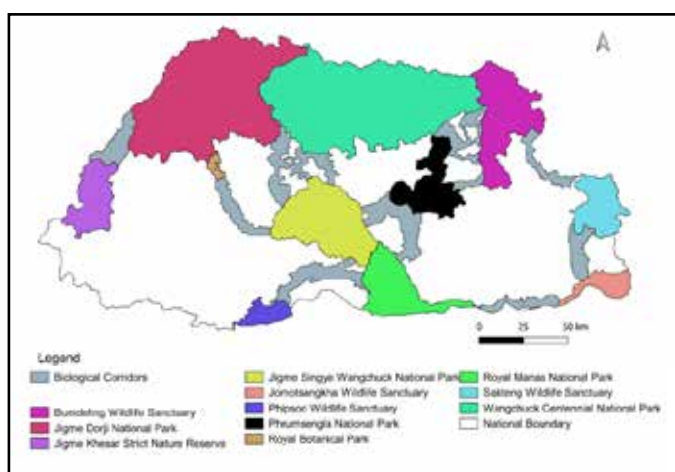


Figure 5. Map showing protected areas of Bhutan.

ongoing taxonomic revisions. Additionally, new field discoveries render the current figure as provisional.

Scientific understanding of the Kingdom's snakes has improved considerably since early documentation efforts at the turn of the century, particularly through regional biodiversity surveys and targeted herpetofaunal studies. Despite this progress, substantial knowledge gaps remain. These include limited data on population trends, fine-scale distributions, habitat use, and species-specific responses to environmental change. Many taxa remain poorly studied or are Data Deficient, which constrains accurate conservation assessments and planning.

The overall conservation outlook for Bhutan's snakes is cautiously optimistic. The country benefits from strong constitutional environmental protections, a high level of cultural reverence for nature, and an extensive protected area network that collectively support biodiversity conservation. However, pressures such as habitat fragmentation, infrastructure development, climate change, and human–wildlife conflict continue to affect snake populations, especially in lowland and mid-elevation zones where human activity is more intense.

Future conservation effectiveness will depend on moving beyond broad protection frameworks toward more targeted, evidence-based approaches. Priority actions include the establishment of a coordinated national monitoring system using tools such as field surveys, environmental DNA (eDNA), and citizen science to improve detection and long-term tracking of species. Updated IUCN-aligned assessments are needed to identify threatened, endemic, and

medically significant species more accurately, rather than relying on static species counts. Strengthening transboundary collaboration with neighbouring India is also essential for managing wide-ranging Himalayan taxa. In addition, integrating reptile conservation into national climate adaptation strategies and land-use planning will help address emerging environmental pressures.

Ultimately, Bhutan's snake diversity will be best conserved through the integration of scientific research (Figure 6), adaptive management, landscape-level planning, and above all, local awareness. While cultural and legal frameworks provide a strong foundation for conservation, long-term persistence of these species depends on translating these strengths into sustained ecological monitoring and practical conservation action that maintains their ecological roles within Himalayan ecosystems.

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Figure 6. Representative snake species recorded from Bhutan, (A) Yellow whip snake (*Ahaetulla flavescens*), (B) Zaw's wolf snake (*Lycodon zawi*), (C) Indian Cobra (*Naja naja*), (D) Common wolf snake (*Lyodon aulicus*), (E) Buff striped keelback (*Amphiesma stolatum*), and (F) Diard's blind snake (*Argyrophis diardii*) can be found in commonly (Photos: Chogyal Tashi and Jigme Tshelthrim Wangyal).

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