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SPECIAL ISSUE | THE STATUS OF SNOW LEOPARDS ACROSS HIGH ASIA

Snow Leopard (*Panthera uncia*) Status in Nepal

Rinzin Phunjok Lama [1*], Gopal Khanal [2], Hari Bhadra Acharya [2], Madhu Chetri [3], Narayan Koju [4], Kamal Thapa [5], Paras Bikram Singh [6], Samundra Ambuhang Subba [7], Sheren Shrestha [8], Tashi R. Ghale [1], Naresh Kusi [9,10], Ashok Subedi [3], Bikram Shrestha [11,12]

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CORRESPONDING EDITOR: Örjan Johansson
HANDLING EDITOR: Justine Shanti Alexander

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1 Upper Karnali Landscape Initiatives (UKALI), Simkot-6, Simikot, Humla, Nepal
2 Department of National Parks and Wildlife Conservation (DNPWC), Babarmahal, Kathmandu, Nepal
3 National Trust for Nature Conservation, P.O. Box. 3712, Khumaltar, Lalitpur, Nepal
4 Center for Post Graduate Studies, Nepal Engineering College, Pokhara University, Nepal
5 Dreamer Himalaya Expedition, Kathmandu, Nepal
6 Biodiversity Conservation Society (BioCoS) Nepal, Bagdol, Lalitpur, Nepal
7 Department of Wildlife and Natural Resources, College of Agriculture and Natural Resources, Tarleton State University, Stephenville, Texas, 76402, USA
8 WWF Nepal, Baluwatar, Kathmandu, Nepal
9 Himalayan Wolves Project, Salenstein, Switzerland
10 Department of Forestry and Wildlife Management, University of Inland Norway, Elverum, Norway
11 Department of Biodiversity Research, Global Change Research Institute, Czech Academy of Sciences, Brno, Czech Republic
12 Conservation Development Foundation Nepal, 44600 Kathmandu, Nepal
* Email: rinzinplama@gmail.com

1. Distribution

Snow leopards (*Panthera uncia*) are distributed across the northern regions of Nepal, primarily within alpine and subalpine zones at elevations ranging from 3,000 to 5,000 meters (Jackson, 1979; DNPWC & DoFSC, 2024; Khanal et al., 2024). Nepal's snow leopard range has been divided into three key landscapes: (1) Eastern Landscape, (2) Central Landscape, and (3) Western Landscape (Figure 1; DNPWC, 2013). These three landscapes include 26 districts and 11 protected areas (PAs). However, snow leopard presence has not been confirmed in all the areas. The western landscape covers 16,423.62 km² across 10 districts and four PAs; the central landscape spans 6,614.70 km² across eight districts and two PAs; and the eastern landscape encompasses 7,397.46 km² across eight districts and five PAs. In total, these landscapes comprise 30,435.78 km² of potential snow leopard habitat, of which approximately 58% lies within PAs, and 42% lies outside PAs (DNPWC & DoFSC, 2024).

The 2025 national snow leopard population assessment served as the foundation for Nepal's updated IUCN range map. Areas classified as Extant were defined based on confirmed snow leopard presence supported by camera trapping, genetic surveys, and other direct evidence compiled during the assessment. In contrast, Possible Extant areas were delineated based on landscape connectivity,

