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Asia's Wolves and Synergies With Big Cats

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ABSTRACT

In Asia, carnivore conservation is often focused on charismatic big cats. Opportunities to conserve the entire carnivore guild are frequently overlooked by channeling conservation and mitigation efforts into single-species conservation. We synthesize experiences across Asia to explore these challenges and propose mitigations to maximize conservation benefits for the entire carnivore guild. Seven challenges for wolves (*Canis lupus*) in Asia are highlighted: wolves (1) have been neglected over decades of single-species conservation, (2) receive less cultural appreciation in many regions, (3) are subject to lax legislation and law enforcement, (4) are often blamed disproportionately for livestock depredation, (5) are often considered more abundant than they are, (6), receive disproportionately little attention from the scientific and conservation communities relative to their ecological importance, and (7) are threatened ecologically and genetically by increasing feral dog populations. As a result, the status of wolves across Asia is poorly documented, there is an enhanced risk of losing significant evolutionary lineages, and it detracts from research and conservation opportunities to preserve the entire carnivore guild. We propose various remedies, such as widening the scope of existing conservation programs, building awareness and knowledge of communities and law enforcement agencies, and more research to inform conservation and legislation.

1 | Introduction

Asia is one of the most biodiverse regions on Earth, yet much of its biodiversity is threatened. The continent is known for some of the most charismatic fauna that live alongside over half of the world's human population. Despite the general underperformance of most Asian countries to achieve 17% of land protected by 2020 (Farhadinia et al. 2022), there are promising signs of recovery for a number of big cats. For example, the population size of tigers (*Panthera tigris*) has increased in India and Nepal (Jhala et al.

2021), while snow leopards (*Panthera uncia*) were downlisted from the Endangered to Vulnerable category of the IUCN Red List (McCarthy et al. 2017, Figure 1).

Globally, wolves are considered to be Least Concern but Asia's wolf lineages represent some of the most globally diverse and ancient clades of wolves, with four recognized subspecies, all of which are increasingly threatened (Boitani et al. 2023; Werhahn et al. 2024, Figure 1). The Indian and Himalayan wolves (*Canis lupus pallipes* and *Canis lupus chanco*) are the most evolutionary ancient wolf lineages (Chetri et al. 2016; Werhahn et al. 2020, 2024; Hennelly et al. 2021). Both are little studied while facing ever-increasing human-induced pressures toward their persistence. The smallest subspecies, the Arabian wolf (*Canis lupus arabs*), likely has already lost most of its historic range across southwestern Asia (Bonsen et al. 2024). The Eurasian wolf (*Canis lupus lupus*) is documented to occur across the Eurasian steppe and in parts of the highlands of Central Asia (i.e., Tien Shan, Altai, Hindu Kush, Karakoram) and the Kopet Dag mountains of Iran (Hennelly et al. 2021; Boitani et al. 2023). All these wolf populations suffer from intensive persecution and a lack of basic scientific understanding. They coexist with charismatic big cats, which often receive more—although not enough—research and conservation efforts (Macdonald et al. 2015).

Currently, wolf conservation and research are inadequately supported across the Asian range. We, therefore, combined the experiences of conservation biologists representing multiple Asian countries, where wolves coexist with big cats. To start, we convened an online panel discussion on the challenges, consequences, and recommendations for wolf conservation in Asia with conservation biologists representing five Asian countries that work with big cats, wolves, or both (i.e., Georgia, Iran, Nepal, Pakistan, Mongolia). This panel discussion was part of the Wolves Across Borders Conference 2023, held in Sweden. It involved 312 people from 35 countries, who were asked to provide their opinion on the panel discussion topics through an online form, which was also taken into account in this work (see questions in Supporting Information). We invited another five carnivore conservation biologists and practitioners to write this perspective and then represented a total of seven Asian countries (i.e., Georgia, Iran, Nepal, Pakistan, Mongolia, India, and Saudi Arabia).

We outline challenges for advancing wolf conservation and research in Asia and recommend steps for synergies to conserve wolves and other sympatric carnivores and their prey with the goal of maximizing the conservation output for the entire carnivore guild.

