



Increasing Threats to Snow Leopard Survival in Pakistan

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The snow leopard (*Panthera uncia*; **Figure 1**) is an iconic threatened species native to high mountain landscapes and remains scarcely distributed across 12 Central and Southern Asian countries, including Pakistan (**Figure 2**; McCarthy et al., 2017). A population of ~2,710–3,386 individuals is estimated globally (McCarthy et al., 2017), with a decreasing trend primarily due to poaching (McCarthy et al., 2017), retaliation, habitat loss (Li et al., 2020), and climate change (Farrington and Li, 2016). Since 2008, there have been an estimated 221–450 (~ 4/week) snow leopard poaching incidents annually (Nowell et al., 2016; WWF, 2016). Over 90% of these incidents occur in five countries, including China, India, Mongolia, Tajikistan, and Pakistan (WWF, 2016).

Despite their numbers being between 200–420 individuals in Pakistan (Kazmi et al., 2021), snow leopard survival in the country is at higher risk for six main reasons. (I) Poaching; In Khunjerab National Park (KNP) and surrounding conservancies, 13 snow leopards have been killed in the last 7 years (Rashid et al., 2021); however, an expert survey indicates that the situation is much worse than the reported annual statistics suggest (Nowell et al., 2016). (II) Competition for primary prey; Growing populations of feral dogs compete with snow leopards for primary natural prey (markhor; *Capra falconeri*). In Chitral Gol National Park (CGNP; 77.4 km² area) alone, feral dogs have killed 392 markhors in the past 15 years (2006–2020; Khattak et al., 2021), while data for ibex (*Capra sibirica*) and markhor mortality are not available in other regions. (III) Illegal killing of primary prey; The illegal harvest of ibex and markhor for meat is very high in Pakistan's snow leopard habitats. Recently, over 100 ibex were killed for influential and government officials (Mir, 2020). Due to intense unchecked hunting of markhor, its population has catastrophically declined from 2,868 individuals in 2019 to <800 individuals at present (Ahmad and Nabi, 2022). (IV) Trophy Hunting (TH); The current TH program of snow leopard prey in Pakistan runs counter to the ultimate objective of conservation e.g., TH inside national parks and increasing negative attitudes among local residents toward snow leopard (Rashid et al., 2021). (V) Conflict between humans and snow leopards; Snow leopards frequently attack livestock and kill dozens of animals (Geo News, 2021). In retaliation, many snow leopards are killed every year by pastoralists seeking to protect their livelihoods (WWF, 2016). (VI) Environmental factors and lack of research; Climate change, habitat degradation, fragmentation and isolation, overwhelming environmental threats from the China-Pakistan Economic Corridor (CPEC; Nabi et al., 2018, 2019), lack of resources and cooperation from the wildlife department for research, and inaccessibility and geopolitical sensitivity of the research area additionally compromise snow leopard conservation.

Illegal hunting and poaching of snow leopards are widespread activities, owing to snow leopard parts being commonly used for Traditional Chinese Medicine (TCM; Coghlan et al., 2015; Byard, 2016). The snow leopard is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; Checklist of CITES Species, 2022). Illegal wildlife trade, if not controlled, maybe facilitated to major hubs in other southeast Asian countries

through the CPEC of the Belt and Road Initiative (BRI; Farhadinia et al., 2019). The promotion of TCM is a central component of BRI (Hughes et al., 2020) and could enhance demand for threatened wildlife species products. Therefore, it is essential to strictly monitor the illegal trade of wildlife and wildlife products in this region and adjoining countries.

Feral dogs are causing a stark decline in the primary prey of the snow leopards. The numerical increase and geometrical expansion of the feral dog population (Khattak et al., 2021) should be regulated using castration and sterilization techniques. Community awareness of food waste disposal and collaborative teamwork between municipal and wildlife departments could further help regulate the feral dog population in CGNP and neighboring regions.

If the extensive and unregulated killing of primary prey by feral dogs, hunters, and poachers continues, the snow leopards being a top “specialist predator,” may lack necessary food resources. Consequently, snow leopards would be more likely to kill livestock, which would, in turn, exacerbate poaching and retaliatory killing. Considering the drastic decline in primary prey, it is in the species’ best interests to revisit the current TH policy. Strict action is required against the influential government officials and hunters to discourage and better regulate ibex and markhor hunting. Although most herders nowadays are aware of the threatened status of the snow leopard, they still have negative attitudes toward the species due to their role in livestock deaths. Pastoralist financial losses are either not compensated or very little financial assistance is provided (Geo News, 2021). The government’s responsibility is to fully support local people.

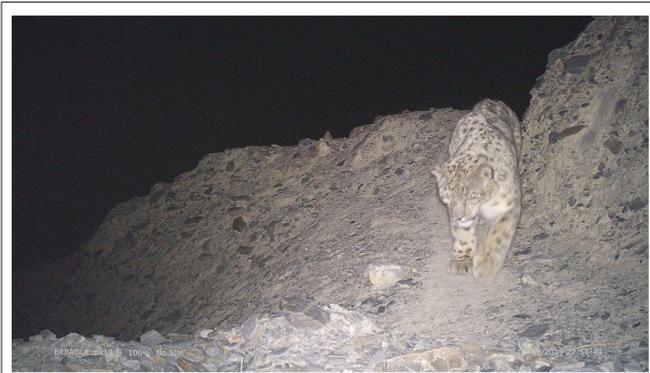


FIGURE 1 | Snow leopard photo captured at the Khunjerab National Park, Pakistan. (Photo credit; Shahid Ahmad).