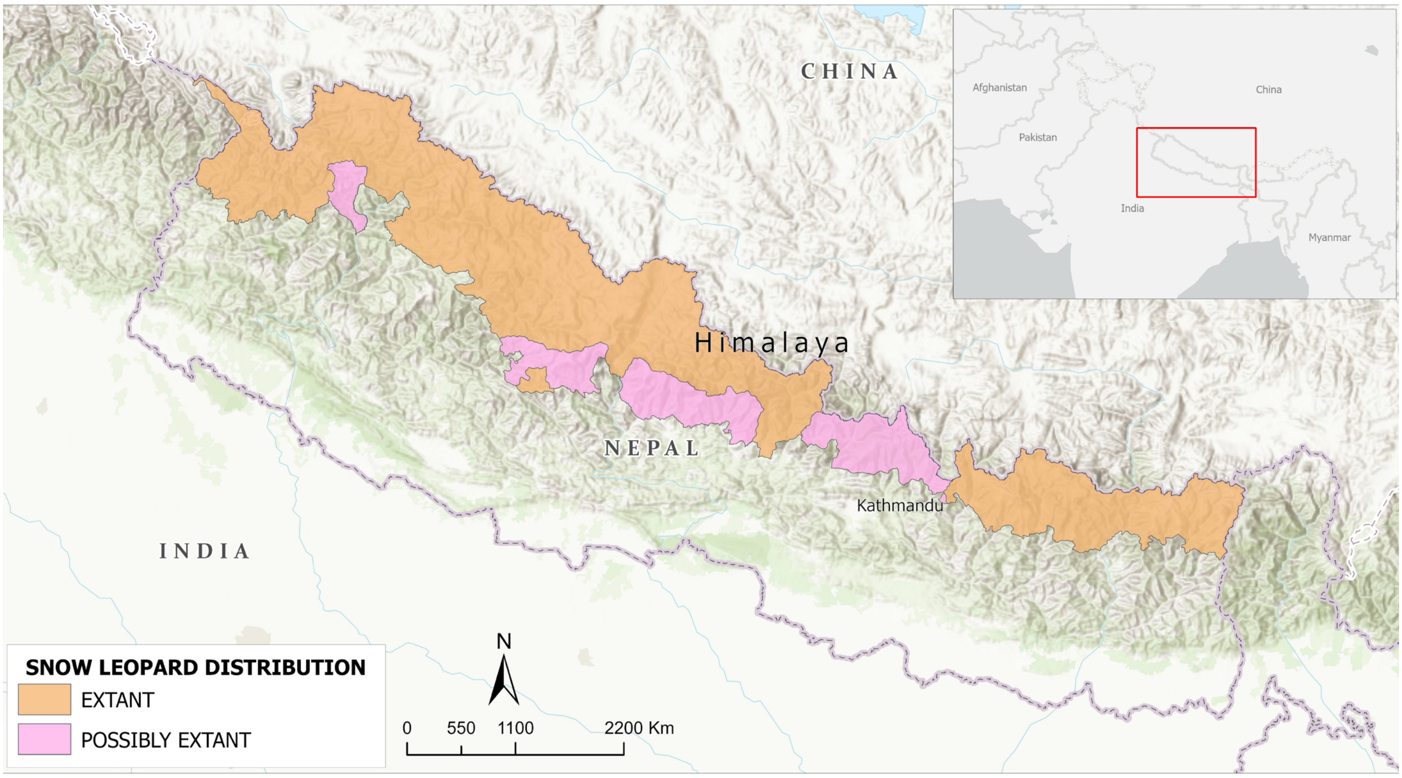

Figure 1. *Distribution of the snow leopard (Panthera uncia) in Nepal. Orange areas indicate extant range, where the species is known or strongly inferred to occur. Pink areas indicate possibly extant range, where presence is uncertain but considered likely based on habitat suitability and proximity to confirmed records, following IUCN Red List mapping criteria.*

suitable habitat characteristics, and expert knowledge, including regions where snow leopards are likely present but where confirmed records such as photographic evidence or genetic confirmation are lacking.

Annapurna Conservation Area has the largest extent of suitable snow leopard habitat (4,321.4 km²), followed by Shey Phoksundo National Park (3,613.3 km²). Both are among the most important PAs for snow leopards (Chetri et al., 2019b; SPNP, 2023; DNPWC & DoFSC, 2024). Outside the PA system, Humla District contains the largest potential snow leopard habitat (3,983 km²), followed by the Chharka Tangsong region in eastern Dolpa (1,918 km²), which lies between Shey Phoksundo National Park and the Annapurna Conservation Area (DNPWC & DoFSC, 2024).