2 | Challenges and Mitigations for Wolves Coexisting With Big Cats in Asia

2.1 | Decades of Single Species Conservation

Many Asian countries benefited from decades of dedicated conservation work targeting big cats (Mishra et al. 2003; Jhala et al. 2021). Effective outreach programs, such as livelihood and development programs, have been implemented to incentivize and benefit local people as a result of various big cats conservation programs. This valuable work has included the construction of water channels, predator-proof corrals, livestock insurance schemes, and livestock vaccination programs (Mishra et al. 2003). In many Asian countries, compensation for livestock depredation by big cats is provided, but less so for wolves (e.g., Pakistan; Table 1). This exacerbates local attitudes toward wolves, which are increasingly negative.

In addition, wolf habitats often lack political support for protection. In the Indian lowlands, conservation focuses primarily on tigers, which often live in protected forests, while Indian wolves inhabit unprotected grasslands despite both species having the same legal protection status and small population sizes (Jhala et al. 2022).

2.1.1. Recommended Mitigations

Instead of single-species conservation planning, multi-species and ecosystem management approaches deliver increased cost-effectiveness while providing benefits to the large carnivore guild and their prey (Noss et al. 2021). Furthermore, considering the entire carnivore guild helps mitigate the complicated and connected interactions between peoples' attitudes to different predators. For example, irrespective of positive attitudes toward big cats, more wolf attacks on livestock can be associated with more negative attitudes toward big cats, highlighting that peoples' attitudes toward one species may be affected by the perceived activity of another (Farhadinia et al. 2017). This implies that compensation schemes will be more effective if they cover all carnivores causing conflict (e.g., as done in Oman and some states of India; Table 1). Due to the large spatial requirements of large carnivores, protected areas alone may not provide adequate protection. Working at the landscape level will benefit the entire carnivore guild rather than focusing only on protected areas. To expand the protection coverage for these wide-ranging species beyond the protected area network "other effective area-based conservation measures" (OECMs) and restoring disturbed landscapes should be promoted in addition to formal protection (Farhadinia et al. 2022). However, any measure of protection applied needs to involve the local indigenous communities closely in its establishment and management.

2.2 | Wolves Are Less Charismatic and Less Culturally Valued

Asia hosts diverse people and cultures, and their relationships with the various predators are complex, multifaceted, and vary across the continent. In many Asian regions, big cats hold higher charisma to local communities and the broader public, which can influence tolerance as well as scientific and funding attention (Macdonald et al. 2015).

The snow leopard is prominently featured in Buddhist paintings and temple art, whereas the tiger and lions are depicted as carrying the goddess Durga in Hindu mythology. Buddhists are relatively tolerant of livestock depredation by snow leopards; they believe these animals are sacred and that killing one is an unforgivable sin (Li et al. 2014; Kusi et al. 2019). Naturally, there is greater tolerance for losses attributed to animals that are

FIGURE 1 | Big cats and wolves of high Asia. From left to right and top to bottom: Tiger (*Panthera tigris*; Courtesy: Yadvendradev V. Jhala), snow leopard (*Panthera uncia*; Courtesy: Claudio Augugliaro), Persian leopard (*Panthera pardus tulliana*; Courtesy: Future4Leopards Foundation/Iran Department of Environment), Eurasian lynx (*Lynx lynx*; Courtesy: Himalayan Wolves Project), Himalayan wolf (*Canis lupus chanco*; Courtesy: Himalayan Wolves Project), Indian wolf (*Canis lupus pallipes*; Courtesy: Mihir Godbole/The Grasslands Trust), Eurasian wolf (*Canis lupus lupus*; Courtesy: Claudio Augugliaro) from Mongolia, and the Arabian wolf (*Canis lupus arabs*; Courtesy: Hadi Al Hikmani).

TABLE 1 | Legal protection, conservation activities, and depredation compensation for big cats and wolves across selected countries in Asia.

