



Snow Leopard (*Panthera uncia*) Status in India

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1. Distribution

Snow leopards (*Panthera uncia*) in India are primarily found in the high-altitude regions of the Himalayas and Trans-Himalayas. Their habitat is characterized by steep, broken terrain, including cliffs, rocky outcrops, and ravines. The typical habitat has low above-ground productivity, and the vegetation is typically characteristic of dry alpine at higher elevations and subalpine in lower elevations (Chundawat, 1992; Fox et al., 1991). Although rare, snow leopards have also been reported from lower, forested regions of the Greater Himalaya (Bandyopadhyay et al. 2009). Snow leopards tend to be detected at elevations ranging from 3,000 to 5,500 meters, often above the tree line, where steppes, alpine meadows and rocky regions dominate. Their geographical range encompasses a large part of the western Himalayas, including the Union Territories of Jammu and Kashmir and Ladakh, and the states of Himachal Pradesh, Uttarakhand, and the eastern Himalayas including the states of Sikkim and Arunachal Pradesh.

The snow leopard in India is a protected species and receives the highest level of protection, i.e., protection under Schedule 1 of the Indian Wildlife Protection Act, 1972. India has established several protected areas to help conserve snow leopard habitats, including the Chanthang Cold Desert Wildlife Sanctuary (WLS), Great Himalayan National Park (NP), Pin Valley NP and Gangotri NP. The protected area network in India spans ca. 37,000 km² that covers approximately that covers approximately 34% of the snow leopard distribution range in India. (Bhatnagar et al., 2024).

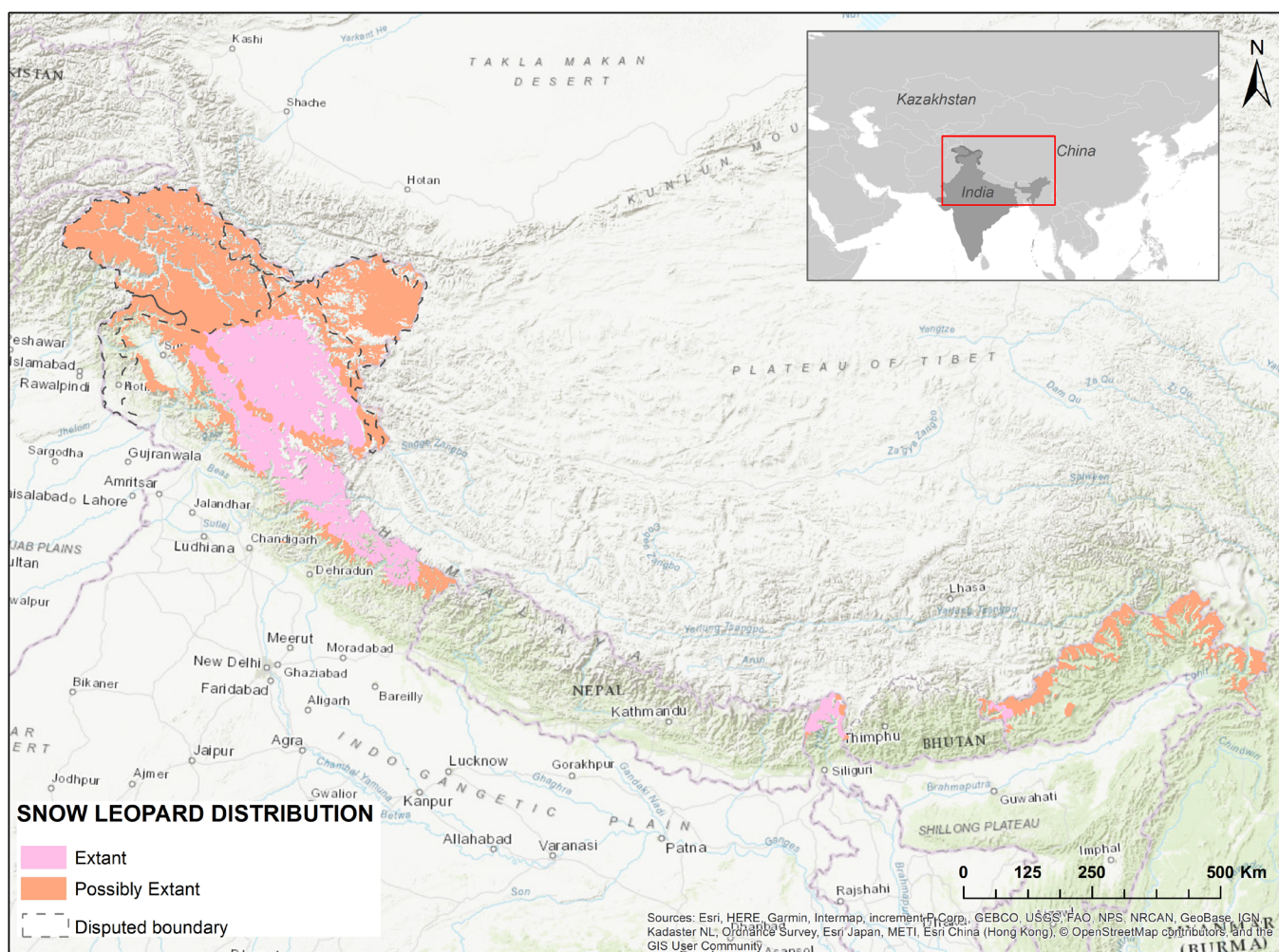


Figure 1: Map showing the extant and possibly extant region for snow leopard distribution in India. The map includes regions under dispute with Pakistan and China and the snow leopard distribution as well as the borders are indicative and subject to uncertainty.