Studies based on sign surveys, occasional sightings, and interviews with local communities also confirm snow leopard presence in several other PAs, such as Langtang National Park (Adhikari, 2004; Chalise, 2011), Api Nampa Conservation Area (Khanal et al., 2020a), and Dhorpatan Hunting Reserve (Gautam, 2016). However, no recent confirmations have been made using more robust methods such as camera trapping or genetic analysis of fecal samples. A radio-collared snow leopard from Kanchenjunga Conservation Area was documented traveling to Makalu Barun National Park (Subba et al., 2025). Rara National Park, however, does not yet have confirmed records of snow leopard presence.

Outside the PA network, the species' distribution remains uncertain in some regions, including the corridor linking Langtang National Park and Manaslu Conservation Area, as well as Bajura District in far-western Nepal.

2. Population

In 2025, the Government of Nepal completed the first-ever nationwide population estimation of snow leopards using a multi-season Spatially Explicit Capture-Recapture (SECR) model. The estimated abundance was 397 snow leopards (95% CI: 331.11- 475.60), across 30,435.78 km² with a mean density of 1.56 individuals per 100 km² (95% CI: 1.30–1.87). This recent estimate highlights regional strongholds in population and density. Among the three landscapes, the western landscape has the highest abundance (234.08; 95% CI: 196.10- 279.42), accounting for 60% of Nepal's snow leopard population, followed by the central (89.42; 95% CI: 72.81- 109.82) and eastern (73.33; 95% CI: 61.41 -87.57) landscapes (DNPWC & DoFSC, 2025).

The 2025 national estimate falls in the range of the previous population estimate of 301-400 snow leopards (WWF Nepal, 2009), which was based on the sign encounter rate extrapolations (DNPWC, 2013). The present assessment follows the Global Snow Leopard and Ecosystem Protection Program – Population Assessment of the World's Snow Leopards (GSLEP-PAWS) guidelines (Sharma et al., 2019), with robust methodology and large sampling sites (DNPWC & DoFSC, 2025).

Shey-Phoksundo National Park (SPNP) supports the largest population of snow leopards, with an estimated density of 2.21 snow leopards per 100 km² and a total estimated population of 90 individuals (95% CI: 78–109) (SPNP, 2023). A previous study (Khanal et al., 2020b) recorded densities of 2.51 individuals per 100 km² (95% CI: 1.76-2.62) in Upper Dolpa and 1.21 per 100 km² in Lower Dolpa, both within SPNP, indicating substantial spatial variation in density. Additionally, DoFSC, (2024) estimated a population of 30 individuals (95% CI: 27-37) with a density of 1.5 per 100 km² (95% CI: 0.93-2.02) in eastern Dolpa, adjacent to the park.

In the Namkha region of Humla district, Lama et al. (in review) estimated a population of 39 individuals (95% CI 30.3–60.9), with a density of 1.84 per 100 km² (95% CI: 1.44–2.89). In the Api Nampa Conservation Area, the far-west corner of Nepal, Khanal et al. (2020a) projected a population of 6–9 individuals, based on prey biomass.

In the Annapurna–Manaslu landscape, Chetri et al. (2019b) estimated a mean density of 0.95 snow leopards per 100 km² (95% CI: 0.1–1.9 per 100 km²), with region-specific estimates of 1.07 per 100 km² in Annapurna and 1.16 per 100 km² in Bhimthang–Manaslu. Some hotspots within Annapurna Conservation Area, such as the upper Phu Valley of Manang, reported densities as high as 6 snow leopards per 100 km² (Wegge et al., 2012). Such high estimates may be due to the relatively small survey area (125 km²), which encompassed prime snow leopard habitat. Similarly, in Upper Mustang, Aryal et al. (2014) estimated a density of