Country/species		Leopard (*Panthera pardus*)	Snow leopard (*Panthera uncia*)	Tiger (*Panthera tigris*)	Lion (*Panthera leo*)	Grey wolf (*Canis lupus*)	Indian wolf (*Canis lupus pallipes*)[a]	Himalayan wolf (*Canis lupus chanco*)[b]	Arabian wolf (*Canis lupus arabs*)
Afghanistan	Legal protection	NA	Yes	NA	NA	Yes	NA	NA	NA
	Conservation activities	NA	NA	NA	NA	NA	NA	NA	NA
	Depredation compensation	NA	Some	NA	NA	No	NA	NA	NA
Bhutan	Legal protection	Yes	Yes	Yes	NA	NA	NA	Yes	NA
	Conservation activities	NA	Yes	Yes	NA	NA	NA	No	NA
	Depredation compensation	NA	Some	Yes	NA	NA	NA	Some	NA
China	Legal protection	Yes	Yes (Cat I)	Yes (Cat I)	NA	Yes (Cat II)	NA	(Not specifically listed)	NA
	Conservation activities	Some	Yes	Yes	NA	No	NA	NA	NA
	Depredation compensation	Some	Some	Some	NA	Some	NA	NA	NA
India	Legal protection	Yes (Schedule 1)	Yes (Schedule 1)	Yes (Schedule 1)	Yes (Schedule 1)	NA	Yes (Schedule 1)	Yes (Schedule 1)	NA
	Conservation activities	Yes	Yes	Yes	Yes	NA	Some	Some	NA
	Depredation compensation	Yes	Yes	Yes	Yes	NA	Some	No	NA
Iran	Legal protection	Yes	NA	NA	NA	Yes	NA	NA	NA
	Conservation activities	Some	NA	NA	NA	No	NA	NA	NA
	Depredation compensation	No	NA	NA	NA	No	NA	NA	NA
Georgia	Legal protection	Yes	NA	NA	NA	No	NA	NA	NA
	Conservation activities	Some	NA	NA	NA	Some	NA	NA	NA
	Depredation compensation	No	NA	NA	NA	No	NA	NA	NA
Kazakhstan	Legal protection	Yes	Yes	NA	NA	No	NA	NA	NA
	Conservation activities	No	No	NA	NA	NA	NA	NA	NA
	Depredation compensation	No	No	NA	NA	No	NA	NA	NA

(Continues)

TABLE 1 | (Continued)

Country/species		Leopard (*Panthera pardus*)	Snow leopard (*Panthera uncia*)	Tiger (*Panthera tigris*)	Lion (*Panthera leo*)	Grey wolf (*Canis lupus*)	Indian wolf (*Canis lupus pallipes*)[a]	Himalayan wolf (*Canis lupus chanco*)[b]	Arabian wolf (*Canis lupus arabs*)
Kyrgyzstan	Legal protection	NA	Yes	NA	NA	No	NA	NA	NA
	Conservation activities	NA		NA	NA	No	NA	NA	NA
	Depredation compensation		No			No			
Mongolia	Legal protection	NA	Yes	NA	NA	No	NA	NA	NA
	Conservation activities	NA	Yes	NA	NA	No	NA	NA	NA
	Depredation compensation	NA	No	NA	NA	No	NA	NA	NA
Nepal	Legal protection	No	Yes (App. I)	Yes (App. I)	NA	Yes (App. I)	NA	(Not specifically listed)	NA
	Conservation activities	Some	Yes	Yes	NA	Some	NA	Some	NA
	Depredation compensation	Yes	Yes	Yes	NA	Yes	NA	Yes	NA
Pakistan	Legal protection	Yes	Yes	NA	NA	Yes			NA
	Conservation activities	Some	Yes	NA	NA	No	No	No	NA
	Depredation compensation	Some	Yes	NA	NA	No	No	No	NA
Tajikistan	Legal protection	NA	Yes	NA	NA	No	NA	NA	NA
	Conservation activities	NA	Some	NA	NA	No	NA	NA	NA
	Depredation compensation	NA	Some	NA	NA	No	NA	NA	NA
Turkmenistan	Legal protection	Yes	NA	NA	NA	No	NA	NA	NA
	Conservation activities	NA	NA	NA	NA	No	NA	NA	NA
	Depredation compensation	No	NA	NA (extinct)	NA (extinct)	No	NA	NA	NA
Uzbekistan	Legal protection	NA	Yes	NA	NA	No	NA	NA	NA
	Conservation activities	NA		NA	NA	NA	NA	NA	NA
	Depredation compensation	NA	No	NA	NA	No	NA	NA	NA