As research efforts expand, the estimated extent of snow leopard distribution in India has been revised. Earlier studies reported the extent of the snow leopard habitat to be ca. 75,000 km² (Chundawat et al., 1988). More recent assessments now estimate the snow leopard habitat in India to cover approximately ca. 120,000 km² (Bhatnagar et al., 2024).

The updated IUCN Red List distribution map for the snow leopard in India (Figure 1) was developed using verified occurrence data. This included published records, genetically confirmed scat samples, and photographic evidence from camera traps.

Elevation Filtering: Snow leopards primarily occupy high-altitude alpine zones between 3,000 and 5,500 meters, primarily between 3,000–5,500 m in the Western Himalaya (Chundawat, 1992; Fox et al., 1991; McCarthy & Chapron, 2003). To delineate these elevational areas, data were extracted from the Shuttle Radar Topography Mission (SRTM) digital elevation model (Jarvis et al., 2008). The raster reclassification tool in ArcGIS Pro was

used to identify and map areas within this elevation band, representing potentially suitable habitat.

Within each state, spatial coordinates of confirmed snow leopard occurrences from the past five years were compiled from published datasets and locations shared by expert scientists (Vardhan et al. 2025; K. Suryawanshi & R. Sharma, pers. comm., 2024). These locations are detections from camera trapping surveys and genetic analyses of scat samples. These confirmed detections were used to generate a Minimum Convex Polygon (MCP) in ArcGIS Pro according to the mapping standards in the IUCN Red List Assessment. Each MCP was subsequently intersected with hydrological catchment boundaries to delineate catchment zones with verified presence and was classified as Extant. Areas within the suitable elevation range, but without confirmed records in the past five years, were classified as Possibly Extant. These areas may support snow leopards but require further field verification through field-based surveys.

2. Population

Under the Project Snow Leopard, launched by the Government of India in 2009, a population estimation effort and the detailed protocol for conducting assessments was launched in 2019. Under Project Snow Leopard, a team of researchers from multiple institutions completed the first national-level survey to estimate snow leopard populations in 2023. This country-level effort provided the first robust estimate of snow leopard numbers in India (MoEFCC, 2023). These robust estimates were reached using the two-step protocol developed under the Snow leopard Population Assessment of India (SPAI) effort, which is based on the PAWS (Population Assessment of World's Snow leopards) effort. The effort involved 1,971 camera trap locations across the union territories of Ladakh and Jammu and Kashmir, and the states of Arunachal Pradesh, Himachal Pradesh, Sikkim, and Uttarakhand.

The camera trapping surveys detected 241 unique adult individuals and reported an estimated population size of 718 individuals. According to the report, the largest population was recorded in the Ladakh region, with 126 unique adult individuals detected by camera traps. However, a more recent published study using genetic data identified 72 unique individuals in Ladakh, based on large-scale scat sampling and genetic analyses (Vardhan et al., 2025), compared to the 126 individuals mentioned in the earlier report (MoEFCC, 2023). Vardhan et al. (2025) did not estimate the overall population size for this region and thus the total population may not be comparable.

An important development has been the documentation of snow leopards from previously unconfirmed regions such as Jammu and Kashmir (Khanyari et al., 2023), Sikkim (Sikkim Forest & Environment Department and WWF, 2025), and Arunachal Pradesh (WWF-India, 2023) over the last five years, along with robust estimates from all regions using camera-trapping methods (Suryawanshi et al., 2021; Pal et al., 2021).

As part of this national effort, regional density estimates for six regions were also reported. It is important to note that these region-wise estimates, based on administrative boundaries, may not represent sub-populations. Table 1 below provides a summary of regional wise estimates.

Population trends for snow leopards in India remain unknown. Prior to this robust estimate that followed the SPAI and PAWS (Population Assessment of World's Snow leopards) guidelines, it was estimated that India could host a population of about 516 (238-1039) snow leopards (Bhatnagar et al., 2016). The updated 2023 estimate now puts the estimated number at 718 individuals.

3. Threats

Historical threats

Snow leopards have historically been hunted for their prized fur, which remains in demand on international markets. Their body parts are also used in traditional medicine, especially in regions influenced by Tibetan and Chinese practices. Panjwani (1997) reports that trade in snow leopard skins continued in Jammu and Kashmir until the end of the 1990s. However, retaliatory killing is considered a bigger threat than illegal wildlife and poaching (Mishra et al., 2016; Snow Leopard Working Secretariat, 2013).