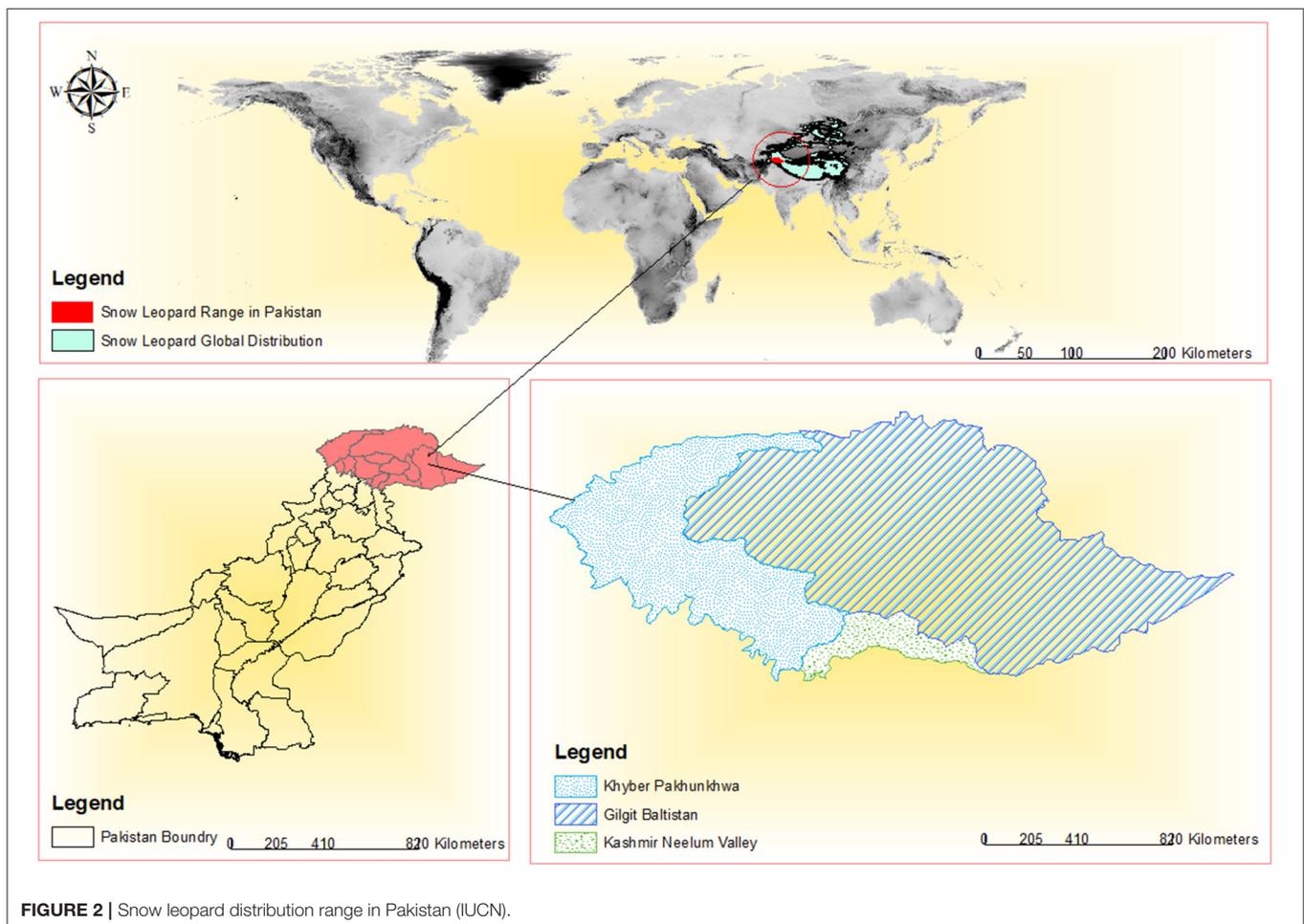


FIGURE 2 | Snow leopard distribution range in Pakistan (IUCN).

Jobs in ecotourism, wildlife, and environmental conservation departments may help in alleviating dependence on pastoralist economies in Pakistan.

The CPEC and climate change could have ecological effects on local biodiversity (Nabi et al., 2017; Lashari et al., 2021) that could significantly impact the conservation and management of wildlife in Pakistan's fragile ecosystems. More studies are needed to understand these impacts. For this, sufficient funds are needed to equip researchers and wildlife department officials to access areas of snow leopard habitat that are largely unexplored for research, patrolling, and management. There is also a need to deeply investigate the availability of food resources for snow leopards and eco-physiological studies using non-invasive samples (e.g., hairs, fecal samples).

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AUTHOR CONTRIBUTIONS

SA and GN conceived the study and drafted the manuscript. CH and IS critically reviewed the manuscript. XL funded and critically reviewed the manuscript. All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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