Table 1*: Snow leopard population and density estimates across Nepal by site or region*

Site/Region	Estimated Population	Density (per 100 km²)	Source
National (Nepal-wide)	397 (95% CI: 331.11–475.60)	1.56 (95% CI: 1.30–1.87)	(DNPWC & DoFSC, 2025)
Western Landscape	234.08 (95% CI: 196.10–279.42)	Not specified	(DNPWC & DoFSC, 2025)
Central Landscape	89.42 (95% CI: 72.81–109.82)	Not specified	(DNPWC & DoFSC, 2025)
Eastern Landscape	73.33 (95% CI: 61.41–87.57)	Not specified	(DNPWC & DoFSC, 2025)
Shey Phoksundo National Park (SPNP)	90 (95% CI: 78–109)	2.21 (95% CI: 1.76- 2.62)	(SPNP, 2023)
Eastern Dolpa (adjacent to SPNP)	30 (95% CI: 27-37)	1.5 (95% CI: 0.93- 2.02)	(DoFSC, 2024)
Namkha, Humla District	39 (95% CI: 30.3–60.9)	1.84 (95% CI: 1.44–2.89)	(Lama et al., in review)
Api Nampa Conservation Area	6–9		(Khanal et al., 2020a)
Annapurna–Manaslu Landscape	48	0.95 (95% CI: 0.1-1.9)	(Chetri et al., 2019b)
Annapurna (within above)	Not specified	1.07 (95% CI: 0.71-1.62)	(Chetri et al., 2019b)
Bhimthang–Manaslu (within above)	Not specified	1.16 (95% CI: 0.73-1.87)	(Chetri et al., 2019b)
Phu Valley, Manang (Annapurna area)	Not specified	6.0	(Wegge et al., 2012)
Upper Mustang (Annapurna area)	~22	1.9	(Aryal et al., 2014)
Lapchi Valley (Gaurishankar CA)	~6	2.14	(Koju et al., 2024)
Gaurishankar Conservation Area (GCA)	15 (95% CI: 5.57-35.92)	0.92 (SE 0.44)	(Chetri et al., in review)
Kanchenjunga Conservation Area (KCA)	13 (95% CI: 9-24)	1.0 (95% CI: 0.5-1.7)	(DNPWC, 2024)
Sagarmatha (Everest) National Park	4	0.7	(Lovari et al., 2009)
Sagarmatha	≥3	Not specified	(Křenová et al., 2022)

1.9 per 100 km², corresponding to an approximate population of 22 individuals.

In eastern Nepal, the Lapchi Valley within Gaurishankar Conservation Area recorded six individuals, with an estimated crude density of 2.14 snow leopards per 100 km² (Koju et al., 2024). In a survey conducted in the whole of Gaurishankar Conservation Area, 15 individuals were reported with an estimated density of 0.92 per 100 km² (Chetri et al., in review). In the far-east part of Nepal, in Kanchenjunga Conservation Area, a recent survey by DNPWC (2024) recorded 13 individuals (95% CI: 9.3 –23.5), estimating a density of 1 per 100 km² (95% CI: 0.51–1.69). In contrast, a previous study using fecal genetics (Thapa et al., 2021) reported 19 individuals (10 males, 9 females), potentially including sub-adults, and projected a population of 24 with an estimated density of 3.9 per 100 km². This unusually high density should be interpreted with caution.

In Sagarmatha (Everest) National Park, Lovari et al. (2009) confirmed four individuals through fecal genotyping, estimating a density of 0.7 per 100 km², whereas Křenová et al. (2022) indicated a minimum of three snow leopards.

3. Threats

The Snow Leopard Conservation Action Plan (2024-2030) of the Government of Nepal has identified eight major threats to snow leopards, categorized as persisting and emerging threats (DNPWC & DoFSC, 2024). Persisting threats include human-wildlife conflict, wildlife crime, habitat fragmentation, loss and degradation, and wild prey depletion. Emerging threats consist of climate change impacts, diseases, illegal wildlife trade, and poorly planned infrastructure development.