(Continues)

TABLE 1 | (Continued)

Country/species		Leopard (*Panthera pardus*)	Snow leopard (*Panthera uncia*)	Tiger (*Panthera tigris*)	Lion (*Panthera leo*)	Grey wolf (*Canis lupus*)	Indian wolf (*Canis lupus pallipes*)[a]	Himalayan wolf (*Canis lupus chanco*)[b]	Arabian wolf (*Canis lupus arabs*)
Oman	Legal protection	Yes	NA	NA	NA	NA	NA	NA	Yes
	Conservation activities	Yes	NA	NA	NA	NA	NA	NA	No
	Depredation compensation	Yes			NA	NA	NA	NA	Yes
Yemen	Legal protection	Yes	NA	NA	NA	NA	NA	NA	No
	Conservation activities	No	NA	NA	NA	NA	NA	NA	No
	Depredation compensation	No			NA	NA			No
Saudi Arabia	Legal protection	Yes	NA	NA	NA	NA	NA	NA	Yes
	Conservation activities	Yes	NA	NA	NA	NA	NA	NA	No
	Depredation compensation	No	NA	NA	NA	NA	NA	NA	No

Note: Green: protection and/or conservation measures in place. Light green: some protection and/or conservation. Red: no protection and/or conservation measures in place.

[a]The Indian wolf range is defined as the wolf population found in lowland India and Pakistan (Hennelly et al. 2021).

[b]The Himalayan wolf range is defined by Werhahn et al. (2024).

culturally admired. For example, in Nepal, Kusi et al. (2019) found that snow leopards had a higher cultural and religious status compared to wolves, and even when snow leopards were responsible for greater economic losses than wolves, there was nonetheless greater tolerance for snow leopards (also see Augugliaro et al. 2020; Bhatia et al. 2021).

In Mongolia, wolves have been traditionally regarded with respect, especially in the past before the socialist state in 1924 (Sukhbaatar 2020). However, the reverence for wolves that was known in the past seems to do little to protect them in modern Mongolian society today. The wolf population in Mongolia is declining despite this cultural connection, and wolves remain the most persecuted species in the country, with an intense ongoing wildlife trade of wolf parts (Wingard et al. 2018; Sukhbaatar 2020).

2.2.1. Recommended Mitigations

A deep understanding of the indigenous cultural context is critical for developing sound conservation action. Indigenous communities should be respected for their contribution to conservation and included in conservation actions as knowledge keepers and stewards whose ancestors have, in many cases, coexisted with carnivores for millennia. Changes in society can significantly impact traditional practices and weaken beliefs. Understanding these changes is important for recovering the beneficial effects these traditional practices and belief systems can have for nature conservation. Integrating local religious and cultural philosophies into conservation practice can encourage environmental stewardship (Bhatia et al. 2017).

Outreach programs, tailored to the local cultural and religious context and addressing all conflict-causing carnivores, should provide ecological and conservation knowledge on the behavior and status of wolves and big cats. Media framing must aspire to neutrality for all carnivores to avoid inaccurately fueling negative public perceptions, and to foster tolerance.

Conservation interventions that alter the direct interaction with predators are important, for example, improving livestock safety through predator-proof corrals, and improved herding practices, as well as those that improve social factors and psychological impacts of human–carnivore interactions, for example, strengthening the support system within the community and with conservation practitioners, nature awareness raising and education campaigns (Bhatia et al. 2021).

2.3 | Wolves Are Subject to Lax Legislation and Weak Law Enforcement

Different carnivores receive varying degrees of protection across Asian countries. For example, wolves are not legally protected in some countries (e.g., Georgia, Mongolia, and Yemen) and legally protected in others (e.g., India, Iran, Nepal, and Pakistan; Table 1). Where wolves are protected, law enforcement and fines for persecution are often much less strict for wolves than for big cats. There is often a lack of scientific information on wolf and big cat populations, which may result in law enforcement and fines that do not reflect the severity of the population's status. For example, in Saudi Arabia, the fine for killing a leopard is 400,000 SAR while that for a wolf is a fifth of the amount at only 80,000 SAR, although both species are nationally protected and little is known about the population status or size of the Arabian wolf (Bonsen et al. 2024). In Mongolia, wolves are in decline and listed as Near Threatened. However, the government tolerates the hunting of wolves even inside protected areas despite them being legally protected, and often pays a bounty to hunters for each wolf killed (Augugliaro et al. 2020).