Livestock grazing pressure remains an important threat in the snow leopard habitats in India (Mishra et al., 2004; Suryawanshi et al., 2010; Sharma et al., 2024). The intensity of livestock grazing poses a major challenge, manifesting in increasingly complex ways as a stressor. Grazing patterns are increasingly shaped by market forces, particularly the demand for cashmere, leading to the decrease in some native livestock populations (horses, yak) in some areas and an expansion of transhumant herding. This shift has intensified grazing pressure, resulting in wildlife declines, particularly in regions such as Changthang (Tsewang et al., 2007; Singh et al., 2015; Morup et al., 2023).

Table 1: Regional Estimates of Snow Leopard Populations in India (MoEFCC 2023)

Region	Number of camera locations	Unique individuals	Density (per 100km ²)	Population size
Ladakh	956	126	0.34 ± 0.14	477
Jammu & Kashmir	135	9	0.75 ± 0.52	9
Himachal Pradesh	284	44	0.08 - 0.37	51
Uttarakhand	382	40	0.7 - 1.04	124
Sikkim	99	14	0.4 ± 0.11	21
Arunachal Pradesh	115	8	0.26 ± 0.11	36
Total	1971	241		718

Research has helped us understand the mechanisms by which high livestock densities can impact the population-level of snow leopard wild prey, such as blue sheep, *Pseudois nayaur*, and ibex, *Capra sibirica* (Mishra et al., 2004, Suryawanshi et al., 2010, Sharma et al., 2024). The high level of overlap in pastures between domestic and wild ungulates, through resource-driven competition, negatively impacts the prey of snow leopards. These insights are crucial for informing the scale and focus of future conservation interventions.

Emerging threats

Developmental pressures have led to large-scale land-use changes (e.g. agricultural expansion and infrastructure development) in the Indian Himalaya over the past decade (McCarthy & Chapron, 2003; Thakur et al., 2024; Bhatnagar et al., 2024; Sikkim Forest & Environment Department and WWF-India, 2025). Recent surveys show that not only ungulates show an increasing tendency to avoid roads, likely in response to growing disturbance from tourist activity and vehicular traffic but also signs of snow leopards (scats, scent marks, and pugmarks) decline closer to roads (Sikkim Forest & Environment Department and WWF-India, 2025). This is potentially the most important emerging threat because much of the snow leopard habitat is outside protected areas in India. Green energy initiatives, particularly solar parks, expand into snow leopard habitats posing new risks through habitat degradation and fragmentation (Patel et al., 2024). Additionally, the population of free-ranging dogs in the Himalayan regions is increasing, posing direct risks to carnivores and causing significant livestock losses for herders, which hinders wildlife conservation efforts (Pahuja & Sharma, 2021; Mahar et al., 2024).

4. Conservation

Conservation efforts for snow leopards are increasingly focused outside the protected area network – where much of their range is located. In the last five years, these efforts have focused on participatory, knowledge-driven, and landscape-scale programs (Khanyari et al., 2023; Bhatnagar et al., 2024; Young et al., 2024). Much of the community-led conservation actions have focused on minimizing livestock losses through predator-resistant corrals, insurance schemes for livestock, and encouraging pro-conservation behavior through handicrafts-based initiatives focused on women engagement (Alexander et al., 2022; Young et al., 2024).

About 34% of snow leopard range in India is within protected areas (Bhatnagar et al., 2024). Under the Government of India's Project Snow Leopard, each of the six states where the snow leopard is found, plans to identify at least one landscape (1000-5000 km²) which can be managed. These contiguous areas will have protected areas interspersed with multiple-use habitats (Bhatnagar et al., 2024). The Project Snow Leopard and the SECURE Himalaya project are two notable projects in India that have continued to work on conservation of snow leopards in India.

Future directions

Conservation efforts have traditionally prioritized reducing

livestock losses, but future strategies must adopt a multi-pronged approach (Mishra et al., 2024) that combines loss reduction with education, awareness, and livelihood improvements. Addressing the issue of free-ranging dogs is particularly critical. Potential solutions include ABC (Animal Birth Control) programs, consistent monitoring of dog-induced losses, and promoting dog adoption programs. Recently, much concerted efforts have been made by the Government of India to strengthen conservation planning through coordinated and evidence-based approaches. The launch of the International Big Cat Alliance (IBCA), along with discussions held with the National Board for Wildlife (NWLB) around infrastructure development, shows the strategic, high-level engagement in wildlife conservation. In parallel, the Ministry of Environment, Forest and Climate Change (MoEFCC) is undertaking efforts to redevelop the Project Snow Leopard (PSL) framework and the SECURE 2.0 program to ensure they operate in a genuinely evidence-based, landscape-scale, and participatory manner. The Ministry is also moving towards establishing more formal partnerships with the armed forces, recognizing their role in conservation across remote and strategically important landscapes. Overall, the focus on well-funded, landscape-level, participatory, and cross-sectoral planning represents a robust and pragmatic approach, however, implementing these measures in remote landscapes, especially with the growing influx of tourists each year, presents significant challenges.

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6. Conflicts of Interest

The authors declare no known conflicts of interest.

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