Among the identified threats, human-snow leopard conflict over livestock predation and resulting retaliatory killing remains the most severe and enduring threat to snow leopards (Oli et al., 1994; Khanal et al., 2024; Chetri et al., 2019a; Lama et al., 2018; Jackson et al., 1996). The situation becomes more critical when snow leopards are involved in the mass killing of livestock, leading to heavy financial losses (Thapa, 2021). Numerous studies have emphasized the urgent need for effective conflict mitigation strategies (Filla et al., 2022; Thapa, 2021; Khanal et al., 2020b; Chetri et al., 2019a; Jackson et al., 1996; Oli et al., 1994).

Linear infrastructure, especially roads, poses an increasing threat by fragmenting habitats and facilitating human access to core snow leopard areas, thereby elevating the risks of illegal hunting and illegal wildlife trade (DNPWC & DoFSC, 2024; WWF Nepal, 2018). This threat is more pronounced in areas outside PAs, where remoteness and rugged terrain hinder effective monitoring and law enforcement, which is also not adequate in PAs (R.P. Lama, *pers. comm*., 2025).

High human dependence on PAs for resource extraction continues to challenge snow leopard conservation in Nepal. In western Nepal, particularly in Shey-Phoksundo National Park, and Api Nampa Conservation Area, the seasonal influx of thousands of collectors harvesting Cordyceps (*Ophiocordyceps sinensis*), a highly valued parasitic fungus, causes significant disturbance to snow leopards, their prey and habitats (Lama, 2017). Furthermore, climate change is projected to reduce the extent of suitable habitats, increasing both the frequency and severity of human-wildlife conflicts, and alter predator-prey interactions as highlighted by several studies (Aryal et al., 2016; Lovari et al., 2013; Forrest et al., 2012). Furthermore, the combined effects of climate change and anthropogenic pressures are concurrently degrading and diminishing optimal habitats, undermining both wildlife viability and livestock-based food security for communities. These pressures intensify competition for dwindling resources, ultimately escalating human–wildlife conflicts (Farrington et al., 2024).

Recent camera trap studies have recorded common leopards in snow leopard habitats. Although these species may have coexisted for many years, the presence of multiple large predators in the same area is a matter of concern. Among them, snow leopards are often blamed for predation and thus the retaliation is higher compared to common leopard, whose occurrence is still unknown to many local people (Singh et al., 2025).

Other emerging threats associated with climate change, disease spillover, and poorly planned infrastructure development also have the potential to impact snow leopards in the future (DNPWC & DoFSC, 2024). Zoonotic diseases, transfer between wild prey and domestic livestock, and dog-mediated transfer to snow leopards can be fatal (Ng et al., 2019). In Shey- Phoksundo National Park, the country's main stronghold, disease (Mange/Scabies) seems to be one of the key emerging threats to snow leopards and wild prey such as blue sheep as multiple instances of disease-caused mortality have occurred (Gopal Khanal, *pers. comm*., 2025). However, current evidence on this issue remains limited (DNPWC & DoFSC, 2024; Lama et al., 2020). In a rare and alarming incident in 2023, an injured snow leopard was found in the lowland plains at just 146 m elevation, approximately 57 km from the nearest known habitat. This unprecedented foray into densely populated lower elevations signals snow leopard dispersal and highlights new, under-recognized threats to the species (Chetri et al., 2024).