2.3.1. Recommended Mitigations

Weak law enforcement may be improved by sensitizing and educating conservation and management authorities with the latest science on the importance of wolves and big cats for biodiversity conservation and ecosystem health. Management should be science-based and consider the beneficial role of all large carnivores within ecosystems. It is important to disseminate relevant research, including data on carnivore population sizes and trends, amongst government officials. It is further important to explain that indiscriminate killing of wolves, intended to reduce human–wolf conflict, may be counter-productive and may increase livestock depredation due to the increased number of breeding wolves as compensation for mortality (Wielgus and Peebles 2014). In contrast, nonlethal management methods such as fladry, electric fences, and range riders, among others, have proven to be very effective (Van Dessel and Snijders 2023).

2.4 | Wolves Are Perceived to Cause More Conflict

Wolves and big cats come into conflict with humans due to livestock depredation. The level of conflict caused by wolves and big cats, respectively, varies regionally (Farhadinia et al. 2017; Kusi et al. 2019; Lyngdoh et al. 2014). Nevertheless, pastoralist communities in many regions often perceive wolves to cause greater economic loss, a perception contributing to negative attitudes toward wolves. While perceptions are the basis for human attitudes and actions, they may not always reflect the reality of the conflict (Kusi et al. 2019).

Different patterns of habitat and prey selection underlie varying levels of livestock depredation by wolves and big cats. In mountainous regions, wolves prefer rolling valley floors and hillslopes, which are also favored pasturelands and can lead to higher livestock depredation rates by wolves (Kabir et al. 2017). In contrast, snow leopards prefer rugged, inaccessible areas and cliffs (Lyngdoh et al. 2014). And, unlike big cats, wolves occasionally forage on human refuse, which makes them more visible and brings them into more interaction with humans around dump sites (Mohammadi et al. 2022; Bonsen et al. 2024). These differences in habitat and food selection can result in people encountering wolves more frequently (Farhadinia et al. 2017; Augugliaro et al. 2020), which can contribute to higher levels of conflict and more negative perceptions.

2.4.1. Recommended Mitigations

Quantifying the contribution of different causes of livestock mortality is critical to quantifying the real economic loss associated with large carnivores. Reducing perceptions that do not reflect reality and mitigating the true economic loss through compensation, intervention, and tolerance is often required. Local measures to reduce conflict require reducing the associated costs of coexisting with carnivores, such as establishing a long-term program to compensate for livestock depredation losses by all large carnivores.

Conservation education campaigns help convey an understanding of wolf and big cat behavior and raise awareness of potentially dangerous situations to be avoided. For example, sharing knowledge that unprovoked wolf attacks by non-rabid individuals are extremely rare is likely to quell fears and prejudices (Linnell et al. 2002). Also, community-based carnivore monitoring is promising because herders who engage in data collection learn to better differentiate predation by different carnivores and to distinguish scavenging from depredation. A realistic understanding of livestock depredation and carnivore biology and conservation by local communities can positively affect their attitudes toward all carnivores.

2.5 | Wolves Are Considered Overabundant

Wolves are often perceived by local people to be overabundant. There are various ecological explanations for this perception, such as their activity occurring throughout the day and their social system operating as family groups, compared to the often crepuscular and nocturnal and solitary-living big cats. Also, the wolves' wide-ranging movements and their preference to inhabit valley floors and lowlands, which are often also preferred by herding communities, contribute to this perception (Kabir et al. 2017). The greater conspicuousness of wolves compared to more secretive carnivores, including most big cats, feeds the impression of their greater abundance.

2.5.1. Recommended Mitigations

Ecological knowledge around carnivores, such as social behavior, temporal patterns, movement ecology, and habitat selection all contribute to the risk of overestimating wolf abundance and need to be effectively communicated with local communities and authorities. Importantly, robust estimates of wolf and big cat abundance are needed as a priority, especially within priority study sites covering both protected and non-protected areas, to provide policymakers, management authorities, local people, and

conservation practitioners a better understanding of the status of these carnivores in their region.