4. Conservation

The snow leopard has been provided with legal protection by the National Park and Wildlife Conservation Act 1973, as one of the priority species for conservation in Nepal. The Snow Leopard Conservation Action Plan (2024–2030) guides the national priority efforts for snow leopard conservation (DNPWC & DoFSC, 2024), while specific climate-smart plans guide landscape-level priorities (MoFSC, 2017). Nepal's snow leopard conservation efforts have evolved significantly, from early community-based empowerment and conservation initiatives in the 2000s to a more integrated approach that combines local stewardship, development priorities, and targeted threat mitigation. The current approach primarily focuses on supporting local communities with tools and resources to coexist with snow leopards, including predator-proof corrals, income-generating programs, and mechanisms to offset livestock losses (e.g., livestock insurance schemes and compensation relief payments), while addressing context-specific priorities. However, recognizing the integrated nature of challenges and the need to find solutions that benefit both people and nature, Nepal government also prioritizes engagement with diverse non-conventional stakeholders including local governments, faith institutions, media among others (DNPWC & DoFSC, 2024). Efforts are also being made by these institutions to contribute to the government's vision for collaborative conservation (NBF, 2024).

Community-managed livestock insurance schemes and incentive-based conservation models (e.g., saving and credits, and revolving funds for communities, revenue sharing from national park income) have significantly reduced retaliatory killings (Gurung et al., 2011; Thapa et al., 2023). The Government of Nepal has endorsed the Wildlife-Friendly Infrastructure Construction Directives (2022), which guide infrastructure development in wildlife habitat. In addition, the Government of Nepal has revised the Wildlife Damage Relief Guidelines (2023), which streamline compensation for wildlife-induced damages, including livestock predation by snow leopards. However, the effectiveness of other efforts aimed at reducing livestock loss (e.g., corrals) and those targeting the decrease of hunting, illegal trade, and habitat loss is poorly understood. Nepal formulated the first one of its kind climate-smart snow leopard ecosystem management plan for its Eastern Himalayan Landscape, stepping up for integrating climate adaptation into species and landscape-level conservation (MoFSC, 2017).

Nepal has strong multi-stakeholder cooperation and collaboration in snow leopard conservation. Government agencies collaborate closely with NGOs/INGOs and community-based organizations, such as Snow Leopard Conservation Committees (SLCCs), Buffer Zone Management Committees (BZMCs) and Community-Based Anti-Poaching Units (CBAPUs), to implement conservation programs. Nepal collaborates with neighboring countries through the South Asia Wildlife Enforcement Network (SAWEN), to combat cross-border wildlife trade. The Government of Nepal, through the Wildlife Crime Control Bureau (WCCB), which operates 34 units across the country, is actively engaged to curb wildlife crime (Koirala, 2025). Major stakeholders and conservation institutions have also focused on building climate resilience, strengthening community support, and technology-driven responses regarding snow leopard conservation (WWF Nepal, 2025; Pratihast et al., 2025; DNPWC & DoFSC, 2024). These tools enable real-time data sharing, mapping of high-conflict zones, and informed management interventions.

Conservation education is also being institutionalized, with snow leopard modules integrated into school curricula in Taplejung and Mustang district, fostering early awareness and behavioral change among students (Anil Adhikari, *pers. comm.*, 2025). Furthermore, ex-situ initiatives, such as snow leopard conservation education and captive management programs at the Central Zoo in Lalitpur, play a vital role in public outreach and awareness.Nepal has established the Himalayan Research Center in the Kanchenjunga Conservation Area to facilitate research on high mountain ecosystems and species such as snow leopard. Noting gaps in management high mountain rangelands, efforts have been initiated to develop co-management solutions, integrating modern science and traditional knowledge, engaging conservation authorities, communities and faith leadership (DNPWC & DoFSC, 2024).

Linking ecotourism with snow leopard presence, particularly in the Annapurna and Kanchenjunga regions has offered sustainable financing while promoting human-wildlife coexistence (Schutgens et al., 2019; Hanson et al., 2023). Additionally, Nepal actively engages in cross-border cooperation through platforms like the Global Snow Leopard and Ecosystem Protection Program (GSLEP), participating in national and international workshops that strengthen global snow leopard conservation efforts (GSLEP, 2020).

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6. Conflicts of Interest

The authors declare no known conflicts of interest.

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