2.6 | Wolves Are Understudied and Neglected by Conservation

The low priority accorded to wolf conservation and research across Asia constrains science-based conservation policy and management. For example, the evolutionarily distinct wolves in the Himalayas and Tibetan Plateau were neglected by science for decades (Werhahn et al. 2020; Hennelly et al. 2021). Recently, the Himalayan wolf was assessed as Vulnerable on the IUCN Red List with a declining population trend (Werhahn et al. 2024). Along with the Indian and Himalayan wolf, genomic work suggests wolves in Southern China and southwest Asia are evolutionarily distinct populations (Hennelly et al. 2024). Thus, wolves in Asia, especially in southern regions, represent a disproportionate amount of the global genetic diversity of wolves. Concerningly, wolves in these regions live with the highest human densities, yet little is known about them besides that they are increasingly rare. Similarly, Arabian wolves, representing a uniquely arid adapted wolf, are few in populations and little researched.

2.6.1. Recommended Mitigations

Studies on wolf population sizes, demography, and trends, as well as their evolution and ecology across various Asian landscapes, are urgently needed to inform international and national legislation, management, and conservation. The current situation illustrates the need to incorporate existing science into conservation policy and management. Often, wolf and big cat conservation and research can be combined cost-effectively to the synergistic benefit of both, illustrating the general principle in conservation that a problem shared can be a problem reduced (Augugliaro et al. 2020; Macdonald et al. 2012).

2.7 | The Emerging Problem of Free-Ranging Dogs

The growing number of feral dogs is a conservation threat to wolves. Feral dogs pose a problem for wolves due to disease transmission, competition for resources, and wolf–dog hybridization (Lescureux and Linnell 2014). Feral dogs can play a major role in livestock depredation and attacking humans, and sometimes wolves are incorrectly blamed for the damage caused by dogs.

Dogs and wolves hybridize; the frequency of hybridization increases with the lack of conspecific mates for wolves and the abundance of feral dogs. In western Iran, 23% of local communities perceived wolf–dog hybrids as responsible for some attacks on livestock, and conflict caused by hybrids is often attributed to wolves (Mohammadi et al. 2022). This can undermine wolf conservation because it is difficult to attribute blame accurately. Hybrids generally show reduced fear of humans and a greater tendency to live in the vicinity of human settlements (Linnell et al. 2002).

2.7.1. Recommended Mitigation

A familiar set of interventions is available: education, sterilization and vaccination, and control of factors that lead to the proliferation of feral dogs (e.g., solid waste management). Importantly, herders can be trained to protect their stock from feral dogs and wild carnivores, and the wider public should be trained in responsible dog ownership.

3 | Conclusion

Wolves are widely distributed across Asia and sympatric with several charismatic big cats. While wolves of Asia hold most of the global genetic diversity and form multiple evolutionary distinct lineages, their conservation has not been prioritized and their behavior, ecology, and evolution remain little researched. It is important to note that wolves and other species have benefitted from habitat protection initiated under big cat conservation.

The lower conservation priority of wolves is characterized by the paucity of conservation programs and limited research, along with often lower cultural and religious status, lower legal protection, and weak law enforcement. This contrasts with the promising outcomes achieved by remarkable efforts of big cat conservation across various Asian countries and also contrasts with the ecological importance of wolves. Sympatric predators such as wolves could be more explicitly incorporated and be co-beneficiaries of conservation programs dedicated to the protection of big cats.

Holistic consideration of the complete guild of large carnivores has multiple benefits for nature and humans. First, wolves of Asia belong to multiple evolutionarily distinct wolf lineages that merit conservation prioritization. Second, wolves can provide an umbrella role for less-protected species and overlooked landscapes (e.g., grasslands in India) by restoring biodiversity, ecological functioning, and ecosystem resilience. Third, securing wolf populations can provide additional health services to local communities through the need for better waste management.

Halting the biodiversity crisis requires a greater focus on developing more comprehensive alliances, and thus efficiencies and synergies, in conservation goals and actions that account in an integrative way for guilds of species, and the holistic conservation of the ecological communities of which they are part.

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Data Availability Statement

Data available on request from the authors.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.